Panafrican Research Agenda

on the pedagogical integration of ICT

application for funding presented to IDRC

by
The Educational Research Network
for West and Central Africa

African training and educational research institutions
South Africa, Cameroon, Congo, Egypt,
Kenya, Mali, Morocco, Mozambique, Uganda,
Central African Republic, Senegal

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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

PROJECT SUMMARY

Panafrican Research Agenda on the Pedagogical Integration of ICT

At last November's World Summit on the Information Society in Tunis, Kofi Annan reminded us that we are living in a world of rapid change where technologies play a multitude of roles. How we tap this technology's potential will shape our future together. We cannot remain indifferent to this enormous metamorphosis. As researchers and teachers, we have a responsibility to embrace the processes of change that ICT brings to teaching, life, learning, work, and livelihoods.

The purpose of the proposed Panafrican Research Agenda on the Pedagogical Integration of ICT is to contribute to this broadening process and to participate in the access, construction, and production of knowledge in the information era.

Information and communications technologies (ICT) are increasingly present in African societies, and have been introduced to varying degrees at all education levels from preschool to university, and in both the formal and informal sectors. They are also used to offer distance education to teachers and other adult learners. However, depending on the various education systems across Africa, ICT are increasingly being taught as a completely separate discipline, while ICT integration into pedagogical practices to improve the quality of teaching and learning remains in the exploratory stage.

Outside of South Africa, little African research is being conducted on the efficient use of ICT in education, even though a IDRC-funded study in 2004-2005 in Central and Western Africa has demonstrated the potential of ICT to transform pedagogical practices.

The following proposal begins with a review of the literature on ICT integration, conceived as the routine use of information technologies by students and teachers engaged in active learning to support and improve teaching and learning activities and render them more meaningful. The research objectives, methods, intended outcomes, and partner institutions involved in this study are then presented.

The objective of this research project is to better understand how the pedagogical integration of ICT can improve the quality of teaching and learning in Africa. The development of an Observatory on ICT in African education would be the main activity in the initial two-year phase, modelled on observatories in other sectors, such as oceanography, which have successfully gathered, organized and updated data for researchers and practitioners in specific fields.

The proposed observatory indicators were developed through a highly participatory process involving researchers—male and female—from universities in 11 countries in different parts of the African continent and a workshop held in Dakar in September 2006. The 160 indicators would monitor policies, access, teacher training, ICT use, learning, school administration and gender. Both qualitative and quantitative research methods would be used to gather Observatory data. Data on several of the indicators currently exist in some of the countries or on the Internet, but they are disparate. Brought together in one place by a research community, new data combined with the existing data would build the foundations for future research and collaborative efforts on the pedagogical integration of ICT in Africa. Observatory data would also support policy development initiatives, particularly those related to teacher training, a crucial factor for African development. Partnership agreements could be signed with organizations, some of which have already expressed their intention to collaborate and their willingness to contribute by developing content for the Observatory and/or helping promote it.

Besides producing enriching information and organizing it via a user-friendly interface, the research process would contribute to capacity building in African higher educational institutions, with a particular focus on the pedagogical integration of ICT, a sector that can advance educational change in the 21st century. African academic researchers would have opportunities to engage their students in Observatory activities. A thematic newsletter would be issued every two months to report on Observatory data. Opportunities for policy discussion would be offered under the communication strategy. Special mechanisms would be put in place to encourage all participating researchers to contribute to the newsletter content and to prepare scientific articles for publication, based on knowledge and analyses generated by project participation.

The main project partners would be the education faculties in eleven countries across Northern, West, Central, East and Southern Africa: Cameroon, Central African Republic, Congo, Kenya, Mali, Morocco, Mozambique, the Republic of South Africa, Senegal and Uganda. The *Réseau ouest et centre africain de recherche en education* (ROCARE) / Educational Research Network for West and Central Africa (ERNWCA) would be responsible for continent-wide project coordination. The University of Montreal would be the technical partner, playing a key role in matters of science, technology and publication. National Committees would approve the Observatory content, and an International Scientific Committee would oversee project evolution. The Observatory would be assessed in part by a statistical analysis of Internet data and an online survey. Lessons learned would be documented and continuously incorporated as the project unfolds.

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I. INTRODUCTION

In the 1970s, a few of the better-endowed African schools were already undergoing a minor audiovisual crisis. They were using fragile, cumbersome and costly equipment that necessitated time-consuming repairs. There was also a compatibility problem between the different components. However, the underlying reason for this scholastic failure was that this audiovisual breakthrough took place at the margins of pedagogy. As Michel (1981) explains, they did not know what to do with new and unfamiliar tools. To add to the problem, teachers were unsure as to which overall strategy to use—integration across all disciplines, independent work, individual or collective work, and so on. Advance in audiovisual technology were hindered by both the fears and hopes it raised.

Against this background, the first computers began to infiltrate African schools.

Computers made their first appearance in certain schools in Northern Africa at the end of the 1960s, mainly for management applications. It was only in the 1970s that they were used in educational institutions in North America and Europe. In Africa, the first computers arrived in educational institutions at the end of the 1970s. For instance, the LOGO project was set up in Senegal in partnership with the Massachusetts Institute of Technology (MIT).

Governments at the time were apparently motivated by a dual goal: to initiate students to the computer, and to introduce certain software programs. Two streams were very dominant: Skinner's programmed teaching and LOGO language, developed by Papert. LOGO, the first computer language for children, was especially popular in North America. Seymour Papert, LOGO's creator, had completed his studies with Piaget in Geneva and was working at MIT at the time. His most famous work, *Mindstorms - Children, Computers, and Powerful Ideas*, became a universal reference. Papert's overriding aim was to develop educational tools and software with socio-constructivist potential. More precisely, he wanted to develop a language that would allow students to construct their own knowledge. LOGO software was initially developed for the Apple II, and later for IBM computers.

For more than a decade, introductory computer courses in Africa were offered in only a few lycées and some universities. Information and communication technologies were largely ignored. Instead, computer processing was considered a requisite discipline. This urgency was particularly felt in Africa in January 1982, when *Time Magazine* acknowledged the importance of the computer by naming it "Man of the Year," the first time a machine was honoured.

Therefore, computer processing was, and still is, taught in many schools throughout the 54 countries on the continent. Thanks to the dominance of the behaviourist educational approach, the next development was computer-programmed teaching (CPT). Teachers then became interested in teaching certain subjects with the help of technology. From teaching computer programming per se and computer programmed teaching, we move to computer-assisted teaching (CAT), which was widely adopted in North America and Europe. And now, just a few short years later, an entire spectrum of tutorials has been developed for educational purposes. Tutorials, or educational software, were designed to help learners acquire knowledge and develop skills (Clark & Mayer, 2003). By the early 1980s, computer-assisted learning (CAL) emerged on the scene, and in the mid 1990s, ICT was being used in a variety of disciplines. Recently, since the late 1990s, the pedagogical integration of ICT appears to be on the ascendant in educational circles. The hope now is that teachers can better teach all manner of subjects with the help of information and communication technologies, and that students will learn more, and more easily. In today's education community, information and communication technologies are recognized as a cross-curricular competency for students and teachers alike.

In 2006, the Internet will celebrate its 37th birthday. In the space of only a few short years, this tool that was initially possessed by the army and later by the universities, has increasingly become a familiar tool used daily by individuals on every continent. The number of Internet surfers on the Earth vaulted from 16 million in 1995 to over 650 million in 2006, an explosive expansion. The exponential use of technologies also heralds a revolution that was long awaited by educators. The global knowledge community, promised in the 1970s, proclaimed in the 1980s, and anticipated in the 1990s with mixed feelings of fear and disbelief, has in the 21st century become an undeniable reality for all people.

As Kofi Annan declared last November at the World Summit on the Information Society in Tunis, we are living in an era of rapid change where technology plays an increasingly central role in all aspects of our lives. Information and communications technologies greatly influence the evolution of all societies on the planet, wielding significant impacts on economic, social and cultural dimensions. With the introduction of ICT, everything changes: our approaches to teaching, living, learning, working, and livelihoods. Most individuals and nations are in agreement that we must not let this societal metamorphosis bypass us, nor should we indifferently submit to it. On the contrary, citizens of all countries, including the African nations, which are lagging behind in many such areas, must be ready to build their own destinies. And to do so, they must take an active part in the technological world.

In a recent speech delivered at the University of Nairobi, Democratic Senator Barack Obama criticized the inertia of many African countries in matters of technology and education. For instance, he noted that South Korea and Kenya have had similar economies for the past 40 years, but South Korea now enjoys an economy that is 40 times larger than its African counterpart, particularly due to the successful implementation of technology into all spheres of Korean society, including education.[1]

Although technology has jump-started the engine of the information era, it is now incumbent on all nations to take part in constructing the information society such that no person is barred from access to the knowledge available on the Internet, and so that every person might share the benefits of a better future, market globalization and internationalization.

This document presents the Panafrican Research Agenda on the Pedagogical Integration of Information and Communication Technologies (ICT) into the African education system. More specifically, we have attempted to define the pedagogical integration of ICT (Section II), according to Karsenti and Larose (2005), as a use that permits either enhanced teaching or enhanced learning. The guiding pedagogical principles for better usage of these technologies, across all teaching levels and in varied educational contexts, are briefly outlined in this section. Next, we identify the main issues related to the pedagogical integration of ICT into the education system (Sections III and IV). Following that, we stress the importance of conducting research on this problem (Section V). Based on our findings, drawn from the little African scientific literature that exists combined with the abundant English and European literature, we define key issues and research objectives (Section VI). With support from the *International Development Research Centre - Canada* (IDRC), African training and research institutions in the education sciences could focus on these key issues and objectives within the framework of a continent-wide project addressing the pedagogical integration of ICT into African education systems.

The research methodology is then presented (Section VII), and the importance of adopting an approach in two major and distinct phases (Section VIII). The first phase would begin with the establishment of the Observatory. Its functions and features are fully described in Section IX). The consideration of gender (Section X) would be determinant in this project, and would make an overall contribution to build research capacities at several levels (Section XI), promote political dialogue (Section XII) and develop strategic partnerships (Section XIII). Several further points concern the expected research results (Section XIV), results diffusion and sharing strategies (Section XV), Phase I evaluation (Section XVI) and the different institutional partners involved in the project (Section XVII). In closing, the budget proposal is presented (Section XVIII) and finally, the bibliography. The Observatory indicators, the core elements for the first two project years, are presented in a separate Appendix.

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1 From a speech delivered on August 28, 2006.

II. PEDAGOGICAL INTEGRATION OF ICT AND THE VARIOUS TEACHING/LEARNING CONTEXTS IN AFRICA

Drawing from the existing literature, this section presents a brief overview of the various visions and concepts of ICT integration into education, the principles and theories of the pedagogical integration of ICT, and the potential uses of ICT in various African learning contexts.

2.1 Pedagogical integration of ICT: Definition

According to many authors (UNESCO, 2004; Grégoire, Bracewell & Laferrière, 1996; Karsenti & Larose, 2002; Tardif, 1998), ICT in an educational context refers to a set of combined technologies that enables not only information processing but also its transmission for purposes of learning and educational development.

The scientific literature describes different approaches to the integration of ICT into education. Raby (2004), building on the works of Lauzon Michaud and Forgette-Giroux (1991), made a clear distinction between two different types of ICT integration: physical and pedagogical. Physical integration consists of making technological equipment available to teachers and students and promoting its use for occasional pedagogical needs. Physical integration is therefore understood as a process that leads to the introduction and/or deployment of technologies in the educational institution.

In contrast, the pedagogical integration of ICT into schools means the appropriate, habitual and sufficiently regular use of ICT that produces a beneficial change in educational practices and improves student learning (Depover & Strebelle, 1996; Isabelle, 2002). This type of integration implies the routine use of ICT in the learning process. The pedagogical integration of ICT must therefore be understood as integration such that the student is learns and socializes through a multitude of interactive and communication channels. It cannot be reduced to mere physical integration, which is nonetheless imperative.

Furthermore, the pedagogical integration of ICT does not necessarily mean introducing these technologies as a new curriculum subject and instructing students in its operation (MEQ, 2000; Karsenti, Savoie-Zajc & Larose, 2001; Raby, 2004). Rather, ICT should be used habitually and regularly by students and teachers who are actively engaged in real-life learning contexts in order to support and improve the teaching and learning experience and make them more meaningful.

Taken as a whole, pedagogical integration of ICT means not only the implementation of networks and equipment, but also the use of a set of innovative technological techniques—audiovisual, information processing and telecommunications—to enhance learning at schools and in continuing education programs and for economic, social and cultural development.

The theories and principles of pedagogical ICT integration may be grouped into six main orientations for the utilization of ICT for educational purposes:

1- Adopt a critical and discerning attitude toward the pros and cons of ICT as a teaching and learning support, and critically assess the data gathered by networks;
2- Identify and evaluate the potential for information processing tools and networks to develop educational competencies;
3- Identify and communicate information using pertinent and varied forms of multimedia;
4- Use ICT effectively to research, interpret and communicate information and to solve problems;
5- Use ICT effectively to build networks for exchange and continuing education in specific subject areas for teachers, learners and pedagogical practitioners;
6- Tap into ICT opportunities for learning and assessment activities.

2.2 Utilization of ICT at different teaching levels and in diverse learning contexts in Africa

In Africa, we find multidimensional uses of ICT, from primary school to higher education. ICT are increasingly used in primary schools, including the preschool, kindergarten, primary and elementary levels. Aside from entertainment value, the greatest benefit of ICT at this level is the liberation of the students' ideas and aspirations. ICT also provides valuable and varying support for child learning, as it fosters emotional and social development, motor skills, physical health, language acquisition, general knowledge, cognitive skills, etc. The use of ICT in preschool and primary school is a core learning tool for the educational basics: reading, writing, communication, listening, patience, and so on.

ICT utilization appears to be more widespread in African secondary schools, including general secondary and technical schools, where it is used by both teachers and students to teach and learn subjects. In the technical and professional schools, ICT are used more specifically to teach and learn specialized disciplines. Thus, we observe that certain disciplines have developed ICT-related practices. Accordingly, ICT integration into learning activities in secondary schools would seem to be all the more important, since it goes beyond interpersonal communication and integrates several dimensions such as interactive learning, collaborative learning, and research for information for analysis and problem-solving.

In the higher African educational institutions, ICT integration also appears to be considered a necessity both for university students and teachers. Indeed, as we highlight below in the section on issues, numerous disciplines are either not taught or poorly taught in Africa owing to lack of teachers. ICT utilization for online learning (e-learning) is one way to address this lack, as it would provide broader access to higher learning. Moreover, the higher education sector includes graduate teaching and continuing education, where ICT holds enormous potential for adult self-training and lifelong learning. Distance education has become increasingly common, particularly in adult learner communities in various university programs. In many African universities and training schools, ICT utilization in this context fosters self-training and successful cyberspace initiatives that are independent of time or location. Thus, ICT enables coaching and tutoring outside regular class hours. This opens the way to a new approach to the concept of time units, learning locations and learning activities. Aside from all this, online learning allows international cooperative teacher training. It also promotes national and international exchanges between teachers and contributes to the fine-tuning of pedagogical practices.

ICT are present at all levels of the education system and specialized training programs in Africa, and it would be important for this research project to cover all teaching levels and training contexts, from preschool, primary and secondary school to university and beyond.

III. ISSUES

3.1 From the digital divide to the technopedagogical divide

Although information and communication technologies occupy an ever-larger place in the daily lives of an enormous number of people, we must recognize that the ingress of ICT has not been consistent across all societies. Hence, the well known "digital divide" between the so-called developed and developing countries. In fact, many African countries, which are also some of the poorest on the planet, are increasingly living in a world of technological deficiency, i.e. lack of access to knowledge that is available to everyone else via the Internet.

The OECD (2006) recently demonstrated that this lack of basic network infrastructure and international connection may be blamed on the more pronounced digital divide in the world's lowest income areas. In concrete terms, apart from countries at war, the West and Central African countries are lagging the furthest behind the Western World in this respect. For instance, Niger regularly ranks at the top of the list in two categories: poorest countries in the world and countries where information and communication technologies are particularly slow to arrive.

Accordingly, if Africa aims to better prepare its citizens for the challenges of the third millennium, it must also foster a thorough integration of information and communication technologies, i.e. the regular and routine pedagogical integration of ICT into education in order to tap new, attractive, promising and diversified potentials. On the other hand, we must note that African initiatives to connect to the Internet are not in their infancy. In fact, despite the great divide between Africa and the Northern countries and within African countries and regions as well, technologies appear to be gaining ground with exponential speed. To illustrate, the Senegalese capital Dakar has a constantly growing number of households with high-speed connection, which was almost inconceivable a few short years ago. Moreover, a recent study funded by the IDRC (Karsenti et al., 2005) revealed that almost 75% of students in certain Senegalese lycées had an email account. And yet, particularly in the southern part of the country, a large number of schools and villages have never had electricity. Thus, the phenomenon of the digital divide is not limited to Northern and Southern countries; it is also felt within the African continent and within specific countries.

Caused by a combination of social, economic, political and environmental factors, the digital divide is a complex and widespread issue in Africa. Nevertheless, our view is that there is another, ever more important, concern: the pedagogical integration of ICT into African schools. Recognizing that, in some cases, ICT have barely penetrated African society, the digital divide in schools remains a great worry,. In the pedagogical integration of ICT, Africa is largely still at square one.

3.2 Why ICT in African education?

Despite the progress Africa made in the late 1970s, we note 30 years later that the introduction of information and communication technologies into the education system—which is fundamental to the knowledge economy—has been a difficult struggle, and in the opinion of some researchers, far too slow.

Many have pointed out that it is utopian to talk about education technologies in a continent where great numbers of schools have neither electricity nor running water, or where there are schools at all. The current situation of the African education system would appear to rule out ICT use in schools. This is because school policies must address such overwhelming needs that hard choices must be made. Little priority is given to computer equipment, and even less to the pedagogical integration of ICT. Consequently, the ICT needs of students and teachers are typically the last on the list. These arguments are important, but they should not be used to eliminate technologies completely from the African education system. Education should be able to prepare Africans for today's realities, and this is paramount. The African education system must also prepare children for tomorrow's realities. At the same time, it must help preserve the past so that technologies do not become a Trojan horse in the form of cultural or intellectual imperialism.

Why introduce ICT into education? Because, as explained above, ICT wields a fundamental impact on political, economic and social conditions in changing societies. For this reason, the key stakeholders in African education—teachers, school principals, specialists, parents, and government ministers and officials—must be actively involved in ICT uses and content, and above all the pedagogical integration of ICT into education. Furthermore, we must be concerned about ICT in education because it is clear that ICT will continue to significantly impact all societies worldwide, in all economic, social, and cultural aspects. Education cannot escape this trend. While ICT have infiltrated schools in the Northern countries in great numbers, Africa lags far behind. For several years now, African education systems have been coping with a multitude of problems, and countries have initiated reforms that generally do not attach much importance to ICT. The ADEA (2002), for its part, has stressed that ICT represent a learning channel with the potential to enormously improve the quality of basic education teaching. And yet, as noted by the World Bank (2002) and in the latest report by the Massachusetts Research Association (2005), there is a

serious lack of ICT research in Africa in the areas of effective educational uses and potential impacts on the quality of African education. Moreover, an exhaustive review conducted in 2003 by the IDRC (Karsenti, 2003) clearly showed that only a very few studies on the integration of ICT into African education have been carried out, apart from a few works by South African scholars.

Moreover, the findings of these studies are striking and paradoxical: the more African societies use ICT, the less they appear – proportionally - in schools. The spillover into education has not yet occurred. Should we be concerned about when ICT arrives or the disparity between the social and educational use of ICT? Do we really need to question why or why not schools are equipped with ICT? It is not surprising that schools are slow in adapting to social change. After all, schools are considered as noble institutions that embody a commitment to the long term, with a mission to instruct and educate. So the important issue is probably not so much a question of when ICT arrives in the classroom, but rather their enhanced pedagogical use for teaching towards educational goals. Hence the importance, in our view, of focusing less on the digital divide debate and more on the pedagogical integration of ICT into education.

Finally, we must stress that many researchers (see BECTA, 2005), have demonstrated that technologies are likely to have greater impact when integrated pedagogically, providing the following benefits:

- Better mastery of basic competencies
- Better mastery of the technologies themselves
- Better skills preparation for the knowledge society
- Higher motivation for school learning and advancement to higher learning.

In sum: Why introduce information and communication technologies (ICT) into African education?

- To help students preserve their past
- To prepare students for today's reality
- To ensure a future for African students.

IV. IDENTIFICATION OF ISSUES RELATED TO THE PEDAGOGICAL INTEGRATION OF ICT IN AFRICA: STATUS

The problems and barriers with respect to ICT integration by teachers stem from several sources: inadequate initial training, insufficient motivation, absence of technical support, a school administration that does not embrace ICT usage, lack of administrative support, etc. (see Cuban, 2001; Dede, 1998; Means, Penuel & Padilla, 2001). To better identify the many barriers to the pedagogical integration of ICT into education, we have classified them into two main categories: *external barriers* (connected to the school, society, etc.) and *internal factors* (connected to the teacher or the teaching process). Among the key *external barriers*, the hardware issue is usually at the forefront (McCrory Wallace, 2004).

4.1 Challenges of ICT integration: industrialized countries

In the so-called industrialized countries, barriers to ICT integration are limited to three main components: hardware, software, and technical support. Heavier investment in all three areas would foster the pedagogical integration of ICT into education. However, as demonstrated by Cuban (1997, 1999), technological access is an essential yet insufficient condition to foster the pedagogical integration of ICT by teachers. Investment in hardware and technical training is simply not enough. Cuban's argument is based on a series of surveys conducted on professors at Stanford University—a relatively well endowed institution where professors have enjoyed over twenty years' access to the latest technologies and good technical support. Cuban's findings reveal that these professors use little or no ICT in their teaching practice, never mind all the resources at their disposal. He characterizes this as a "[...] limited and unimaginative instructional use of computers." In his view, they use it in the same manner as primary and secondary teachers, who have neither the technical nor material resources of the university teachers. Although Cuban (1997) does not deny that equipment and technical support are essential for the pedagogical integration of ICT into education, he points out that these conditions are nonetheless insufficient, since teaching cannot be considered a manufacturing process where productivity may be raised—and time saved—by investing in technological resources. Teaching, as Rousseau (1966, p.112) explains, is an art, the goal of which is not always to save time: "Dare I expound the greatest, the most important, and the most useful rule in all education? It is not to save time but to waste it." (free translation) Depover and Strebelle (1996, p. 24), who researched ICT use in Belgian schools, are entirely of the same opinion, noting that:

> Many studies have shown that the pedagogical effectiveness of ICT depends more on the capacities of teachers to integrate and operate new technologies in a relevant pedagogical context than on the available information technology infrastructure. (free translation)

For several years now, the international scientific literature (Becker, 1994, 2000; Cuban, 1997; Scottish Board of Education, 2000; Pouts-Lajus & Riché-Magnier, 1998) has highlighted eleven key issues in the pedagogical integration of ICT:

1. Lack of time (ICT integration is not prioritized in teaching practice, where the workload is already very heavy)
2. Hardware issues (lack of hardware, difficulty of access, obsolescence, defects, lack of adequate peripheral devices such as printers and scanners, too-slow or non-functioning Internet connections, etc.)
3. Technical difficulties (technical problems encountered when using technologies)
4. Absence or lack of technical support for ICT integration
5. Absence or lack of administrative support by the educational institution
6. Absence or lack of support, training, or technopedagogical skills (inadequate initial training for new teachers and non-existent or inappropriate continuing education for practicing teachers)
7. Class management problems that limit the potential for technopedagogical innovations in the classroom
8. Group size (too many students in the class for effective ICT integration)
9. Organizational constraints and barriers within the education system
10. Group heterogeneity of technical skills, which complicates the task of pedagogical ICT integration
11. Absence or lack of relevant pedagogical materials.

The primary problem that teachers face appears to be lack of time (Cuban, 1997). In fact, since ICT can be very time-consuming, they are usually feared by many teachers who are already at the end of their rope and are intimidated or even overwhelmed by what has been known for many years as the "technological change" (Karsenti & Larose, 2001). As Chenevez (2002) explains, it is no easy task to prepare today's students for tomorrow's technological challenges when the teachers themselves are out of date. It is also true that ICT usually complicate teaching routines at the beginning, even though, after a certain adjustment period, the rewards may be great (Pouts-Lajus & Riché-Magnier, 1998).

Some studies, e.g., by Depover (2005) and Leclerc (2003), show that teachers' beliefs and resistance to change are basic factors in the use or non-use of ICT. The *Québec Conseil supérieur de l'éducation* (CSE) (2002) and Fullan (2001) also stress the importance of training and awareness raising for all

stakeholders on the relevance of integrating ICT into schools. Without the commitment of teachers, it would be hard to image successful ICT integration (Isabelle & Lapointe, 2003; CSE, 2000).

According to numerous authors (Leclerc, 2003; CSE, 2000; Isabelle, Lapointe & Chiasson, 2002; Rogers, 2000; Sherry, 1998; Depover & Strebelle, 1996; Bibeau, 1996; Fullan, 2001), ICT use in education must surmount organizational, administrative, human, pedagogical, training, informational, technical support, funding, and technological problems. The lack of training and time required to master the technology and develop appropriate classroom courses are tremendous odds that educational institutions must overcome if they are to adopt and integrate ICT into their portfolios (Tunca, 2002; CSE, 2000; Pajo & Wallace, 2001).

Turning to the organizational, administrative, and human factors, barriers include lack of vision and strategic planning (Bibeau, 1996), scattered efforts, disorganization and uncooperativeness between sectors and users, and poor organization.

4.2 Challenges of ICT integration: Africa

There are several explanations for the failure of ICT utilization for pedagogical purposes in certain African educational contexts (see Karsenti, 2003). According to Howell and Lundall (2000), the key factors blocking educational institutions from using microcomputers as teaching and learning tools are insufficient funds, insufficient number of computers, lack of teachers with IT skills, teachers' inability to integrate the computer into the different subject areas, and lack of appropriate microcomputer teaching programs.

As mentioned above, computer usage has not evolved consistently across Africa. In South Africa, for instance, certain fringe elements of the school-age population are using computers for educational purposes at a level comparable to that of developed countries, while the majority of schools in sub-Saharan Africa are still exploring the ways and means of connecting to the Internet, with many in the introduction and launching phase.

The overall findings of the studies consulted point to the hardware issue as the primary constraint on the equitable use of innovative technologies. The dearth of structures and the high costs of equipment greatly exacerbate the group usage ratio. Even so, all 54 African countries have connected to the Internet (Jensen 2002). However, there remains the mind-bogglingly difficult feat of achieving a student-computer ratio of 10 to 1 and 100% Internet connection in most of the primary, secondary, and higher educational institutions in Africa. To illustrate, the World Bank's World Links for Development (WorLD) project (2000) estimated a ratio of 139 students per computer across Africa.

Other studies show that the problems blocking African educational institutions from equipping themselves with computers are, in descending order: lack of electricity, lack of funds, insufficient accommodation capacity, lack of qualified staff, and insecurity. On top of that, very little of the equipment available nationally is allocated for ICT use in education, in schools. Furthermore, in sub-Saharan Africa, the low density of telephone lines and the high costs of installing and maintaining them constitute a major barrier

Numerous authors (Oladele, 2001; Intsiful, Okyere & Osae, 2003; Selinger, 2001; Tunca, 2002; Bakhoum, 2002) have also cited lack of tools; inoperative software; insufficient or absence of technological infrastructure such as telephone lines; marginal, disparate, inadequate and obsolete communications networks; fluctuating electric power supplies; recurrent power brownouts and blackouts; ailing road systems, etc. In fact, it would seem that most African countries have neither the infrastructure to ensure nation-wide Internet connection nor the wherewithal to install it. Thus, UNESCO found that the overall rate of Internet penetration across Africa was only about 1.5%, with wide variations across regions, always keeping in mind that these conditions are determinant yet insufficient for ICT literacy.

With the help of organizations such as WorldLinks, African countries have made determined progress in the areas of computer equipment and Internet connections in schools. Clearly, there has been a substantial influx of computer hardware in many *lycées* and colleges in several African countries. Nevertheless, as revealed in a recent study funded by the IDRC, these investments are not enough to ensure a genuine pedagogical integration of ICT. In fact, the study showed that once the WorldLinks funding was used up, IT use gradually faded in the institutions, with a few rare exceptions where students were highly motivated to use ICT (see Karsenti et al., 2005).

To these hard-to-control variables we can usually add the high numbers of students required for an efficient pedagogical use of computers. And this despite the fact, as noted by Depover (2005), that enrolment in basic education in Africa is barely 50%, while access to secondary school is an option for only a minority of students.

In addition, the issue of ICT utilization becomes more acute when we consider access by women. In most cases, women are unable to take advantage of the opportunities offered by ICT. In many regions, women have been accorded second-class status in the areas of self-government and the interconnectedness offered by the information era. In some communities, cultural restrictions that prohibit girls from attending school at all add further barriers to effective ICT utilization in schools (Draxler & Haddad, 2002; Karsenti et al. 2005).

Marie Hélène Mottin-Sylla and colleagues (2005) studied six French-speaking African countries (Benin, Cameroon, Burkina Faso, Mali, Mauritania and Senegal) from 2004 to 2005. They found that, overall, women have much fewer opportunities than men to benefit from the African digital revolution,

as they have been allotted the roles of consumers and "helping hands." Their research reveals the scope of the ICT gender divide and voices a plea for greater equality in the digital revolution. Section X of this document specifically addresses the gender issue.

In most African universities, training appears to have reached a limit in terms of overcrowded auditoriums and classrooms teaming with hundreds, even thousands, of students. Open and distance education (*Formation ouverte et à distance* – FOAD) is one response to this problem. However, a successful FOAD initiative, considered a panacea by many, including l'*Agence Universitaire de la Francophonie* and the African Virtual University (AVU), requires the appropriate usage of ICT, in other words comprehensive pedagogical ICT integration.

Aside from the time and place constraints on ICT development, the use and maintenance of existing infrastructures runs up against the lack of local expertise and user know-how in the African education system.

On top of this, there is the thorny problem of infrastructure, which is indispensable for ICT use by educational institutions. For instance, staff must be found to implement technological applications and develop teaching programs (Murphy, Anzalon, Bosch & Moulton, 2002). And when ICT, as in all pedagogical contexts, the human factor is paramount. For instance, if taught by a trained teacher's assistant, children might learn computer skills that are never or rarely used at school. And it is no surprise that Africans who learn how to use ICT tools consume more resources than they produce (see Karsenti, Touré & Tchameni Ngamo, 2006). This is because the lack of information, training, experience, as well as pedagogical, staffing, professional, technical, and financial support impedes the development of uses and teaching content adapted for African contexts as well as the construction of student-run education portals.

Of all the human resources deficiencies, the most important is surely that of teachers. Generally, initial teacher training in Africa does not prioritize the use and pedagogical integration of ICT (Karsenti, 2006; ROCARE-Cameroun et al., 2006).

To ensure the participation of all teachers in the ICT integration process and to mobilize their interest and encourage them to use ICT in practice, it would seem indispensable to create favourable conditions. This problem is all the more urgent since many African schools do not have a specially equipped room or convenient time-space for those teachers who would like to work with computers.

In fact, in most African countries, schools have very little computer access time, and rarely at times that are convenient for teachers or students. Since teachers are not very familiar with media use, they often adopt inappropriate pedagogical strategies. Students do not have standardized background knowledge in the different subject areas, nor do they have standardized technological skills or experience with multifaceted learning styles. All these shortcomings impede the pedagogical use of ICT.

ICT integration into education also raises new challenges for teachers as students begin handing in assignments lifted straight from the Internet. Aside from the low pedagogical value of such effortless work, teachers must now add exposure and confrontation of plagiarizers to their many other duties. And although teachers bear the burden of proof in such cases, when they are not ICT-savvy, the task becomes practically impossible.

ICT also threaten the teacher's classroom authority. ICT appeal to the students and leave the teacher with a feeling of powerlessness. This can be very unsettling, especially for teachers who follow traditional, encyclopaedic approaches. However, current research (see BECTA, 2005) indicates that ICT should not replace open pedagogical approaches. Rather, it should provide practical assistance by improving teaching activities and facilitating student learning. Children are rapidly won over by a story told on an educational CD-ROM. The animated images and sound tracks are attractive extras that teachers could probably not produce themselves. Nevertheless, children will immediately invite the teacher to watch the story with them and ask them to explain various elements or the ending of the story, and so on.

James (2001) noted that, even in South Africa, which seems to be far ahead of other African countries, less than 5% of educational institutions that are equipped with computers have budgets for teacher training in ICT use. And yet, to ensure the sustainable use of ICT in teaching, investment in human capabilities is paramount.

In many sub-Saharan African countries, there is a real political will to introduce ICT into the education system, but no clearly formulated national ICT policies. Information technology is more or less lumped in with the official school programs, with no budget allocations for ICT. Funds for ICT equipment and operation generally comes out of school fees, fundraising campaigns, donations from national and international organizations and partners, and in countries like Nigeria and Cameroon, state funding. Meanwhile, the research literature has repeatedly stressed the need to adopt stable, ongoing policies and budgets for ICT utilization (Karsenti & Larose, 2005).

Beyond developing human resources and building the capabilities to design, install, maintain and use new ICT infrastructures and applications, a key challenge for ICT use in African societies is to arrange for their distribution and use in distant and isolated rural schools (Chéneau-Loquay & N'diaye Diouf, 1998). Cyber-cafés are an important vehicle for ICT use in many African countries. They act to spread ICT use to areas where there are few access points. Aside from the issue of unequal distribution of technological equipment across the regions, there are concerns about the equitable use of ICT in a continent where a substantial portion of children without opportunities to use computers in class have no computers at home either, unlike children in developed countries. These problems are liable to hinder the pedagogical integration of ICT into many African schools. All

this against a background of the relatively recent and limited introduction of ICT into Africa, the lack of appropriate equipment, the lack of qualified human resources, and the enormous number of disadvantaged populations. A further serious handicap is the acknowledged fact that people need time to familiarize themselves with the computer and explore its potential before they can use it to revolutionize classroom activities.

V. THE IMPORTANCE OF CONDUCTING RESEARCH ON THE PEDAGOGICAL INTEGRATION OF ICT

The majority of strategic studies on ICT in African education differ according to the country studied. Objectives vary from collaborative learning to providing communities with information. Some objectives are unclear. Other objectives are relatively precise and measurable, or else more general and instructive in studies that clearly describe the various applications of ICT in African schools.

This only underscores the importance of a more useful study that promotes the effective use of ICT to enhance learning (The TLT Group, 2004) and develop education. More precisely, it would be important to conduct research that describes how ICT are used in order to facilitate the application of best educational practices, such as the principles proposed by Chickering and Gamson (2004):

Good practice in undergraduate education

1. encourages contact between students and faculty,
2. develops reciprocity and cooperation among students,
3. encourages active learning,
4. gives prompt feedback,
5. emphasizes time on task,
6. communicates high expectations, and
7. respects diverse talents and ways of learning.

This research would also shed light on the pedagogical uses of ICT in different African learning settings and areas such as student learning, programs and pedagogy, online education (e-education), professional development, evaluation, etc. In fact, results of the first phase of the trans-national research project on ICT integration in African ICT pioneer schools (see Karsenti et al., 2005) clearly demonstrate that ICT usage in Africa has been inadequately documented compared to other parts of the world.

This view is supported 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).

Pedagogical ICT integration initiatives have involved a variety of situations such as visual projection, preparation of class notes, and distance self-learning. A promising research approach would be an attempt to provide an overview of the diverse experimental uses of ICT in learning. Long-terms ICT initiatives, national and continental, have not yet been clearly monitored or evaluated.

It would also seem urgent to reflect on the pedagogical integration of ICT into teaching in particular African localities where learning with these tools is a very chaotic process. ICT themselves do not encourage students to be creative or to grasp the scientific approach. That requires a pedagogical framework within which technology can facilitate the use, processing and production of relevant information, among others. No matter how powerful the hardware, it serves no educational purpose if it is not used for appropriate purposes. Hence, education research has a duty to shine a scientific spotlight on training in the pedagogical uses of ICT, a societal issue of enormous import.

As a continent that lags far behind in ICT adoption, use and innovation, Africa is not at the point where it can use educational ICT to provide its people with a better education or to take advantage of the investment potential and opportunities it offers. Nevertheless, several countries are convinced that ICT use is an undeniably sound economic development strategy when viewed as an investment in the future. This raises possibilities of ICT utilization for African development and a restructuring of knowledge based on a consideration of local African realities.

VI. RESEARCH ISSUES AND OBJECTIVES FOR THE PEDAGOGICAL INTEGRATION OF ICT IN AFRICA

This document has highlighted several issues and aspects to explore, from forms of use to paramount sectors, pedagogical approaches and key favourable and unfavourable determinants for the educational use of ICT. From this literature review, an initial, relatively exhaustive general research question was formulated to address the pedagogical integration of ICT into different African training and learning contexts.

6.1 Main research question:

How can the pedagogical integration of ICT into African education systems improve the quality of teaching and learning?

This question is central to the development of the Panafrican Research Agenda on the Pedagogical Integration of ICT into education. In addition, this question is entirely consistent with the IDRC mission, which is embodied by the five-year Acacia program to support research leading to recommendations for concrete improvements in the quality of teaching and learning.

6.2 Secondary research questions

Several sub-questions related to the main study question would be addressed:

- What ICT usage policies are in force in African education systems?
- What is the state of connectivity, equipment and its management in African education institutions?
- How are African teachers trained in the pedagogical uses of ICT?
- What is the ICT usage profile across the education systems?
- How does ICT impact the various teaching/learning levels in Africa?
- What is the role of administration in the ICT integration process?
- What strategies could be used to promote relative gender equity in ICT use in African education systems?

On the basis of the general research question, the overall research objective was formulated:

6.3 Overall research objective:

To better understand how the pedagogical integration of ICT can improve the quality of teaching and learning in Africa.

This overall research objective, stemming directly from the research question, as recommended by most research methodology experts (see Huberman & Miles, 1994), is accompanied by specific research objectives that would be set to promote research development on the pedagogical integration of ICT in Africa.

6.4 Specific study objectives

1.0 Appraise ICT policies in African education systems
2.0 Report on the state of connectivity and equipment and its management in African institutions
3.0 Describe African teacher training systems in the pedagogical uses of ICT
4.0 Draw a portrait of ICT use in African educational institutions
5.0 Better understand the impacts of ICT on education
6.0 Better understand the roles of school principals, administrative staff and the community in ICT integration
7.0 Identify guarantor strategies for the equitable use of ICT in education.

The above-listed objectives would be the cornerstone for more specifically targeted examinations of the pedagogical integration of ICT into African teaching systems. These objectives could be combined, depending on the education stakeholders addressed (principals, teachers, students, parents, governments, etc.) as part of the empirical research carried out under this project. Achievement of these research objectives would allow an overall understanding of the educational potential of ICT in a range of African contexts. This would in turn shed light on existing usage in the different pedagogical fields and promote mutualisation.

VII. RESEARCH METHODOLOGY

> *It is an ambitious and presumptuous, a vain and envious brain that tries to persuade others that there is but a single path to investigate and grasp the knowledge of nature. And it is a foolish and gullible man who chooses to believe in it himself. Therefore, although the steadiest and firmest path, the most contemplative and distinct, the highest reflective mode, must always be preferred, and honoured and cultivated as well, we nevertheless must not find fault with another path that is not without fruition, even though the fruits do not come from the same tree. Giordano Bruno (1548-1600) (free translation)*

Methodology means the "science of the method" or the "science of how to do it," according to Lessard-Hébert, Goyette and Boutin (1990), who emphasized that research methodology is a "set of guiding ideas that direct the scientific investigation" (p. 17) (free translation). For Crotty (1998), methodology is the strategy, the action plan, the process that underlies the choice and application of specific working techniques known as methods. It matches the choice of methods with the expected results (p. 3).

This section presents the methodology for the Panafrican Research Agenda on the Pedagogical Integration of ICT. First, we present a justification of the chosen methodological approach, known as the *mixed-methods* research approach, one of the more promising methodological research approaches (Section 7.1). Next, we present the main methodological approach: the multi-case study (Section 7.2), a very effective method for this type of study (Section 7.3). The triangulation method, used to validate data collection techniques and verify the authenticity of information sources, is then presented (Section 7.4), as well as the main data collection instruments (Section 7.5). Following that, the main indicator categories (Section 7.6) and the planned strategies for data collection (Section 7.7) and analysis (Section 7.8) are presented. The chapter on methodology ends with a brief overview of the partner countries selected to participate in the study (Section 7.9) and the main procedural steps of the research (Section 7.10).

7.1 Methodological approach: the mixed method era

It is noteworthy that, for the last 20 years, many researchers have adopted one of two main methodologies or paradigms for education sciences research (see Krathwohl, 1998). These methods are considered so different as to be diametrically opposed: quantitative and qualitative research.

Proponents of the quantitative approach contend that research in the education sciences must be objective, free of bias and broadly applicable. At first glance, this is the approach advocated by the Canadian Council on Learning (CCL), which supports research on learning based on a useful base of evidence.

Enthusiasts of the qualitative approach (see Lincoln & Guba, 1985), for their part, have rejected the idea of objectivity as the *sine qua non* for research in the social sciences. For the more orthodox, objectivity and generalization in the social sciences are both impossible and undesirable. In contrast, qualitative research is characterized by an inductive focus, extensive descriptions, etc.

These two epistemologically incompatible positions have often evoked what Howe (1988) calls the "quantitative-qualitative incompatibility thesis" in support of the research methods and data collection methods inherent in these two incompatible approaches. Consequently, for the past 20 years, most researchers in the education sciences have felt they had to choose between the qualitative and quantitative approach.[2]

Why did the education sciences advocate this methodological dichotomy, which does not seem to account for the complexity of real-life situations? Why did they not seek a compromise between these "two solitudes"?

Note that although for a long time social science researchers felt they had to choose between qualitative and quantitative approaches, in 1986 this was considered progress compared to the previous mindset. Let us recall that education research used to be dominated by the so-called quantitative method, which directed researchers to begin their studies with hypotheses and seek to prove or disprove them. An additional option was then introduced whereby researchers could choose between the quantitative and qualitative approaches, an option that became increasingly popular after the mid 1980s (see Erickson, 1986).

These days, the methodology of choice in the education sciences is a mixed methodology, also known as *mixed methods research*.[3] This is a natural and particularly pragmatic outcome of both the traditional quantitative and qualitative methods. Mixed methods research is actually a kind of methodological eclectism that strategically marries qualitative and quantitative data into a coherent and harmonious union. Consequently, the research results are enriched. This mixed approach borrows from diverse methodologies, both qualitative and quantitative, depending on the research objective. The result is a kind of methodological pluralism. Moreover, a mixed research methodology facilitates the triangulation of research results. In fact, the use of diverse methods to ensure that rigorous conclusions are drawn based on a range of research data is a highly promising research direction. Johnson and Onwuegbuzie (2004) also noted that mixed-method research usually generates superior results to those of single-method research.

2 *What is more, regardless of student preferences, a good number of universities still offer courses whose structures reflect this dichotomy. Students must sign up for either qualitative or quantitative research.*

3 *Also called mixed research.*

It is only quite recently that the mixed research methodology has gained in use and recognition in education sciences circles, despite the fact that several authors have defended this union for almost 20 years. Indeed, the works of Mark and Shotland (1987), Reichardt and Gollob (1987), Brewer and Hunter (1989), Caracelli and Greene (1993), Van der Maren (1995), Behrens and Smith (1996), and Krathwohl (1998) all point out that the two approaches are usually opposed, when they could just as well be complementary (Van der Maren, 1995), allowing a more complete and thorough understanding of the phenomenon studied (Moss, 1996, p. 22). Krathwohl (1998) stressed the importance of combining different methods as a way to better "attack" the research problem (p. 618).

He also stressed the importance of creative combinations of the diverse methodological elements in a coherent and organized manner so as to better address the research question. In addition, he felt that the only limits on researchers were their imaginations, and that research findings must be presented in a convincing manner (p. 27). Indeed, by choosing one particular method over another, certain benefits are lost while others are gained. Thus, Brewer and Hunter (1989) argue that each method has its own particular drawbacks, but fortunately, the drawbacks usually differ. They add that researchers can use a variety of imperfect research methods to combine their strengths while compensating for their respective drawbacks and limitations (p. 16-17). Johnson and Onwuegbuzie (2004) have gone further by proposing three major research paradigms: quantitative, qualitative and mixed research.

Our proposal for a Panafrican Research Agenda on the Pedagogical Integration of ICT definitely calls for this new research methodology. It would not be a question of imposing a mixed methodology on this important project. Instead, we could choose from an eclectic assortment of data collection methods to address the research questions and objectives. In some cases, a single quantitative approach might be best; in other cases, the qualitative approach might be preferable. In any case, a mixed methodology could be used as well. Clearly, however, the methodology must be rigorously, rationally, coherently and harmoniously articulated. It must also be consistent with the overall research objective. Thus, by adopting the mixed research method, we would carry out both qualitative and quantitative methodologies and apply twice the rigor.

7.2 Case and multi-case studies: the main methodological approach

This study aims to **better understand how the pedagogical integration of ICT can improve the quality of teaching and learning in Africa**. Thus, the aim is to demonstrate the interactions (relations between ICT and teaching/learning) while seeking to better understand and explain them. With the objectives providing a starting point for the study, the methodological approach retained is the *multi-case study*, as described by Yin (2000) and Stake (1996). Contandriopoulos and colleagues (1991: 37) have also called this type of research investigation a case synthesis.

> Case synthesis or case study research is a strategy whereby the researcher decides to work on an analysis unit (or a very limited number of them). Observations are made within the case. (free translation)

Yin (1994) defines the *multi-case study* as distinct from the single-case study; it aims to reveal the convergences between several cases while examining the particularities of each case. However, note that this method requires a certain rigor as well as similar investigative procedures applied to different situations in order to compare the different case studies. Merriam (1988), and Miles and Huberman (1984) point out the undeniable advantages of the multi-case study over the single-case study:

> If time, money, and feasibility permit, a researcher might want to study several cases. In so doing, one increases the potential for generalizing beyond the particular case. An interpretation based on evidence from several cases can be more compelling to a reader than results based on a single instance (Merriam, 1988: 154).

> By comparing sites or cases, one can establish the range of generality of a finding or explanation, and at the same time, pin down the conditions under which that finding will occur [...]. The researcher attempts to see processes and outcomes that occur across many cases or sites and to understand how such processes are bent by specific local contextual variables (Miles & Huberman, 1984: 151).

This method would appear to be particularly suited for the present study; specific cases liable to demonstrate the interactions studied (ICT and education) could be selected. The multi-case comparison (Yin, 2000) would also be suitable for the proposed study because it would facilitate an understanding of the dynamic relations between ICT, learning, teaching, educational administration, etc. The multi-case study approach would incorporate multiple data collections and results derived from similar indicators. The particular relevance of this method stems from the case study criteria defined by Yin (2000: 23), which correspond to the methodological features of the present study (Table 1).

Table 1
Case study criteria according to Yin (2000) and features of this research project

Yin's (1994) criteria for the case study	Features of the present research project
1) The case study investigates a contemporary phenomenon within its real-life context.	Real-life phenomenon (pedagogical integration of ICT) studied in a real-life context (institutions)
2) The boundaries between phenomenonand context are not clearly evident.	To date, little is known about the impacts of ICT on teaching and learning in Africa.
3) Multiple sources of evidence are used.	Researchers will use multiple sources of data and information to better understand the impacts of ICT on teaching and learning.

Miles and Huberman (1991) also pointed out the indisputable advantages of the multi-case study over the single-case study. Nevertheless, we are aware of certain methodological limitations in this study, and precautions, such as data triangulation (Huberman and Miles, 1994), would be taken to ensure validity.

7.3 Strengths of the proposed study

A key strength of the proposed study is undoubtedly the research methodology retained. Multi-case studies are rarely encountered in the education research field. And yet, this approach is well suited to the issues, research question and objectives of the proposed Panafrican Research Agenda on the Pedagogical Integration of ICT. The originality of Yin's (2000) multi-case study is certainly an asset that could facilitate the uncovering of basic convergences between ICT and teaching/learning in widely varying contexts, on the one hand, and distinguish innovations particular to each context on the other. Thus, according to Merriam (1988), an investigation conducted in different settings would obtain a more global, complete and extensive perspective on this phenomenon. Similarly, Van der Maren (1993: 17) emphasizes that the great advantage of the case study is that it reveals general, if not universal, features based on a detailed and thorough study of one or more cases. Contandriopoulos and colleagues (1991: 37) also state that:

> The explanatory strength of this strategy [the case study] rests in the structural coherence of the relations between the case components and the coherence of the variations of these relations with time. The explanatory strength therefore derives from the depth of the case analysis and not the number of analysis units studied. (free translation)

7.4 Triangulation as a methodological precaution

An important element in all education research is triangulation, which means viewing research results from diverse perspectives. The mixed approach can be incorporated as a very valuable element in the triangulation procedure. According to Bogdan and Biklen (1992), research validity resides primarily in determining whether the data collected by the researcher actually correspond to the phenomenon studied. Triangulation is a common, practical and relevant method to offset validity bias. Thus, triangulation validates the researcher's hypothesis through diverse verification methods.

> Methodological triangulation combines dissimilar methods such as interviews, observations, and physical evidence to study the same unit (Merriam, 1988: 69).
>
> The rationale for this strategy is that the flaws of one method are often the strengths of another, and by combining methods, observers can achieve the best of each, while overcoming their unique deficiencies (Denzin, 1970: 308).
>
> The achievement of useful hypothetically realistic constructs in a science requires multiple methods focused on the diagnosis of the same construct from independent points of observation through a kind of triangulation (Campbell and Fiske, 1959: 81).

According to Stake (1995), aside from the use of different methods, an excellent way to triangulate research results is to review the phenomenon in light of the collected results to ensure good correspondence with the perception of the phenomenon.

Therefore, all the researchers under this project would adopt this method for a given indicator. The methodology workshops would also be very useful, since they would set the methodological guidelines and foster complementary methods used between different researchers, as appropriate. This is because the methods would change according to the different indicators. Consequently, all the researchers would use the same methods for a given indictor, but overall, diverse methods would be used to achieve our indicators.

7.5 Main data collection instruments

In addition, as suggested by Yin (2000), the investigative methods used in a multi-case study must be standardized to a certain extent. It would therefore be important for the researchers to use similar data collection instruments as far as possible. The research program that we are undertaking would include four main data collection instruments:

- Survey questionnaires
- Interviews (individual and group)
- Class observation checklists
- A compendium of textual data.

As explained by Krathwohl (1998) and Van der Maren, the survey questionnaire has the advantage of achieving rapid contact with a large number of people. It would be very useful for our research project, particularly to obtain responses on the diverse indicators requiring consultations with specific populations (students, educators, etc.). For example, to obtain responses on an indicator showing learner and educator ICT usage, national teams could administer the survey questionnaires to reach a substantial number of subjects relatively rapidly and easily.

Goyette (1994) describes the interview procedure as highlighting the research process through an informal conversation. He further explains that the interview procedure facilitates the planning, conduct, and even the analysis of the interview. Mishler (1986) stresses the need for properly trained interviewers. A well-prepared interview is more likely to obtain more accurate and relevant information on the research topic in question. On the other hand, a badly prepared or inexperienced interviewer would be less likely to obtain meaningful research data (Mishler, 1986).

During the interview, the subject should always be encouraged to speak on the issue at hand. According to Mishler (1986), it is essential to keep the subject directly on topic. Finally, the conclusion is the last step of the interview (Mishler, 1986). At this point, the interviewer should ensure that he/she has truly understood what the respondent wanted to say by summing up the responses for the interviewee's corroboration. This constitutes a form of triangulation (Stake, 1995), since the subject is "confronted" (Huberman & Miles, 1994) with the collected data.

As part of this research project, we would draw up an interview guide so that the interviews would be semi-structured (Sedlack & Stanley). For instance, the interviews could be structured to enable the national teams to better understand the difficulties that teachers encounter in the pedagogical integration of ICT in Africa. Aside from providing information on the general use of the methodological approach, the methodology workshop would train researchers to conduct the interviews.

We would also carry out classroom observations, which would be made available on the Observatory so that researchers worldwide could view African classrooms along with analyses of the observations performed by African researchers. The national teams involved with the project would be in charge of filming certain classrooms. To systematize the observations made, we would use a classroom checklist. Note that the observation checklist would serve as a basic research tool—an instrument to enable rapid retrieval from sound or video recordings of the interactions relevant to the study. Using the observation checklist, researchers could readily retrieve a significant event for transcription and further examination. Finally, the observation checklist would only be used with sound- or video-recorded classes.

By using an initial checklist with predefined categories, we aim to facilitate the observation of and research on interactions that are relevant to the research objective. Nevertheless, observations would not be limited to these predetermined categories. Depending on the situation, observers might add categories for particular cases. Since three other observers would be trained to carry out the study, it would be important to work with a checklist of pre-established categories.

The compendium of textual data would primarily gather, organize, analyze and synthesize diverse documents that are closely related to the Observatory indicators. To cite a previous example, we plan to compile all ICT policies in African countries.

7.6 Determination of the indicators

As explained above, the indicators would be central to the proposed ICT Observatory. An indicator is a category of information that is collected and stored in an observatory from where it may be retrieved. In this case, it would consist of a reliable qualitative or quantitative variable to measure and evaluate conditions and equipment over time in order to monitor the pedagogical uses of ICT. The ICT indicator would be an index of the quantity or quality evidenced by a specific aspect of ICT integration. This would allow the actual performance and effectiveness of each study objective to be assessed, thereby simplifying the data collection process. The indicators would play an integral part in determining the effectiveness of the pedagogical uses of ICT and their impacts on the entire learning process. To achieve the study objectives, the research would employ clearly defined and consistently applied indicators to better assess the conditions for optimum ICT use in the learning process. To define the indicators, we have drawn from the scientific literature on the pedagogical integration of ICT as well as real-life situations. Thus, to supplement the literature review, we held a Project Development Workshop under the auspices of the IDRC in Dakar in September 2006, where we consulted with 35 experts in the field of ICT in education and drew up the indicators. We classified the indicators into seven main categories:

Main indicator categories

1) National education and ICT policies
2) Equipment, connectivity and access
3) Teacher training
4) Utilization of ICT
5) Impacts on teaching and learning
6) Institution/school management and integration of ICT
7) Equity policies and practices.

Appendix A presents the main indicators for the ICT Observatory, to be established in Phase I.

7.7 Data collection strategy

The first step in the data collection strategy—and one of the most important steps in the study—would be to gather, analyze and synthesize the data for uploading to the online Observatory. This necessary and crucial phase would be ongoing for the next five years, with a particular focus in the first two years (January 2007 to December 2008) on gathering data for approximately 90% of the indicators.

The first step in the uploading of the ICT Observatory indicators would be to compile all the available data on ICT in African education systems onto this platform. Under a previous research project, we identified a substantial number of organizations from which it would be possible, or even essential, to gather information. Of course, we would start with the IDRC-funded projects in order to make available data from sources that are currently inaccessible to some of the researchers. Contacts have already been made with institutions that have carried out sizeable data collections on ICT for the publication of reports. These contacts would lead to the formalization of agreements to upload the data to the defined Observatory indicator categories.

To expand on the body of data provided by the various organizations—which would by itself maximize the benefits of previous research—the national teams would methodically and meticulously compile information for each indicator and submit it for analysis and synthesis. To achieve a thorough and organized data collection, we would hold an initial methodology workshop, which would be attended by two participants from each country.

For certain types of information, document consultation should suffice. For other types of information, a field data collection would be advisable, and this would be one of the main activities throughout the project's duration.

Once the data are gathered, they would be digitized and uploaded via a collaborative platform to facilitate the process. Finally, all the compiled data on the ICT Observatory site would be further analyzed with a view to optimizing the data collection process.

7.8 Data treatment and analysis

Because the data would include figures, texts, images, photos, etc., following the above-presented arguments, quantitative analyses would also be appropriate for this research project, with an explicit invitation to use qualitative methods as well. Qualitative data analyses would be carried out using a coding strategy with classification codes and precise coding categories. Accordingly, codes would be assigned to define the qualitative variables. In addition, the data categorization could incorporate many levels of definition.

The qualitative data analysis strategy was derived from the approaches proposed by L'Écuyer (1990), and Huberman and Miles (1991, 1994). We have adopted the *content analysis approach* (see Table 2). According to Sedlack and Stanley (1992), and L'Écuyer (1990), content analysis is a classification method whereby the diverse elements of the material analyzed are coded to allow a better understanding of the characteristics and meanings (L'Écuyer, 1990; p. 9).

Table 2
General model for the content analysis procedure (adapted from L'Écuyer, 1990)

Step	Characteristics
I	**Reading of the collected data**
II	**Definition of the classification categories for the collected data**
III	**Categorization of the collected data**
IV	**Quantification and statistical data treatment**
V	**Scientific description of the studied cases**
VI	**Interpretation of results from step V.**

Note that L'Écuyer's model would be well suited for analyzing interviews, classroom observations and other situations as well as political speeches and official documents, among others.

An adapted content analysis strategy would be used to analyze the substantial body of data collected in this multi-case study. Thus, data obtained from the different sites would be coded according to the predetermined indicators (see Appendix A) as well as other indicators that might arise from the collected information. These data would then be categorized using a codification procedure. To illustrate, for the "National education and ICT policies" indicator, a mixed coding could be used to analyze the contents of political speeches on the subject of pedagogical ICT uses. This indicator would precisely identify various kinds of information such as 1) availability of documents and texts addressing national ICT policies; 2) education sector(s) covered by the documents or texts; 3) existence of a specific national ICT education program; 4) availability of regulation, monitoring and incentive programs for ICT access (connection, equipment and training); 5) local developments in ICT educational activities, etc.

Furthermore, the indicators could serve as accurate reports on current uses of information technology units for ICT applications. This data analysis strategy would also highlight the salient data that emerges and allow per-site classification. Comparisons and explanations that arise could be measured against the study objectives.

The qualitative analyses would be performed with NVivo 2.0, commonly used in qualitative research data analysis (O'Connor, 2002; Willis & Jost, 1999). NVivo would be very useful in combination with Merge Module to pool the data from various sites. Methodology workshops would be offered to train researchers in Nvivo so they could better understand the compiled data.

For the quantitative analyses, SPSS 13.0 and LISREL 8.51 would be used to perform descriptive and inferential statistics, including variance analysis to better understand the impacts of ICT on teaching and learning.

In step VI of L'Écuyer's model, it would be important to present the Observatory research and results data to various education stakeholders. This way they could "confront" the data collected so far for purposes of validation and interpretation. An adaptation of the model proposed by Huberman and Miles (1991) (illustrated in Figure 1) illustrates the notion of "data confrontation" (Van der Maren, 1993) or triangulation (Stake, 1995), which would be used to validate the research data.

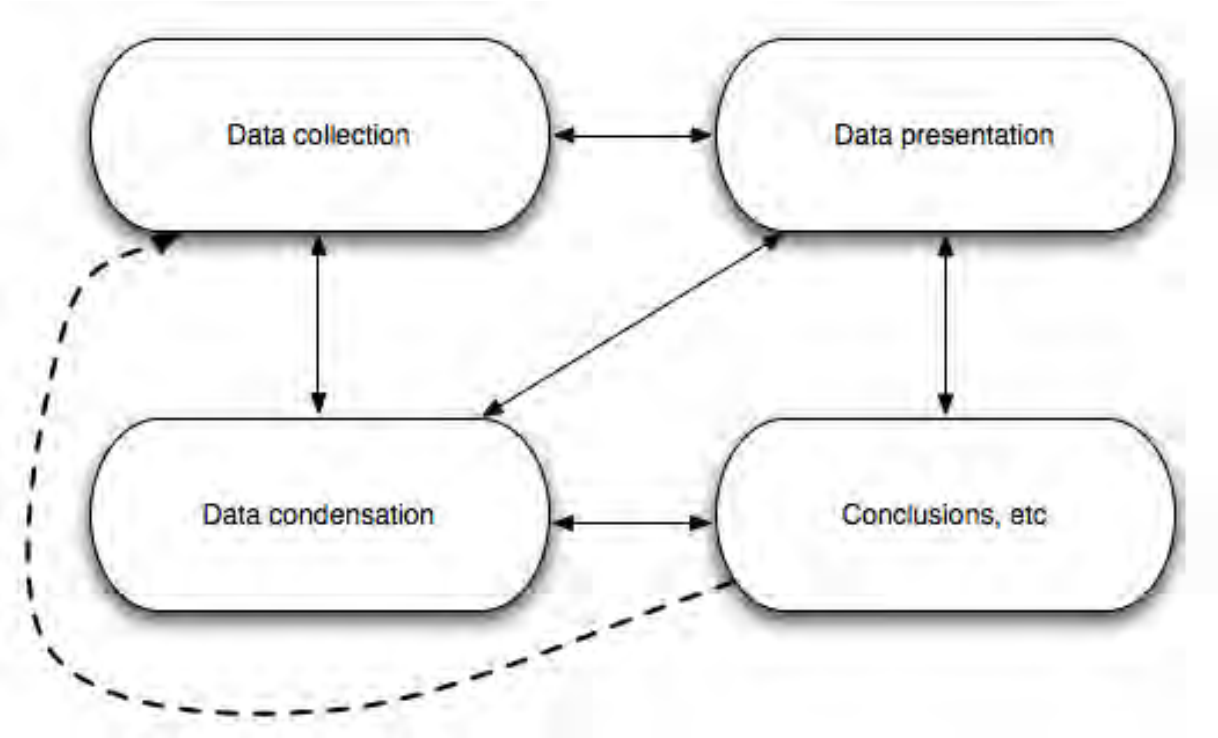

Figure 1 – Adaptation of the Huberman and Miles (1991) model

7.9 Selection of partner countries

Since several universities would participate in this project, the selection of partner countries began prior to the Project Development Workshop held in Dakar in September 2006. We looked for countries where ICT were present in educational institutions so as to maximize the participation of people with experience in the educational uses of ICT. The IDRC has supported and continues to support projects in this area. At the same time, we did not want to exclude countries such as the Central African Republic and Congo, where ICT use in education is less common but the same challenges to its use prevail. In addition, we decided to adopt an adaptative approach towards the countries identified as main Observatory partners. The research teams from these countries would play a key role in constructing and managing the Observatory. In the interests of openness, other countries not directly funded under this project would be invited to collaborate by participating in the Observatory under terms and conditions that are not yet determined. Funding could also be sought from the other development partners. Under the same participatory process used to develop the Panafrican Research Agenda, the 11 following countries were approached and have expressed their intentions to participate in the project:

1. South Africa
2. Cameroon
3. Congo
4. Egypt
5. Kenya
6. Mali
7. Morocco
8. Mozambique
9. Uganda
10. Central African Republic
11. Senegal

To participate in the Observatory, the research teams from these countries would gather data from various pre-school, primary, secondary, higher level and professional and technical schools. Note that the educational institution would represent a case for purposes of our research project. Accordingly, the institutions would be central to the research effort.

7.10 Project execution: key steps

This extensive and important project includes five major steps, divided into two phases:

Phase I (duration: 2 years)

1 Setting up national teams
2 Establishing the Observatory
3 Researching and compiling Observatory indicators

Phase II (duration: 3 years)

4 Researching and compiling Observatory indicators (ongoing)
5 Setting up national research projects on common themes across the participating countries based on Observatory data and analyses.

Phase I is divided into several smaller steps:

Step 1: Collection and uploading of available data (months 1 – 3)

This initial step of the investigation aims to compile a maximum amount of information and make it available on the project Website. A 3-month period should be sufficient to allow field researchers to gather as many data as possible.

Prior to the data collection, a meeting would be held to set up partnerships with the institutions and projects willing to share their document and data resources with the Observatory.

Step 2: Methodology workshop (end of month 3)

The methodology workshop would be held three months after the start of the data collection. Its purpose would be to better prepare the researchers to carry out the field tasks. By bringing together researchers from the various participating countries, the workshop would constitute an oversight group that could explain the methodological approach adopted for the study. Aside from sharing and evaluating the information collected in the first three months, the workshop would be an ideal opportunity for preparing the researchers for a much more extensive field data collection. Among others, it would be an opportunity for the first stocktaking of progress by means of summaries of the types of information gathered and made available online and the potential problems identified. At the same time, it would be an opportunity for the participants to check the consistency of their methodological approaches and fine-tune their procedures.

Step 3: Field data collection (months 4 – 24)

Following the methodology workshop, the third step would be the field data collection, which would be ongoing for 20 months. This procedure would require a lengthy duration to enable the researchers to observe as much as possible and gather the most accurate information. Complete observation of certain types of information might require the setting of minimum durations.

Step 4: Analysis and synthesis of collected data (months 4 – 24)

All the data collected throughout the research process would be analyzed in this step. A general synthesis of the different analyses would then be performed.

Step 5: Publications by national research teams (months 15 – 24)

Researchers would present the results of national studies in scientific reports.

Step 6: Symposium presenting the Phase I results (month 24)

To close the first project phase, a forum would be held to present the study results. The participating countries would be invited to present their key research findings to a general audience.

VIII. PROPOSED APPROACH FOR THE PANAFRICAN RESEARCH AGENDA ON THE PEDAGOGICAL INTEGRATION OF ICT

This section presents the argument for the need to establish the Observatory as the first methodological step. The importance of following a consultative process and a two-phased approach to achieve this project are explained.

8.1 Phase I opportunities

Several aspects argue in favour of the proposed two-phased execution. Phase I is important because it aims to not only set up the national teams that would carry out the project (Section 8.1) but also to establish the Observatory (Section 8.2) and to determine and compile the indicators. Therefore, Phase I would enable us to express the state of the pedagogical integration of ICT in Africa in relation to the quality of teaching and learning. This crucial research step would allow us to not only take stock of the data from previous investigations and compile them on the Observatory but to gather information from the educational institutions as well.

One action plan component is therefore to collect and analyze the information elements from all the participating countries. Adoption of Phase I would provide the momentum for the implementation of the planned indicators. The predefined indicators would be systematized and complementary indicators would be tested with a view to extending the observational scope and performing deeper analyses. At the end of Phase I, the researchers could run the first analyses on the collected data, using the indicators to verify whether the field data relates well to aspects of pedagogical ICT integration. Although these analyses would not draw definitive conclusions, they would provide useful information for further, in-depth analyses on the issues. This is designed as an initial procedural step to survey the diverse uses of ICT in education settings and obtain an overall perspective on ICT usage. In effect, it would be an experimental phase leading to a more rigorous data analysis and more credible results.

8.2 Why begin with the establishment of the Observatory?

A number of European and North American studies have clearly demonstrated a basic, underlying problem in research: results are not properly distributed or shared (see Richardson, 2001). In concrete terms, although an enormous amount of research has been carried out and established, it is normally very difficult in a continent such as Africa to keep abreast of this knowledge. African researchers are held back by having

to repeat research steps that have already been accomplished, which greatly slows their progress. This lack of accessible knowledge is attributed to both the shortage of scientific publications in Africa and the fact that previous results and research work are not uniformly shared (Karsenti, 2003; Maclure, 1997). The task is made even more difficult for researchers in the areas of rapidly evolving technologies like ICT.

Scientists rapidly recognized that an observatory serves as an excellent tool to fill this gap, particularly in the applied sciences and medicine. Thus, observatories on drugs and substance abuse have been set up to provide tools for researchers and scientists as well as practitioners, and the observatory has become the tool of choice for researchers and practitioners seeking updated information on drugs and addiction. A pre-eminent example is the oceanography observatory, which serves as a worldwide scientific reference.

Meanwhile, the scientific literature contains little information on the impact of observatory implementation. Undoubtedly, many observatories enjoyed the multiple benefits of scientific collaboration when the platforms were being set up, but scientific publications investigating the observatories themselves are rare. For example, the Educational Resources in Education Clearinghouse (ERIC database), the largest education database in the world with over 150,000,000 referenced texts, contains only 26 publications on observatories. This testifies to the novelty of the tool at the same time as it underscores the need to compile and distribute research results.

Although many observatories exist today, none specifically address the educational uses of ICT. Furthermore, there are practically no observatories in Africa, with the exception of an observatory on desertification and the participation of the Bamako Malaria Research and Training Centre in a medical observatory.

Nor are there many functional and operating observatories in the field of education. We can mention the European Science and Technology Observatory (ESTO), and the most important is the European Observatory of Innovations in Education and Training, a consortium of 13 European Union members states, operating as a researcher and educator network in the field of comparative education. In the area of ICT in education, we note the Information Technology Observatory of Macau Productivity and Technology Center (CPTTM) and the Observatoire français des médias. However, both are somewhat removed from the field of education per se, and their data usually seem to be outdated and few in number.

From the above, we may conclude that establishing an ICT Observatory as the first step in the Panafrican Research Agenda would constitute a major innovation in the emerging research on ICT in education on the African continent, where interest is steadily gaining momentum. Under this project, the implementation of the Observatory would be evaluated with a view to improving the knowledge of this research and promotion tool, particularly in the African context.

IX. OBSERVATORY FUNCTIONS AND FEATURES

A critical dimension of this step would be the development of the Observatory on the pedagogical integration of ICT in Africa and getting it up and running (www.observatoire-tic.org). What is an observatory? The observatory's mission is to generate information for decision-making and serve as an information source for different domains.

The planned Observatory would be a single platform where research data from several research projects on ICT would be compiled and shared. It would include data from projects funded by the IDRC and other organizations. Since the currently available research data from the diverse organizations is inadequately distributed and shared (see research results), the Observatory would respond to this critical research challenge. In addition, the Observatory could foster change among decision-makers by providing them with ongoing, updated information. Figure 2 below presents the Observatory Home Page.

Figure 2 – Observatory Home Page

Once established, the Observatory would raise the quality of research simply by offering researchers one-stop access to a wealth of highly useful data and information for their research efforts.

The ICT Observatory/*Observatoire-TIC* (www.observatoire-tic.org) would also consolidate information on policies, access issues, practices (training, teaching, learning), impacts, and the issue of sustainability at the continental, regional, national, sectoral (primary, secondary, university and technical) and institutional levels. This consolidation would be dynamic, independent and collaborative (Figure 3).

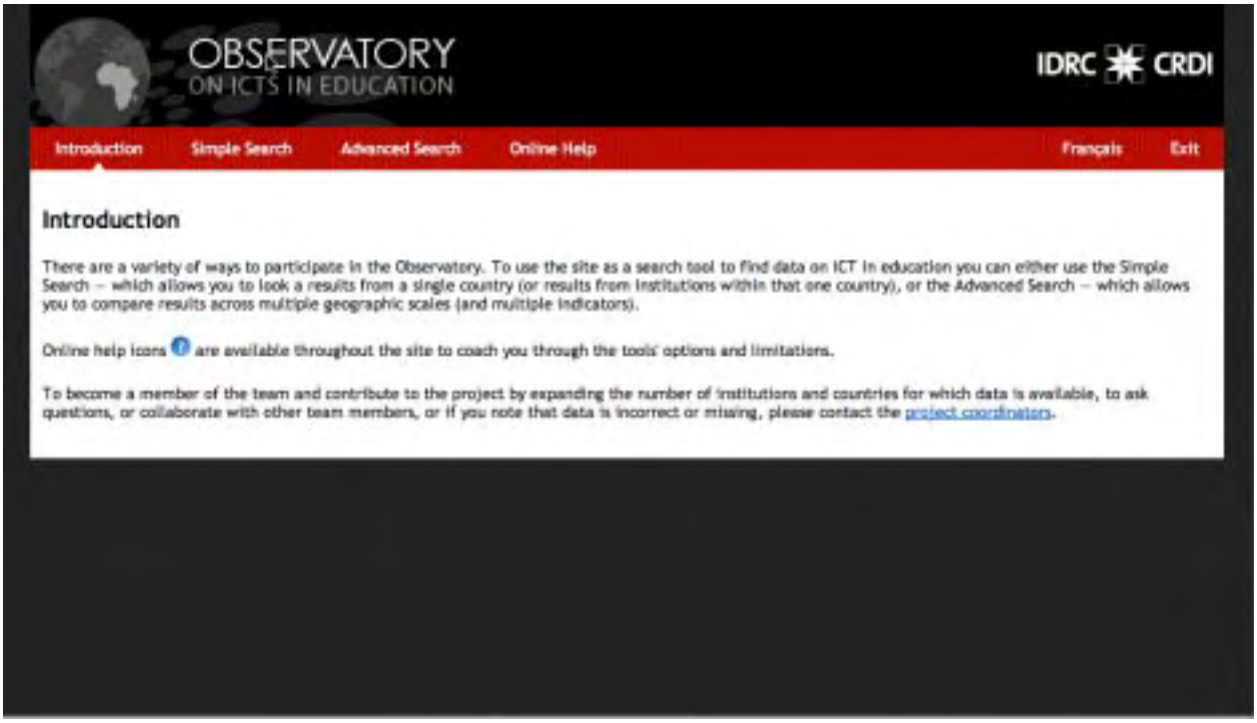

Figure 3 – Research functions of the ICT Observatory

The ICT Observatory would be the first panafrican research tool for ICT in education. It would also be the first panafrican research tool used for institutional development.

On the subject of information processing, note that the ICT Observatory would be designed as a collaboratory, or a platform where a multitude of actors (especially researchers) would have varying access privileges for purposes of uploading data, updating information, printing out reports, etc. Appendix A presents the main indicator categories for the ICT Observatory, to be implemented in Phase I.

Figures 4 and 5 present some more previews of the planned ICT Observatory. Besides the Home Page (Figure 2) and the Thematic Search Page (Figure 3) that offers a search by indicator category, Figure 4 illustrates a thematic search. Figure 5 illustrates a search by country.

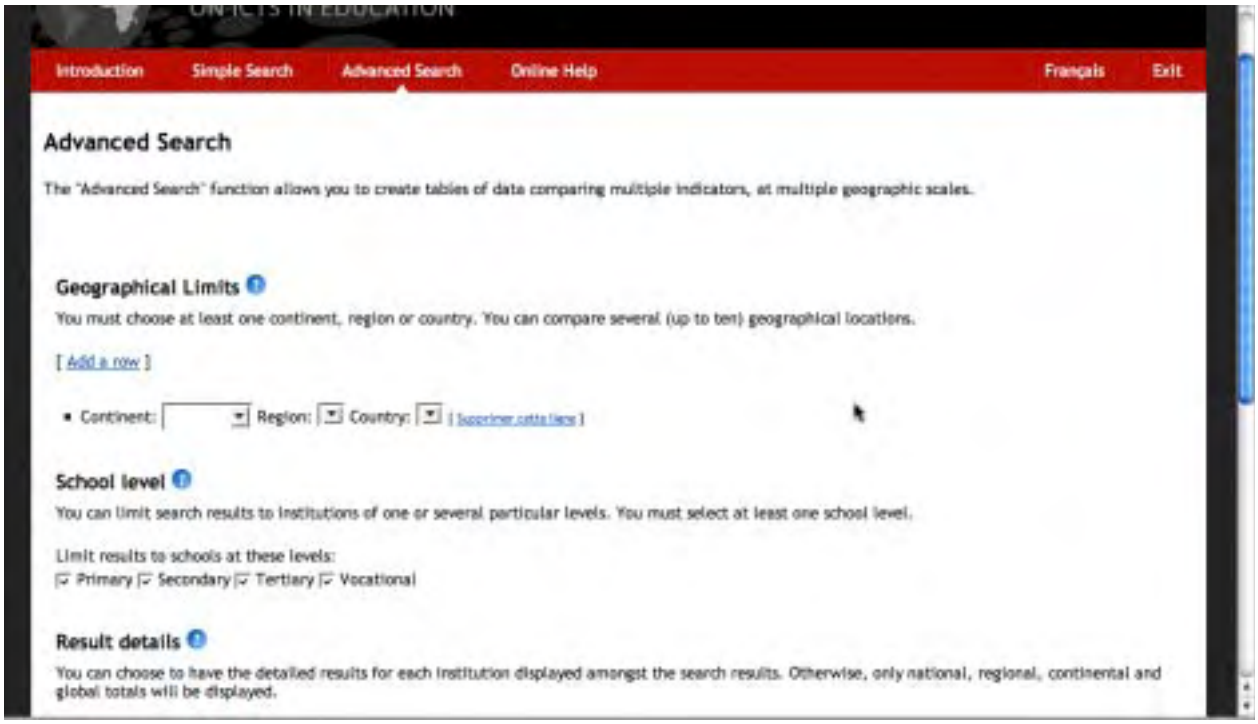

Figure 4 – Example of a thematic search

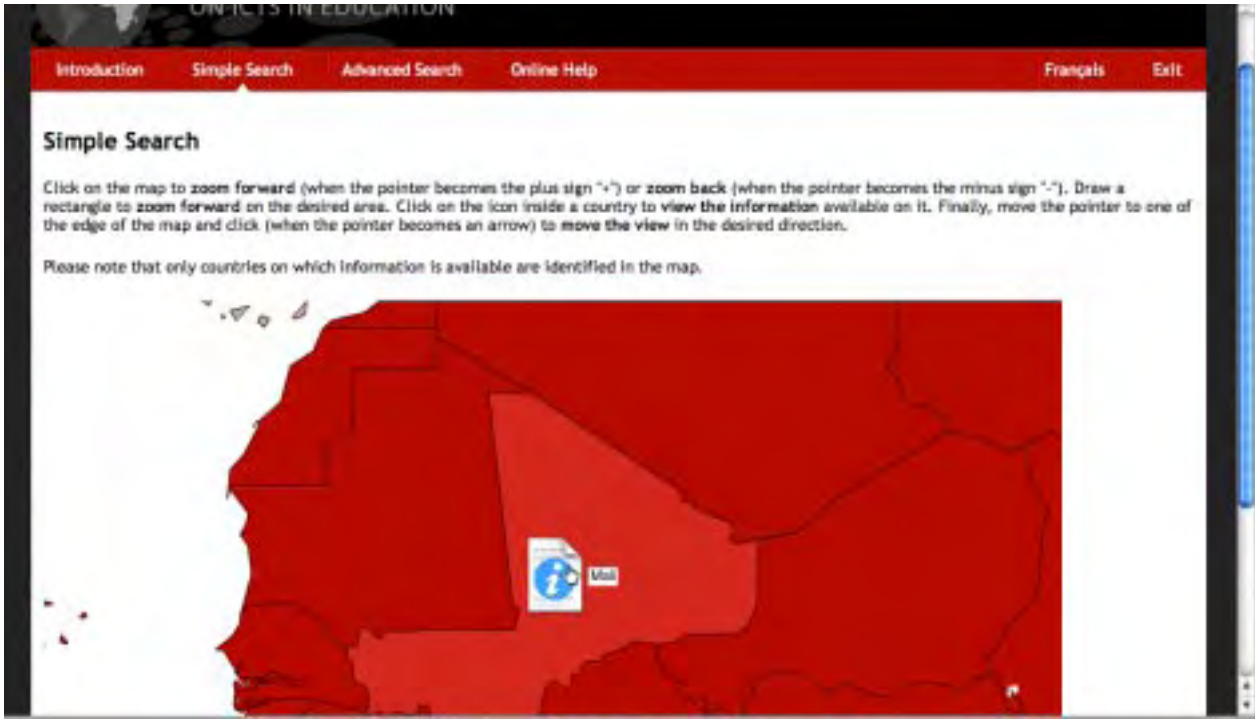

Figure 5 – Example of a search by country

A brief overview of the various existing observatories reveals three main functions:

- Data collection (level I)
- Analysis (level II)
- Synthesis (level III).

Note that digitizing and uploading education policies (e.g., ministerial documentation) would fall under level I, or data collection. A summary of each policy deposited in the Observatory would be a level II analysis. Instead of having to peruse the entire document, researchers could save time by reading the Observatory researcher's analysis. Finally, the data synthesis would present a higher-level analysis. For instance, several policies could be compared.

The Observatory to be implemented as part of this extensive project would necessarily comprise all three levels of information (raw, analyzed and synthesized data). In addition, we would go further by incorporating a fourth level: publications. Why the addition of publications? Because, as indicated above, there is a scarcity of scientific publications in Africa, and the Observatory could serve as a window on the world for African researchers who would like to publish their works. Beyond the informative and data reporting functions, the Observatory would be a comprehensive communications device integrated on a single platform, with a monthly e-newsletter and an RSS feeder as just some of the pre-selected components.

We must stress that, similar to the oceanography observatory, the proposed Observatory would promote the development of local research capabilities. In the first two years, researchers from many countries would learn how to work as a team and at the same time improve their knowledge in the area of educational ICT research. Finally, because the Observatory would incorporate a publication component, researchers could publish two or three texts in connection with their work on the Observatory by the end of the first two years.

As demonstrated by certain highly successful observatories, the Observatory on ICT in African education would allow researchers across many countries to understand the pedagogical uses of ICT in a non-restrictive yet similar manner. More importantly, they would gain an overall understanding of the potential uses of ICT in the teaching/learning process.

Moreover, as explained in Section VII above, researchers would use similar approaches to collect, analyze and synthesize information, thereby facilitating cross-country comparisons.

The Observatory would above all offer the benefits of sharing knowledge, a diversity of experiences, successful innovations, pioneering practices, etc.

The Observatory would also develop collaboration, collegiality and mutuality, not only among researchers, but hopefully, among practitioners and between researchers and practitioners as well.

Finally, aside from all these important aspects, the Observatory would leverage African researchers into taking part in the International Scientific Community through first-rate research initiatives, and above all, the distribution of findings.

X. ICT AND GENDER

10.1 The literature on ICT and gender

From the literature review, research on ICT and gender centres on three themes: women's access to ICT; women's ICT usage and expertise; and ICT access and use equity between men and women.[4] The results do not prove the hypothesis that gender issues go away because the Internet is a virtual environment. It appears that the virtual space is still dominated by men, and that some spaces initially occupied by women were later taken over by men. Women's limited access to ICT would certainly result in negative educational and economic outcomes.

The little research that exists on ICT and gender in the Southern countries aims to identify the barriers to women's access and use of ICT and the solutions that should be implemented, but it does not explore structural issues. These studies are also combined with studies on poverty, demonstrating that economically "poor" women are the most disadvantaged in society. The barriers include lower literacy and education levels, time and cost constraints, geographical locations of access points, insufficient number of computers, sociocultural norms, and lack of information processing skills.

Overall, we note that ICT projects have been carried out in the Southern countries without adapting technical solutions and management approaches to the characteristics, needs and contexts of the countries. It would be important to develop tools to better collect and analyze quantitative and qualitative data on the tendencies of men and women to access and use ICT and to identify the needs and aspirations of men and women in this area.

10.2 ICT and gender in primary and secondary education in West and Central Africa

Under a project funded by the IDRC, research was conducted in 40 primary and secondary "ICT pioneer" schools in five countries from 2004 to 2005. Discussions with the participants uncovered certain realities in West and Central Africa concerning ICT and gender. In the course of this trans-national research project, we found that, although the computer rooms in the schools studied held an almost irresistible attraction for everyone, gender-related issues of ICT access were raised by both students and teachers.

4 *Research into ICT and Gender: Some Key Themes (2003). Butcher, Neil et al., unpublished paper, 21p.*

The people in charge of the computer, multimedia and information processing rooms were mostly, if not exclusively, men. Women were rarely assigned ICT monitoring or teaching duties. However, in about a dozen schools, we learned that special arrangements had been made to allow the less technically adept students to become more comfortable with ICT use. Unfortunately, the scheduling was not always convenient, especially for women.

In the opinion of most school principals, if a difference existed between the boys and girls, it was not very apparent. They also stressed that both boys and girls exhibited computer savvy and enjoyed using ICT. Generally, it appeared that the girls got better marks in the computer class as well as in other subjects.

At school, priority ICT access was given to the most motivated pupils, regardless of sex, although the boys seemed to have more access to computers outside of school, e.g., at cyber-cafés. Some teachers remarked that, in terms of handling computer tools, the boys seemed to have mastered the computer better than the girls overall. In most cases, a few boys were known as ICT experts by their friends.

10.3 Gender-specific examples of ICT integration at different teaching levels

Many sub-Saharan African countries need to improve the quality of education and resolve the equity issue. Discrimination against girls, or sexual differentiation, is a serious concern and a barrier to the integration of ICT in education. The disparities observed between girls and boys in learning to use ICT, at all education levels, underscores the *gender-specific* nature of African societies, where women's and men's living conditions differ. Depending on the region, women enjoy less social access and are submitted to diverse forms of exclusion, which renders them more vulnerable. Sociocultural frameworks have confined African women to the role of housekeeper (RNN, 1997). In such conservative cultural environments, women and men take up distinct duties and roles, resulting in rather different lifestyles and conditions, which in turn produces different bodies of knowledge and gives rise to different informational needs. Thus, sexual differentiation results in a kind of second-class status for women, where women's interests are shaped to comply with deeply held beliefs about their roles in various dimensions of life. These beliefs and ideologies are intrinsic to cultural practices and religious beliefs and practices as well as other aspects of African life (Wolpe et al. 1997). The problem is exacerbated by the fact that girls appear to be alienated by ICT, considering them as belonging to the masculine realm. An investigation of computer savvy by university students revealed that female students were less skilled in the use of information technologies than their male counterparts (Sayed & Karelse, 1997). This imbalance at all levels is undoubtedly attributable to a mixture of cultural norms, but also to historical, economic, sociological, legal and traditional factors.

However, a certain balance between boys and girls in ICT training would be required for the successful long-term integration of ICT into schools. Moreover, girls make up slightly more than half the student population in most African countries. We cannot contemplate integrating ICT into the schools without giving due consideration to girls. ICT integration should not be allowed to be a domain strictly reserved for males. By raising awareness among girls and facilitating their access to ICT, in short, by advocating sexual equality, we could enable a better implementation of ICT into education systems. Any efforts to correct gender imbalances would require schools to encourage girls to use ICT.

According to many studies (Huyer, 1997; CSTD–GES, 1995), several factors must taken into account when developing ICT integration policies so as to overcome the constraints that bar girls from using these technologies at school. For example, educators' (parents" and teachers") behaviours would have to change towards children, from a very young age. Above all, special measures would have to be implemented in the schools to facilitate girls' access to the computer rooms. There should be no barriers to girls. Otherwise, there is a risk for lack of interest and awareness, exacerbated by the influence of the sociocultural environment. Every person who can read and write can use ICT.

The ICT integration process should therefore consider the entire environment, scholastic and sociocultural, so as to correct the educational imbalance between the sexes and produce a new generation of young girls and women who are knowledgeable and trained in day-to-day ICT use. In other words, girls should be offered the same educational opportunities as boys. Sexual discrimination, i.e. exclusion or marginalization, constitutes a serious hindrance to the effective integration of ICT into the education system. The notion of discrimination should be banned from the integration process and replaced by provisions that allow all students to learn ICT. In the interests of equity between the sexes, large-scale strategies should be designed to overcome the barriers to ICT use by girls at school.

If ICT is introduced into school systems without taking into account these social factors, there is a risk of introducing further disparities. The integration of ICT might work to the disadvantage of girls by reinforcing their subordinate status. The best solution would seem to be to develop ICT integration into schools based simply on the increasingly evident needs for efficiency, efficacy, flexibility and sustainability. The realities of the sociocultural environment and the integration of ICT into schools must be taken into account to prevent appropriation, pretence and ignorance. The lack of educational opportunities offered to females, the handicapped and other vulnerable sectors of society constitutes a fundamental obstacle to their participation in the information society and the use of ICT.

In this perspective, the principle of equity is universal education and training that takes into account the diversity of the social mosaic, regardless of individual gender, social class, ethnocultural group, or skills.

10.4 Consideration of gender under the present project

Inequity, at various scales, compounds the effects of risk and vulnerability among the poor. With the goal of better understanding the multiplex challenges of equitable development, this research will address gender, rural/urban residence, and socioeconomic class, using both targeted and integrated methodologies. The indicators in 7.0 will engage these issues specifically, to produce tangible recommendations for improved ICT-in-education equity - while throughout the indicators, equity issues will be addressed in research design, implementation and evaluation.

Since this research project aims to contribute to social and equitable change, and the gender issue would be an essential component, the project would incorporate a consideration of gender at many levels—from process management to data collection and analysis and results distribution.

Development of the Observatory indicators would include a consideration of gender across the sectors. Gender would therefore constitute a separate indicator in Phase I and Phase II, and would ultimately address not only access to ICT but also access to training and other opportunities to improve ICT skills. Similarly, the project would address the specific needs of men and women in the ICT appropriation process in African schools. The project would therefore require a resource person to optimize the research in terms of a cross-sectoral gender analysis.

XI. STRENGTHENING RESEARCH CAPACITIES

Apart from promoting the sharing of information and expertise, the Observatory would be an excellent way to address the current shortage of collaboration among researchers. One of the chief benefits of the project would be the strengthening of research capacities in Africa. It is noteworthy that, although the case for ICT and their integration into the teaching/learning process has been demonstrated and acknowledged, this project would produce further benefits through the acquisition of new research knowledge.

11.1 Strengthening the capacities of countries and researchers

If developing African countries are to escape from the research rut in which they are caught, they need to embark on large-scale research projects that reach larger audiences. This would be essential for the mutual strengthening of research capacities among African researchers. All project participants would greatly benefit from the store of research methods and tools available on the Observatory. Moreover, the range of methodological approaches adopted would strengthen research capacities and be instrumental in obtaining better and more coherent research results in a medium-term perspective. Using the key elements to strengthen research capacities, as explained below, the countries could work with the entire body of data on ICT integration, drawing from a variety of sources as well as interfaces between authors of previous works and users of those works. Finally, to strengthen their capacities, the partner countries would also have to be willing to participate in the project.

As previously demonstrated in numerous studies on the pedagogical integration of ICT, this project should have a major impact on the capacity development of teachers and researchers. The quantity and quality of the data for collection and analysis would help researchers develop their knowledge and professional abilities, and would also constitute a training resource for improving teaching practices and scientific undertakings.

This research project therefore offers multiple scientific benefits. The research model would allow researchers from the participating countries to develop their capacities to assume shared responsibility for the research data and results they produce. The sequencing strategy for the data collection and in-depth analysis steps would help the researchers develop at each level the critical stance and synthetic approach required for sound scientific research. Furthermore, since the data collection would be carried out across a variety of primary, secondary and tertiary schools as well as diverse professional, technical, specialized and partner organizations, the resultant research dynamics would promote greater collaboration and shared responsibility.

These are some of the chief dividends that would help develop and strengthen researchers and contribute to national research, with a view to comparisons with similar international studies using similar tools and indicators. The national researchers and research teams and scientific committees would have opportunities to voice their opinions, independently of their country, on the overall study results. This would be an undeniable asset, as it would encourage a general openness to other people, ideas and realities. Through the data confrontation process and exchanges of views from many African perspectives, combined with an objective oversight by scientists from abroad, very high quality results should come out of this international research project.

Because the research focuses on the pedagogical integration of ICT from primary to tertiary school, it would also contribute to strengthen research capacities in many African educational institutions through national and/or sub-regional methodology workshops. They would be held with the aim of adopting a consistent investigative approach and results distribution procedure. These methodology workshops would help teachers and researchers improve their skills in data collection and processing as well as publishing the results of their work.

Furthermore, this study would help reinforce collaboration between researchers within the countries, while fostering bilateral and international cooperation between researchers and institutions within and between countries. In addition, this study would facilitate coordinated research initiatives on ICT use among the various African educational institutions. At the same time, this research would confer more widespread recognition on national experiments in the pedagogical integration of ICT.

11.2 Strengthening student capacities

Several students currently in training at the partner universities would be invited to collaborate on education research in their future professional careers. Since training for the specific vocation of educator-researcher is rare or nonexistent, it would seem beneficial to recruit these students for this large-scale project.

These students would be introduced to the scientific community and initiated into epistemological research methods, thereby gaining further knowledge and skills.

In fact, the benefits of student participation would be numerous. Among others, it would:

- Allow students to obtain the classroom checklists for the field experiments
- Train professionals to work with an extensive range of research methods and procedures. After participating in the study, students would be invited to take part in the research methodology, data collection, and development of tools to collect and analyze data and observations. Hence, by contributing to design and implement the basic instruments and procedures, they would gain an understanding of the knowledge construction process.
- Raise awareness of the frailty of knowledge, which must be completed, classified and reintegrated back into wider data collections, or else invalidated by new research findings.
- Identify the issues, institutional decision-making policies, resources and territories.

Participating in the research activities would be an excellent way for students to learn, since they would have to address differences and diversities, put the relevant evidence into perspective, account for other consistencies, and consider the needs of each culture and worldview. Confrontation with reality could help change viewpoints and draw attention to different levels of reality and types of phenomena.

Participation in this research on education would therefore be very educational. It would give researchers and students an opportunity to refresh their individual skills and partake in a real scientific research effort. Students would be inspired and guided, which would contribute to the production of scientific knowledge for publication purposes.

Finally, the proposed evaluation procedure would allow a precise and efficient measurement of the real impacts of this study on the research capacities of researchers and students. Aside from evaluating the implementation processes for the research strategies and tools, an evaluation of the different procedures and tools used and their outcomes would be carried out.

XII. POLICY DIALOGUE

With their phased integration into African educational institutions, ICT are attracting increasing attention from the governments, who see them as tools to raise the quality of teaching and learning. Programs and projects to equip the schools are underway. Certain countries have prioritized this area through the development of sectoral and policy strategies. In general however, the governments lack the referential frames, instruments and expertise to develop and implement such strategies and policies. More worrying still is the fact that, in a number of countries, there is no state responsibility or coordination to organize this sector, which is marked by a certain anarchy arising from the multiplicity of public initiatives (government, bilateral and multilateral cooperation) and private (enterprises, NGOs, patronage, etc.).

So that interventions in this area might have a meaningful impact, it would be necessary to initiate fruitful dialogues between the different stakeholders in the education system. Therefore, under this project, policy dialogues would be instituted at different levels to ensure that the research takes into account the needs and priorities expressed by the education community, and that the resultant data and analyses be made available to and used by the policymakers to develop and implement policies for ICT integration into school curricula. This at a time when several countries are undergoing education reform.

12.1 The national level

A five-member National Committee would be set up in each country, comprising the principal researcher, policymakers from the ministries (e.g., education, communication), a curriculum development specialist, and other relevant resource persons. The committee would supervise project activities, validate data destined for the Observatory, and ensure that national priorities for ICT integration are addressed by arranging discussions between the various stakeholders through national institutional mechanisms. In the ROCARE member countries, the expertise developed by the researchers under IDRC-funded ICT projects have already made significant contributions to support the governments in this matter. Of course, there would be different levels of data on the Observatory. But the synthesis level would allow decision-makers to access summary reports via bimonthly newsletters.

12.2 Regional and international levels

Existing regional integration organizations across the continent offer spaces and opportunities for policy dialogue in the framework of sectoral programs such as education, a chief priority. These would be suitable venues for establishing collaborative relations with organizations such as the Union Économique et Monétaire Ouest Africaine (UEMOA), the Communauté Économique des États de l'Afrique de l'Ouest (CEDEAO) in West Africa, the Communauté monétaire et économique d'Afrique centrale (CEMAC) in Central Africa, the Union du Maghreb arabe (UMA) / Arab Maghreb Union (AMU) in Northern Africa, the Southern African Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA) in East and Southern Africa, and the Union africaine (UA) / African Union (AU). Continent-wide and internationally, the Association pour le développement de l'éducation en Afrique (ADEA), the Commonwealth of Learning and UNESCO offer frameworks for dialogue with decision-makers. ROCARE has acquired extensive experience in this field of political negotiation, which could be leveraged to further develop relationships.

XIII. STRATEGIC PARTNERSHIPS

In recent years, Africa has seen a growing number of initiatives to improve ICT access in schools. Aside from the IDRC, several other national, regional and international public and private organizations have set up programs and projects to expand ICT uses for teaching and learning purposes. In addition, there is Schoolnet, the Nepad E.Schools, WorldLinks and Infodev, under the World Bank, The African Virtual University, etc. Some of these players, such as the Nepad E.Schools and Infodev, have undertaken ambitious data collections to gain deeper knowledge of the sector.

Other organizations, such as UNESCO's International Institute for Capacity Building in Africa (IICBA) and the RESATICE online resource network, specialize in research on ICT in education, which would be very useful for the Panafrican Research Agenda.

All these organizations are potential partners for this project. Contacts have already been initiated, and some have expressed a willingness to collaborate by providing information to the Observatory. The forms of partnership could vary across institutions according to their area of expertise. Useful complementarities could be identified, and the Observatory could offer a common platform for improved data collection and analysis on the state of ICT in education, an area in which Africa is severely lacking.

Therefore, once the project is launched, a meeting with the potential partners would be held to discuss these complementarities and establish a strategic partnership framework for Observatory activities. Concrete memoranda of understanding would be negotiated and signed with ROCARE and the partner organizations.

XIV.

MAIN EXPECTED OUTCOMES

This research project aims to achieve the following outcomes:

- Systematic, large-scale documentation and distribution of ICT policies in force in the participating African countries
- Accurate knowledge of the state of ICT connectivity, equipment and management in African educational institutions
- Inventory and large-scale distribution of African teacher training methods in the pedagogical uses of ICT
- Deeper understanding of the pedagogical uses of ICT at the different teaching levels and in different learning and training contexts
- Identification and classification of the real impacts of ICT on the teaching/learning process at the different teaching levels in Africa
- Better understanding of the roles of school principals, administrative staff and the community in the ICT integration process
- Strengthening of guarantor strategies for equity and collaboration between bilateral and international cooperative agencies and between the educational institutions concerning ICT use in education
- Initiation of fruitful dialogues between researchers and the different education stakeholders, particularly the policy makers
- Establishment of strategic partnerships with the institutions and projects working in the area of ICT in education
- Strengthened research capacities and knowledge sharing
- Availability of an Observatory on ICT in Education, operating effectively and sustainably to improve access to data and analyses on the uses of ICT in education continent-wide
- Diverse scientific publications on the pedagogical uses of ICT by national team researchers
- Organization of a Forum to present and distribute the overall research results
- Publication of a monthly e-newsletter
- Production of a collective work presenting the research results
- Identification of common themes across the member countries with a view to pursuing further research in Phase 2.

XV. COMMUNICATION AND SHARING OF RESEARCH RESULTS

Communication of data and results would be central to the project.

Results communication would be paramount. The project would begin with the creation of a website where all information would be uploaded and all project information and data project stored.

Aside from the website, where data would be made permanently available, the Observatory would act as the main source for research results dissemination. In addition, there are several other possibilities for the large-scale diffusion of research results:

1 Regular reports produced by the participating countries
2. Discussions with the project partners and stakeholders
3. Results presented in scientific articles in journals (researchers would submit at least one text per year)
4. A monthly e-newsletter distributed to researchers and practitioners as well as administrators and policymakers
5. Results presentations at forums and other gatherings
6. Overall results presentation in a collective work
7. Results presentation at a forum organized by the IDRC, to provide closure for the first two years of the project
8. Results presentation to the media at conferences organized by ROCARE and other partners.

The results communication process would produce the following mechanisms, outcomes and supports:

Oral communication

- Regular communication between the National Committees and the appropriate ministry officials
- Radio interviews with participating researchers
- Televised round table with the principle researchers from the partner countries.

Meetings

- Organization of national workshops to present project results to all concerned, particularly the schools, partners, policymakers and local and national elected representatives
- Large-scale regional workshop to present research results to representatives of the following organizations:

- RESAFAD
- UEMOA
- NEPAD
- IEARN
- AUF
- World Links
- Globe
- Global Teenager program
- ADEA
- SwissCom
- USAID
- SchoolNet Africa.

International Forum on Panafrican Research on the Pedagogical Integration of ICT

To close the first project phase, a two-day scientific forum to present the overall results of the study would be organized. The participating countries would be invited to present their main research findings to a general audience. Themes of the practical application of ICT, constraints, potential uses, opportunities offered, etc. could be addressed, as predetermined by the International Scientific Committee.

Indeed, it is not enough to collect, document and analyze data to produce ideas and results. There remains the additional and substantial challenge of conveying the message. Thus, the promotion, distribution, and operationalisation of research results at forums and seminars is a strategic approach that gives rise to multiple publication possibilities. Moreover, this forum would be an opportunity to globally evaluate the activities carried out. It would also allow an exploration of future directions, including program exchanges, institutional strengthening, the development and implementation of policies and projects for the pedagogical integration of ICT, etc.

Dissemination : written communication

- Publication of scientific articles
- Publication of a collective work in French and English
- Publication of extracts of research reports on various website s and e-journals (ACACIA, IDRC, CRIFPE, ROCARE, THOT, etc.)
- Release of articles in national and local newspapers
- Written recommendations based on research results for consideration in national education policies and programs.

Dissemination : multimedia communication

- Ongoing leadership and information exchange on the virtual platform (project website)
- Production and diffusion of an interactive CD-ROM targeting national policymakers and key players in the education systems. It would be highly useful at the national and regional workshops to assist the participants and invited representatives from local and international NGOs and institutional partners in understanding the significant study results.

XVI. EVALUATION

Evaluation of this first phase of the Panafrican Research Agenda on the Pedagogical Integration of ICT would be carried out on an ongoing basis and with diverse means. We would not wait until the very end to draw lessons. Thus, ongoing evaluation would be part of the continuous learning process. A reflective process would be adopted whereby the lessons learned would be continuously reinvested into project management and partnerships in order to improve the quality and relevance of the research. These lessons would be shared within the practicing community that would constitute the research network providing the Observatory data, thus contributing to the community's development.

The participants at the methodology workshops would fill out the evaluation sheets and the results would be distributed online to the participants and the entire practicing community a week after the workshops. Results would also be appended to the technical reports.

By the 10th project month, ROCARE would administer a formal electronic survey to the national participants on the quality of implementation and request suggestions for improvement. We would aim for at least 50% participant feedback.

Observatory site visit statistics would inform each participant and partner as well as general site visitors of site consultation frequency and provenance. We would combine this with a qualitative online survey.

By the 12th project month, ROCARE and the University of Montreal would administer from the Observatory website a survey on the site's relevancy and ease of access as well as Web-site data management and data usage. We plan to sample 75 site users from several African countries and regions as well as 25 users from abroad.

XVII.

INSTITUTIONAL FRAMEWORK

This project would establish a multi-institutional partnership, with a focus on the tertiary level research institutions of the participating countries, preferably attached to universities. They would work under the scientific and technical coordination of ROCARE and the University of Montreal.

The national research institutions and the universities would therefore be privileged partners in the project development and implementation. Other partners would pool their efforts as time goes along, each bringing a unique contribution. The following national partners (in alphabetical order) have expressed their willingness to participate in Phase I of the project:

- *School of Education*, Wits University, **South Africa**
- *Département de Sciences de l'Education*, Ecole Normale Supérieure, Université de Yaoundé I, Yaoundé, **Cameroon**
- *École Normale Supérieure*, Brazzaville, **Congo**
- *Women's Faculty of Arts, Sciences and Education*, Ain Shams University, Cairo, **Egypt**
- *School of Continuing and Distance Education*, University of Nairobi, **Kenya**
- *Département des Sciences de l'Éducation*, Institut Supérieur de Formation et de Recherche Appliquée (ISFRA), Bamako, **Mali**
- *École Normale Supérieure Takaddoum*, Ministère de l'Éducation Nationale, de l'Enseignement Supérieur de la Formation de Cadres et de la Recherche Scientifique, Rabat, **Morocco**
- *Department of Evaluation and Research*, National Institute for Education Development (INDE), **Mozambique**
- *School of Adult Education and Communication Studies*, Makerere University, Kampala, **Uganda**
- *École Normale Supérieure*, Bangui, **Central African Republic**
- *Faculté des Sciences et Technologies de l'Éducation et de la Formation (FASTEF)*, Université Cheikh Anta Diop de Dakar (UCAD), Dakar, **Senegal**.

ROCARE, whose regional office is located at the *Institut Supérieur de Formation et de Recherche Appliquée* (ISFRA) in Bamako, Mali, would be jointly responsible with the University of Montreal team for project coordination in Africa. ROCARE is a bilingual network of 400 researchers with over 17 years of experience in trans-national and networking research. ROCARE works to mobilize researchers and partners and strengthen capacities, research, policy dialogue, scientific publication and institutional development. ROCARE was created in 1989 by researchers following a seminar held in Freetown. Its regional coordination office is housed by the Institut Supérieur de *Formation et de Recherche Appliquée* (ISFRA) in Bamako, Mali. In collaboration with the IDRC, ROCARE's mission is to promote African expertise so as to positively influence education practices and policies.

ROCARE would be represented by Kathryn Touré, who would act as Regional Coordinator for the project. For the past 15 years, Ms. Touré has worked to promote ICT in education and to foster international comparative and interdisciplinary studies. She earned a degree in Political Science at the University of Kansas (United States) and studied at the University of Grenoble (France) and the Université d'Abidjan (Ivory Coast). She is currently enrolled in a Ph.D. program in Education with a specialization in the Pedagogical Integration of ICT under the distance learning program offered by the University of Montreal, with financial assistance from AUF. She was responsible for launching one of the first distance learning courses at the University of Iowa (United States), on Internet operation for international development and the creation of favourable conditions for increasing the international content of university study programs. At Africa Online, an African Internet provider, she was responsible for increasing the website market in the public and private sectors in six African countries, and for launching the first online versions of five newspapers in Ivory Coast, thereby contributing to increased African content on the Web. As Coordinator of the Réseau Ouest et *Centre Africain de Recherche en Education*, she is responsible for strategic and partnership development. Her management has contributed to greater visibility for ROCARE research and greater demand for researcher services.

The University of Montreal, Canada, and more specifically the Faculty of Education Sciences, would coordinate the project jointly with ROCARE. The project would particularly benefit from the acknowledged expertise of the contact network of the Canada Research Chair in Information and Communication Technology (ICT) in Education. Professor Thierry Karsenti, Chair holder, would be responsible for scientific aspects of the project. He is a full professor at the University of Montreal, where he teaches in the area of ICT Integration into Teacher Training. His accomplishments and technopedagogical innovations in distance learning have been recognized province-wide and across Canada. He has obtained several Awards of Excellence from the Canadian Association of Distance Education for teaching and pedagogical innovation. He has also earned distinction for his research contributions to the quality of university pedagogy. His research interests lie in the pedagogical integration of new technologies, pedagogical practices of teachers, open and distance learning, and motivation. Note also that besides organizing numerous micro programs to integrate ICT for purposes of distance teacher training in Africa, Professor Karsenti is the principle designer and overseer for the first distance Ph.D. program in Education with a specialization in ICT integration. He also acts as a consultant for several organizations (UNESCO, the World Bank, IDRC, AUF, *la Francophonie*, etc.), various authorities (Canadian government, the *Ministère de l'Éducation, du Loisir et du sport du Québec*) and groups concerned with education. In connection with diverse projects aimed at reducing the digital divide between the Northern and Southern countries, Professor Thierry Karsenti is also responsible for several projects addressing educational tech-

nologies in Africa. He is also President of the *Réseau international francophone des établissements de formation de formateurs* (RIFEFF), which regroups over 450 establishments from Francophonie member states that train teachers, and is a founding member of the *Réseau pour la Formation des maîtres en Afrique*.

Two principle researchers would be hired to ensure activity coordination and follow-up, one from ROCARE and the other from the University of Montreal. They would act as intermediaries and liaisons between the project direction and the national research teams. As such, they would carry out activities in compliance with the adopted methodological approach. Their primary role would be to assist the researchers in attaining their research objectives. To do so, they would ensure regular follow-up and provide the appropriate tools for data collection, analysis, synthesis and publication. In the framework of this large-scale research undertaking, they would play a key role. Among others, their duties would be to:

- Mobilize and support national team researchers in the participating countries
- Prepare the documents and tools required for sound and effective research
- Convey the necessary reminders as to deadlines to ensure timely results
- Verify data quality, centralize data, and ensure optimal storage and archival
- Travel to certain participating countries to support the national teams
- Manage the project website
- Answer technical questions posed by the researchers
- Duly analyze research progress
- Offer individual advice and consultation
- Communicate regularly with the Scientific Committee
- Edit the e-newsletter
- Encourage researchers to submit scientific publications to specialized journals.

In short, the project intermediaries would ensure overall research coordination and provide leadership for the research.

An International Scientific Committee would provide overall project direction. The Committee members would collaborate online. Some members would attend meetings, i.e. methodology workshops and partner meetings. This Committee would be composed of a maximum of six individuals—women and men—including four or five from the African continent and one or two from abroad. Certain individuals have been pre-selected to sit on the Committee, but the advice of the national partners would be sought before making any final decisions. We would do everything possible to ensure that Committee members are aware of gender issues and that an expert on gender issues in education research sits on the Committee.

A National Committee comprising five members maximum would be set up in each country (composition and roles are described in the above section on Policy dialogue).

REFERENCES

Annan, K. (2005). *Déclaration de M. Kofi Annan, secrétaire général de l'organisation des Nations Unies*. Sommet mondial sur la société de l'information. Deuxième phase, 16 novembre 2005, Tunis.

Bakhoum, N. (2002). Services à distance et services de proximité en milieu africain : quels défis pour le bibliothécaire en tant que vecteur de développement ? communication présentée au 68th IFLA Council and General Conference, August 18 - 24.

Becker, H.-J. (1994). How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education*, 26 (3), pp. 291-321.

Becker, H.-J. (2000). Findings from the teaching, learning, and computing survey : is Larry Cuban right ?*Education Policy Analysis Archives*, 8(51), November 15, 2000.

BECTA (2005). *What the research says about barriers to the use of ICT in teaching.* Becta ICT Research.

Bibeau, R. (1996). Concept d'École informatisée clés en main. Dans *Comment informatiser l'école* ? Collection de l'ingénierie éducative, Paris/Sainte-Foy : Centre National de Documentation Pédagogique et les Publications du Québec, pp.13-34.

Butcher, N. (2003). *Technological Infrastructure and Use of ICT in Education in Africa : an overview,* ADEA.

Chéneau - Loquay, A. et N'diaye Diouf, P. (1998). *Comment développer les usages des nouvelles technologies de l'information et de la communication pour les besoins de l'échange*. Rapport d'une mission exploratoire au Sénégal, 18 - 24 avril, Ministère des Affaires Étrangères, Secrétariat d'État à la Coopération.

Chenevez, O. (2002). L'enjeu des TICE en vaut-il la chandelle ? *Les dossiers de l'ingénierie éducative sur le Web.* Texte disponible à l'URL : http://www.cndp.fr/tice/DossiersIE/texte_chenevez.htm

Chisholm I. Dhunpath, R. and Paterson, A. (2004). The use of ICTs in the curriculum in Bostwana, Namibia and seychelles. For Saches : Commissionned by SADC EPSI, June.

Chisholm, L. (2003). Proposal submitted in terms of SADC EPSI theme - The use of information communication technologies in curricula - Through Saches - ICTs and curriculum change in selected SADC countries, March.

Clark, R. C., & Mayer, R. E. (2003). *e-Learning and the science of instruction*: Pfeiffer, San Francisco.

CRDI (1999). *L'Initiative Acacia*, CRDI, Ottawa. Accessible le 30/07/2004 sur Internet à l'adresse : www.idrc.ca/acacia

Conseil Supérieur de l'Éducation (2000). *Éducation et Nouvelles Technologies : Pour une intégration réussie dans l'enseignement et l'apprentissage.* Rapport annuel 1999-2000 sur l'état et les besoins de l'éducation.

Cuban, L. (1997). High-tech schools and low-tech teaching. *Education Week on the Web*, (21). Article disponible à l'URL :http://www.edweek.org/.

Cuban, L. (1999). *Why Are Most Teachers Infrequent and Restrained Users of Computers?* Publication présentée au BCTF Public Education Conference, Technology: Public Education in a Wired World (Vancouver, Canada, février).

Cuban (2001). High Access and Low Use of Technologies in High School Classrooms : Explaining an Apparent Paradox, *American Educational Research Journal*, v38 n4 p813-34.

Dede, C. (1998). The scaling-up process for technology-based educational innovations. In C. Dede ed., *ASCD 1998 yearbook on learning with technology*. Alexandria, Virginia: Association for Supervision and Curriculum Development, 199-216.

Depover, C. (2005). Les TIC ont-elles leur place en milieu scolaire africain ? *TICE et développement*, Numéro 01, 9 novembre, http://www.revue-tice.info/document.php?id=522

Depover, C. et Strebelle, A. (1996). Fondements d'un modèle d'intégration des activités liées aux nouvelles technologies de l'information dans les pratiques éducatives. In Baron G.-L. et Bruillard, É. (Eds), *Informatique et éducation: regards cognitifs pédagogiques et sociaux*, France : INRP, 9 - 20.

Dieng, P. Y. (2004). Etude sur les Usages et bonnes pratiques des technologies et des documents de communication dans l'enseignement à distance et l'apprentissage libre, plus particulièrement dans la formation continue des enseignants au Sénégal. Novembre

Draxler, A. et Haddad, W.D. (2002). *Technologies for Education, potentials, parameters and prospects*. UNESCO.

Gibigaye M., Tankeu R., Ouédraogo, S., Noudehou, S., Mint Elkory, F., et Niang Mbodj, O-Kh. (2005). *Fracture numérique de genre en Afrique francophone, une inquiétante réalité,* Réseau Genre et TIC, ENDA, éditions (Etudes et Recherches, n°244) Dakar. http/www.famafrique.org/regentic/indifract/fracturenumeriquedegenre.pdf

Intsiful, j., Okyere, P.F. et Osae, S. (2003). Use of ICT for Education, Research and Development in Ghana : Challenges, Opportunities and Potentials. In *2003 Round Table on developing countries access to scientific knowledge, The Abdus Salam ICTP, Trieste*, Italy.

Isabelle, C. et Lapointe, C. (2003). Sucessfully Integrating Information and Communications Technologies in Schools by Training Principals. *Alberta Journal of Education Research,* 49 (2), 123 - 137.

IsaBelle, C., Lapointe, C. et Chiasson, M. (2002). Pour une intégration réussie des TIC à l'école: de la formation des directions à la formation des maîtres. *Revue des sciences de l'éducation*, *28*(2), 325-343.

James, T. (2001). *An information policy handbook for Southern Africa*. CD ROM. IDRC.

Jensen, M. (2002). *The african Internet – a status report*. July 2002. Available online : http://demiurge.wn.apc.org/africa/afstat.htm.

Karsenti, T. (2003). Problématiques actuelles et axes de recherche prioritaires dans le domaine des technologies de l'information et de la communication (TIC) en contexte africain. Rapport de recherche présenté au Centre de recherches pour le développement international (CRDI) du Canada. Ottawa : CRDI.

Karsenti, T. (2006). Développer le professionnalisme collectif des futurs enseignants par les TIC : Bilan de deux expériences réalisées au Québec. *Recherche et formation*, 49 (79-30).

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

Karsenti, T. et Larose, F. (2005). Intégration des TIC dans le travail enseignant : Quand la société change, la classe doit-elle suivre ? dans Karsenti et Larose (dir.), *L'intégration pédagogique des TIC dans le travail enseignant : recherches et pratiques*, Presses de l'Université du Québec.

Karsenti, T. et al. (2005). *Les écoles pionnières TIC en Afrique : études de cas.*Rapport de recherche présenté au CRDI.

Karsenti, T., Touré, K. et Ngamo, S. (2006 – in press). Impact d'Internet chez les jeunes en Afrique : Impérialisme culturel ou valorisation des diversités ? *African Media Review.*

Ken Lohento (2003). *Usages des NTIC et médiation des savoirs en milieu rural africain : études de cas au Bénin et au Mali.* Mémoire de DEA en sciences de l'information et de la communication, Université de Paris X - Nanterre - France.

Leclerc, M. (2003). Étude du changement découlant de l'intégration des TIC dans une école secondaire de l'Ontario. Dans *Canadian Journal of Learning and Technology*, V29, N1, hiver.

Lundall, P. & Howell, C. (2000). *Computers in Schools: A national survey of Information Communication Technology in South African Schools*. Bellville: Education Policy Unit, University of the Western Cape.

McCrory Wallace, R. (2004). A framework for understanding teaching within the Internet. *American Educational Research Journal*. Summer 2004, 41(2), 447-488.

Means, B., Penuel, W.R. & Padilla, C. (2001). *The Connected School: Technology and Learning in High School*. San Francisco: Jossey-Bass.

Michel, J.-L. (1981). Le web de la distanciation :Réflexions sur les nouvelles technologies d'enseignement. *L'École libératrice.* (2),1-6.

Murphy, P., Anzalon, S., Bosch, A. et Moulton, J. (2002). *Améliorer les possibilités d'apprentissage en Afrique. L'enseignement à distance et les technologies de l'information et de la communication au service de l'apprentissage*. Banque Mondiale, Région Afrique, Série Documents de travail.

Nyaki Adeya, C. (2004). *ICT and Poverty : A Literature Review.* IDRC, Canada.

Obama, B. (2006). *An honest government, a hopeful future*. August 28 2006. University of Nairobi, Nairobi, Kenya.

OCDE (2006). *Are students ready for a technology-rich world ? What PISA Studies tell us*. Results from Programme for International Student Assesment (PISA) 2003.

Oladele, B.A. (2001). The imperatives of Challenges for Africa in the Knowledge Age : Status and Role of National Information Policy. 67th IFLA Council and General Conference, August 16 - 25, Boston.

Pajo, K. et Wallace, C. (2001). Barriers To The Uptake Of Web - based Technology By University Teachers. *Journal of Distance Education/Revue de l'enseignement à distance,* 16 (1).

Papert, S. (1980). *Mindstorms : Children, Computers and Powerful Ideas.* New York: Basic Books.

Pouts-Lajus, S. & Riché-Magnier, M. (1998). *L'école, à l'heure d'Internet. Les enjeux du multimédia dans l'éducation.* Paris : Nathan.

Rogers, P. L. (2000). Barriers to adopting Emerging Technologies in Education. In *Journal of Educational computing Research,* 22 (4), pp.455 – 472.

Rousseau, J.-J. (1966). *Émile ou de l'éducation.* Paris: Garnier-Flammarion.

SchoolNet Africa et *al*. (2003). *Rapport de l'atelier sur les TIC dans les écoles africaines*. Gaborone, Bostwana, 27 avril au 2 Mai.

Selinger, M. (2001). The Imfundo Project: ICT in teacher education in developing countries. *Society for Information Technology and Teacher Education International Conference 2001*, (1), 3008 - 3013.

Sherry, L. (1998). *Diffusion of the Internet within a graduate school of education.* Unpublished dissertation: University of Colorado at Denver. Available: http://www.cudenver.edu/ ~lsherry/dissertation/index.html.

Times Magazine (1983). *Machine of the year – The computer moves in*. January 3, 1983 Vol. 121 No. 1.

Tunca, B. (2002). Barriers in using Technology. *World Conference on Educational Multimedia, Hypermedia and Telecommunications*, (1), 1980 - 1982.

UNESCO (2002). *Stratégies à moyen terme pour 2002 -2007 pour la région Afrique : Contribuer à la paix et au développement humain à l'ère de la mondialisation par l'éducation, les sciences, la culture et la communication*. Document établi à l'issue de la consultation du Directeur général avec les commissions nationales pour l'UNESCO de la région Afrique, UNESCO.

UNESCO (2003). *Genre et Education Pour Tous: Le pari de l'égalité*. Paris : UNESCO.

UNESCO (2004). Integrating ICTs into Education : Lessons Learned. Bangkok : UNESCO.

World Bank (2002). Enhancing learning Opportunities in Africa, in Working paper series of Africa Region Human Development.

INDICATORS[1]

1 *In each relevant case we wish to gather data for: individual institutions, at primary, secondary, tertiary and technical/vocational levels, in individual countries, regions and across continents.*

Total numbers, compiled lists, percentages, ratios and per capita will be calculated automatically in "dynamic fields" by the system (for learners, educators, administrators, institutions, primary/secondary/tertiary/ vocational levels, countries, regions, or the continent).

TABLE OF CONTENT

Inequity, at various scales, compounds the effects of risk and vulnerability among the poor. With the goal of better understanding the multiplex challenges of equitable development, this research will address gender, rural/urban residence, and socioeconomic class, using both targeted and integrated methodologies. The indicators in 7.0 will engage these issues specifically, to produce tangible recommendations for improved ICT-in-education equity - while throughout the indicators, equity issues will be addressed in research design, implementation and evaluation.

POLICY / ACCESS / TEACHER-TRAINING

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

National Education & ICT Policy	Fields	Examples	Dynamic fields	Examples	Approximate cost
The availability of national ICT policy documents.	Continent . Region . Country. Presence of national ICT policy . Yes/No Description of national ICT policy documents (title of document, date, link, brief abstract – 150 words, document attached).	Africa west Benin Yes Politique et stratégies des TIC au Bénin – Déclaration adoptée par le Gouvernement le 13/02/2003 A new ministry – Ministry of Communications and Promotion of New Technologies is established to coordinate the ICT activities in the country. The Ministry in August 2002 published the national information policy and strategy document "Bénin 2025. une société de l'information solidaire, épanouie et ouverte". The document envisions an open and interdependent information society in Benin by the year 2025. The NICI strategy aims to achieve. establishing a favorable environment for the development of ICTs, development of the ICT infrastructure, creation of a favorable educational environment for the development of ICT human resources, development of sectoral ICT applications, creation of a framework for collaboration on ICT issues. (http.//www.uneca.org/aisi/nici/Benin/benin.htm) http.//www.gouv.bj/textes_rapports/textes/politique/politiquetic.php, benin_binder1.pdf	Total number of countries. Total number of countries with a national ICT policy. Percentage of countries with a national ICT policy. Compiled list of countries with a national ICT policy. Compiled list of descriptions of national ICT policies.	34/52 (65%) Algeria, Benin, Botswana, Burkina… Law no. 2000-03 of August 5, 2000, Politique et stratégies des TIC au Bénin – Déclaration adoptée par le Gouvernement le 13/02/2003, Draft National Information and Communications Technology Policy January 2005 Stratégie d'opéralisation d'un plan de dévéloppement de l'infrastructure national d'information et de communication 2004-2005.	

National Education & ICT Policy	Fields	Examples	Dynamic fields	Examples	Approximate cost
The availability of sector (education) ICT policy documents.	Continent . Region . Country. Presence of sector (education) ICT policy documents. YES / NO Description of sector (education) ICT policy documents (title of document, date, link, brief abstract -150 words, document attached).	Africa south South Africa Yes Draft White Paper on e-Education, Transforming Learning and Teaching through Information and Communication Technologies (ICTs), 20060826 The South African national Department of Education's e-Education White Paper was published in September 2004. e-Education entails the use of Information and Communication Technologies (ICTs) to accelerate teaching and learning goals, particularly in the context of a developing world. South Africa has been able to extend its base of ICT usage with the development of infrastructure and applications made available through government community initiatives, as well as by the private sector, which have extended both usage as well as training to its employees. However, not every citizen is enabled to use ICT because access and technology are only available in primary and secondary towns and not in remote and rural areas. ICT education is improving in some instances but not all schools have infrastructure and computers, and even when they do, they fall into disrepair without maintenance. There is a shortage of IT-literate staff to use and maintain them. http.//www.info.gov.za/documents/subjectdocs/subject/education.htm, 26734.pdf	Total number (and percentage) of countries with a national ICT-in-education policy. List of countries with a national ICT policy in education. List of national ICT-in-education policy documents.	88/52 (15%) Algeria, Egypt, Morocco…	

National Education & ICT Policy	Fields	Examples	Dynamic fields	Examples	Approximate cost
The availability of national curriculum focusing on ICT (ICT as a stand-alone subject).	Continent . Region . Country. Presence of national curriculum documents focusing on ICT. YES / NO Description of national curriculum documents focusing on ICT (title of document, date, link, brief abstract -150 words, document attached).		Total number (and percentage) of countries with a national curriculum focusing on ICT. List of countries with a national curriculum focusing on ICT. List of national ICT curriculum documents.		
The availability of national regulations or incentives for ICT resources (connectivity, equipment, training) in educational institutions.	Continent . Region . Country. Presence of national regulations or incentives for ICT in educational institutions. YES / NO Description of national regulations or incentives for ICT in educational institutions (title of document, date, link, brief abstract -150 words, document attached).		Total number (and percentage) of countries with national regulations or incentives for ICT resources (connectivity, equipment, training) in educational institutions. List of countries with national regulations or incentives for ICT resources (connectivity, equipment, training) in educational institutions. List of national ICT-in-education regulations or incentives.		

National Education & ICT Policy	Fields	Examples	Dynamic fields	Examples	Approximate cost
The presence of ICT (in education) in local development plans.	Continent . Region . Country. ICT present in local education development plans. YES / NO Description of ICT presence in local education development plans (title of document, date, link, brief abstract -150 words, document attached).		Total number (and percentage) of countries with the presence of ICT (in education) in local development plans. List of countries with the presence of ICT (in education) in local development plans. List of local ICT-in-education development planning documents.		
Country ICT-Connectivity rank.	Continent . Region . Country. Institution (name). ICT-Connectivity index score.*		Classement du score de l'index de connectivité-TIC		

Objectives 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).

2.5 To develop an institution, ICT-enablement index (Phase I).

Indicators 2.0

Equipment, Connectivity and Access	Fields	Examples	Dynamic fields	Examples	Approximate cost
The number and percentage of (primary, secondary, tertiary and vocational) institutions with computers.	Continent . Region . Country. Level . Institution (name) Institution has computers?. YES/ NO		Total number of institutions. Total number of institutions with computers. % of computer-equipped institutions.		
The number and percentage of (primary, secondary, tertiary and vocational) institutions with internet connectivity.	Continent . Region . Country. Level . Institution (name) Institution has internet connectivity?. YES/NO Types of connection and bandwidth.		Total number of institutions. Total number of institutions with internet connectivity. Percentage of institutions with internet connectivity. List of types/ quality of connection.		

Equipment, Connectivity and Access	Fields	Examples	Dynamic fields	Examples	Approximate cost
The ratio of computers to educators per institution (primary, secondary tertiary and vocational).	Continent. Continent . Region . Country. Level . Institution (name) Number of educators in the institution. Total number of computers in the institution. Number of computers in the institution available for educators.		Ratio of computers to educators.		
The ratio of computers to learners per institution	Continent . Region . Country. Level . Institution (name) Number of learners in the institution. Total number of computers in the institution. Number of computers in the institution available for learners.		Ratio of computers to learners.		
The presence of a technopedagogical assistant (or ICT advisor / technician) in education institutions.	Continent . Region . Country. Level . Institution (name) Institution has an ICT advisor/ technician. YES/ NO		Total number of institutions. Number of institutions with technicians. Percentage of institutions with technicians.		

Equipment, Connectivity and Access	Fields	Examples	Dynamic fields	Examples	Approximate cost
The types of software applications used in educational institutions.	Continent . Region . Country. Level . Institution (name) . Names/types of software used in institution.		List of software used in educational institutions.		
Institution ICT-Connectivity rank.	Continent . Region . Country. Institution (name). Institution-ICT-Connectivity index score.*		ICT-Connectivity index ranking.		
The rank of ICT-Enablement by institution (primary, secondary, tertiary, vocational). (Phase I?)	Continent . Region . Country. Level . Institution (name) . ICT-E index score.*		ICT-E index ranking.		

Objective 3.0

To portray how African educators are trained with regard to the pedagogical integration 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).

3.8 To develop a teacher-education institution, ICT-integration training index (Phase II).

Indicators 3.0

Teacher-Training	Fields	Examples	Dynamic fields	Examples	Approximate cost
The number of teacher-training institutions.	Continent . Region . Country. Level . Teacher-training Institution (name) Description (150 words).		Number of teacher training institutions. List of teacher training institutions. List of descriptions of teacher training institutions.		
The number of teacher-trainers per institution.	Continent . Region . Country. Level . Teacher-training Institution . Number of teacher trainers in institution.		Rank of institutions with regard to number of teacher trainers. Average number of trainers per institution.		

Teacher-Training	Fields	Examples	Dynamic fields	Examples	Approximate cost
The number of teacher-trainers who have their own email address.	Continent . Region . Country. Level . Teacher-training Institution (name) Number of teacher trainers in the institution with email addresses.		Rank of institutions with regard to (percentage of) teacher trainers with email addresses.		
The ability of teacher-trainers to use ICTs (basic skills).	Continent . Region . Country. Level . Teacher-training Institution (name) The ability of teacher-trainers to use ICTs (description, 150 words).		List of ability of teacher-trainers to use ICTs.		
The number of teacher trainers who use ICTs to train educators.	Continent . Region . Country. Level . Teacher-training Institution (name) . Number of teacher trainers in the institution who use ICTs.		Rank of institutions with regard to teacher trainers using ICT to train teachers.		
The number of preservice educators.	Continent . Region . Country. Level . Teacher-training Institution (name). Number of preservice educators in institution.		Rank of institutions with regard to number of preservice educators. Average number of preservice educators.		

Teacher-Training	Fields	Examples	Dynamic fields	Examples	Approximate cost
The percentage of preservice educators who have their own email address.	Continent . Region . Country. Level . Teacher-training Institution (name) Number of preservice educators in the institution with an email address.		Rank of institutions with regard to number of preservice educators with email address. Average number of preservice educators with email address.		
The presence of ICT in teacher-training curriculum.	Continent . Region . Country. Level . Teacher-training Institution (name) ICT in initial (pre-service) teacher-training curriculum?. YES/NO Description of ICT in initial (pre-service) teacher-training curriculum (150 words). ICT in educator professional development (continuing education)?. YES/NO Description of ICT in educator professional development (continuing education)? (150 words).		Percentage of initial teacher training institutions with ICT included in the curriculum. Percentage of teacher training institutions with ICT programs for professional development.		
The ICT resources (types of equipment?) made available to pre-service educators, and their trainers, during teacher-training.	Continent . Region . Country. Level . Teacher-training Institution (name) . Types of ICT equipment, connectivity, and other resources (list).		Compiled list of types of ICT resources available during teacher-training.		

Teacher-Training	Fields	Examples	Dynamic fields	Examples	Approximate cost
The existence of (nationally regulated) incentives for continuing education / professional development (which include ICT integration) for educators.	Continent . Region . Country. Presence of national incentives for educator professional education which includes ICT . Yes/ No Description of of national incentives for educator professional education which includes ICT (title of document, date, link, brief abstract – 150 words, document attached).		List of national incentives for continuing education.		
Educators who have participated in continuing education/professional development, which included ICT integration.	Continent . Region . Country. Level . Institution (name) . Number of educators in institution. Number of educators who have completed 1 to 50 hours of continuing education/ professional development which included ICT integration. Number of educators who have completed more than 50 hours of continuing education/ professional development which included ICT integration.		The percentage of (primary, secondary, tertiary and vocational) educators who have participated in less than 50 hours. The percentage of (primary, secondary, tertiary and vocational) educators who have participated in over 50 hours. The percentage of continuing education/ professional development, which includedICT integration.		
The rank of teacher-education institutions, by ICT-Integration. (Phase II)	Continent . Region . Country. Level . Institution (name). ICT-I index score.*		ICT-I index ranking.		

IMPLEMENTATION

Objectives 4.0

To portray the uses of ICT in African educational institutions.

4.1 To identify the factors encouraging the pedagogical integration 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).
4.4 To develop an institution, ICT-integration index (Phase II).

Indicators 4.0

ICT Use	Fields	Examples	Dynamic fields	Examples	Approximate cost
The frequency of ICT use by educators for academic purposes.	Continent . Region . Country. Level . Institution (name) Average ICT use by educators for academic purposes.		Average ICT use by educators for academic purposes. Rank in ICT use by educators for academic purposes.		
The frequency of ICT use by learners for academic purposes.	Continent . Region . Country. Level . Institution (name) ICT use by learners for academic purposes. (Likert scale . 0 ; 1-2 hours ; 3-5 hours ; 6-10 hours ; more than 10 hours per week).		Average ICT use by learners for academic purposes. Rank in ICT use by learners for academic purposes.		
The types of ICT use by educators.	Continent . Region . Country. Level . Institution (name) Types of ICT use by educators (for example . powerpoint presentation, Web resources, etc .).		Compiled list of types of ICT use by educators.		

ICT Use	Fields	Examples	Dynamic fields	Examples	Approximate cost
The types of ICT use by (primary, secondary, tertiary and vocational) learners.	Continent . Region . Country. Level . Institution (name) Types of ICT use by learners (list).		Compiled list of types of ICT use by learners.		
The percentage of courses taught using ICT.	Continent . Region . Country. Level . Institution (name) .Number of courses taught using ICT. List of courses taught using ICT.		The average percentage of courses taught using ICT. Ranking of institution in percentage of courses taught using ICT.		
The factors supporting the use of ICT by educators.	Continent . Region . Country. Level . Institution (name) .Stated (by educators) factors that support ICT use by educators (150 words).		Compiled list of factors given in support of ICT use.(from educators).		
The challenges to the use of ICT by educators.	Continent . Region . Country. Level . Institution (name) .Stated (by educators) factors that are challen-ges to ICT use by educators (150 words).		Compiled list of factors given as challenges to ICT use. (from educators).		
The factors supporting the use of ICT by learners.	Continent . Region . Country. Level . Institution (name) .Stated (by learners) factors that support ICT use by learners (150 words).		Compiled list of factors given in support of ICT use (from learners).		

ICT Use	Fields	Examples	Dynamic fields	Examples	Approximate cost
The challenges to the use of ICT by learners.	Continent . Region . Country. Level . Institution (name) Stated (by learners) factors that are challenges to ICT use by learners (150 words).		Compiled list of factors given as challenges to ICT use (from learners).		
The competencies required for ICT use (in education) by educators.	Continent . Region . Country. Level . Institution (name). Competencies required for ICT use (from educators).		Compiled list of competencies required for ICT use (from educators).		
The competencies required for ICT use (in education) by learners.	Continent . Region . Country. Level . Institution (name) Competencies required for ICT use (from educators).		Compiled list of competencies required for ICT use (from educators).		
ICT in education-related research publications.	Continent . Region . Country. (of origin of the author). Level Institution (name) . (of origin of the author). ICT in education-related research publications (Reference, 150 word abstract, document if available).		Compiled list of ICT in education-related research publications. Number of ICT in education-related research publications. Rank of institution in ICT in education related research publication.		

ICT Use	Fields	Examples	Dynamic fields	Examples	Approximate cost
Pioneering initiatives in ICT in education.	Continent . Region . Country. Level . Institution (name) Initiative (description . 150 words, including responsible parties)		Compiled ist of pioneering initiatives in ICT in education.		
The rank of ICT-Integration by institution (primary, secondary, tertiary). (Phase I)	Continent . Region . Country. Level . Institution (name) ICT-I index score.*		ICT-I index ranking.		

IMPACT

Objectives 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

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
IMPACT ON EDUCATORS AND TEACHING The impact of ICT on teaching.	Continent . Region . Country. Level . Institution (name) . Stated impact (by educators) of ICT on lesson-planning. (150 words) Stated impact (by educators) of ICT on in-class teaching. (150 words) Stated impact (by educators) of ICT on evaluation methods (exams, etc.). (150 words) Stated impact (by educators) of ICT on educator-learner communication. (150 words) Stated impact (by educators) of ICT on reflection on teaching . (150 words)		Compiled list of stated impacts of ICT on lesson-planning. Compiled list of stated impacts of ICT on in-class teaching. Total list of stated impacts of ICT on evaluation methods (exams, etc.). Total list of stated impacts of ICT on educator-learner communication. Total list of stated impacts of ICT on reflection on teaching[3] .		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
IMPACT ON LEARNERS AND LEARNING The impact of ICT on learning (in general).	Continent . Region . Country. Level . Institution (name) Stated impact (by learners) of ICT on learning. (150 words) Stated impact (by educators) of ICT on (learners') learning. (150 words)		Total list of stated (by learners) impacts on learning. Total list of stated (by educators) impacts on learning.		
The impact of ICT on learner access to knowledge (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) Stated impact (by learners) of ICT on access to knowledge. (150 words) Stated impact (by educators) of ICT on (learners') access to knowledge. (150 words)		Compiled list of stated (by learners) impacts of ICT on access to knowledge. Compiled list of stated (by educators) impacts of ICT on learners' access to knowledge.		
Documentation produced by learners using ICT (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) Stated impact (by learners) of ICT on documentation produced. (150 words) Stated impact (by educators) of ICT on (learners') documentation produced. (150 words)		Compiled list of stated (by learners) of ICT on documentation produced. Compiled list of stated (by educators) impacts of ICT on documentation produced.		

SUSTAINABILITY / EQUITY

Objectives 6.0

To better understand the role of the leadership of principals, institution 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

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
INSTITUTION MANAGEMENT & ICT The number of institutions with ICT integration plans.	Continent . Region . Country. Level . Institution (name) Institution has ICT integration plan? YES/NO Description of ICT integration plan (150 words, with document attached).		Number of institutions. Number of institutions with ICT integration plan. Percentage of institutions with an integration plan. List of ICT integration plans.		
The number of institutions with a strategy in place to maintain and renew their ICT equipment.	Continent . Region . Country. Level . Institution (name) Institution has a strategy in place to maintain and renew ICT equipment? YES/NO Description of strategy in place to maintain and renew ICT equipment (150 words, with document attached).		Number of institutions. Number of institutions with a strategy in place to maintain and renew ICT equipment. Percentage of institutions with a strategy in place to maintain and renew ICT equipment. List of strategies in place to maintain and renew ICT equipment.		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
The number of institutions that provide access to their ICT infrastructure for the community.	Continent . Region . Country. Level . Institution (name) Institution provides access to their ICT infrastructure for the community? YES/NO Description of types access provided by the institution for the community (150 words).		Number of institutions. Number of institutions that provide access to their ICT infrastructure for the community. Percentage of institutions that provide access to their ICT infrastructure for the community. List of types of access provided by the institution for the community.		
The number of managers (in education institutions) trained to use ICT.	Continent . Region . Country. Level . Institution (name) Number of managers (in institution). Number of managers trained to use ICT (in education institution). Description of training received by managers trained to use ICT (in education) (150 words).		Total number of managers in institutions. Total number of managers trained to use ICT. Percentage of managers trained to use ICT. Compiled list of types of training received by managers to use ICT (in institutions education).		
The impact of ICT on education management practices. (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) Stated impact (by managers) of ICT on education management practices (150 words).		Compiled list of stated impacts (by managers) of ICT on education management practices.		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
The impact of ICT on which curriculum is taught (mathematics, science, language arts, etc., or in teaching or curriculum section?). (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) Stated impact (by managers) of ICT on which curriculum is taught (150 words).		Compiled list of stated impacts (by managers) of ICT on which curriculum is taught.		
The impact of ICT on continuing education / professional development programs.	Continent . Region . Country. Level . Institution (name) Stated impact (by managers) of ICT on continuing education / professional development programs (150 words).		Compiled list of stated impacts (by managers) on continuing education / professional development programs.		
The ability of managers to use ICT (basic skills).	Continent . Region . Country. Level . Institution (name) Number of institution managers with email address. Description of ability of managers to use ICT (basic skills) (150 words). Continent . Region .		Number of managers. Number of managers with email addresses. Percentage of managers with email addresses. Compiled list of ability of managers to use ICT (baic skills).		
The major barriers (as identified by managers) hindering the achievement of their institution's ICT-related goals for learners (the obstacles noted grouped into four categories. those relating to hardware and software, those relating to instruction, and those relating to the training of educators, and others.) (Phase II)	Country. Level . Institution (name) List of barriers, as identified by managers hindering the achievement of their institution's ICT-related goals for learners (the obstacles noted grouped into four categories. those relating to hardware and software, those relating to instruction, and those relating to the training of educators, and others.) (600 words)		Compiled list of barriers relating to hardware and software. Compiled list of barriers relating to instruction. Compiled list of barriers relating to the training of educators. Compiled list of other barriers.		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
Leadership and best practices in ICT integration in education.	Continent . Region . Country. Level . Institution (name) Description of "success stories" in ICT-integration (Description, 300 words . what, by whom, how, with what result?).		Compiled list of "success stories" in ICT-integration.		

Objectif 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

Indicators 7.0

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
POLICY RELATED TO EQUITY The existence of equity policy documents related to ICT.	Continent . Region . Country. Presence of national ICT equity policy . Yes/No Description of national ICT equity policy documents (title of document, date, link, brief abstract – 150 words, document attached).		Compiled list of national ICT-equity policy documents		
GENDER The number of female learners who have access to computers (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) Number of male learners in institution. Number of male learners who have access to computers. Number of female learners in institution. Number of female learners who have access to computers.		Percentage of male learners who have access to computers. Percentage of female learners who have access to computers.		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
SOCIO-ECONOMIC CLASS The percentage of institutions in, urban areas that have access to technology in comparison with semi, and non, urban areas.. (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) . Institution in urban area? YES/NO Institution in semi-urban area? YES/NO Institution in non-urban area? YES/NO Institution has access to technology?. YES/NO		Number of institutions in urban areas. Percentage of institutions in urban areas that have access to technology. Number of institutions in semi-urban areas. Percentage of institutions in semi urban areas that have access to technology.		
The learner to computer ratio in urban areas in comparison with semi, and non, urban areas. (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) . Institution in urban area? YES/NO Institution in semi-urban area? YES/NO Institution in non-urban area? YES/NO Number of learners. Number of computers learners have access to ICT.		Learner to computer ratio in urban areas that have access to technology. Learner to computer ratio in semi urban areas that have access to technology. Learner to computer ratio in non, urban areas that have access to technology.		
CULTURAL AND CONTENT SENSITIVITY The impact of ICT on the development of a variety of African educational content. (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) . Stated impact (by managers) on the development of African course content.		Compiled list of impacts on the development of African course content..		

Indicators	Fields	Examples	Dynamic Fields	Examples	Approximate cost
SPECIAL EDUCATION The impact of ICT on learners with special needs. (primary, secondary, tertiary, vocational).	Continent . Region . Country. Level . Institution (name) . Number of learners with special needs. Number of learners with special needs who have access to ICT. Percentage of learners with special needs who have access to ICT. Stated impact of ICT on learners with special needs.		Compiled list of stated impacts of ICT on learners with special needs.		
LANGUAGE The relationship between ICT-in-education integration and local language(s).	Continent . Region . Country. Level . Institution (name) . Stated elements of the relationship between ICT-in-education and language.		Compiled list of stated elements of the relationship between ICT-in-education and language.		