Linking Learning to Life and Life to Learning:

What is the Role of Information and Communication Technologies (ICT)?[1]

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ABSTRACT

The gap between life and learning, and between precolonial and modern or formal educational approaches in Africa, needs to be reconciled so that schools can move toward sustainable, meaningful education. The increasing integration of information and communication technologies (ICT) into teaching and learning in Africa provides a unique opportunity to open schools and systems up to such reconciliation. The evidence, from "open" data on the PanAf Observatory, comes from 107 educational institutions—primary to university—across the continent. Surveys and interviews conducted by research teams in 12 countries with thousands of educators and learners reveal how they are using information and communication technologies in culturally and socially relevant ways that are linking schools and universities with communities near and far. This flattens the hierarchies of school and classroom structures, deepens the relationship with knowledge and opens the educational experience. We argue that if African students are to be prepared for active participation in and shaping of 21st century living, both teachers and students will need to make good use of technologies and socio-constructivist pedagogies. However, systemic practices and policies are needed in addition to individual innovation to ensure that ICT use helps evolve learning to a more active, dynamic and open process linked to real life, rooted in African mores and connected to contemporary concerns.

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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

"Educators and teachers of the future must
integrate this technological culture."
École Normale d'Instituteurs de Brazzaville

Introduction

The aim of pre-colonial—or traditional—education in Africa was to preserve the community's cultural heritage and equip new generations to adapt to their environment (Mazonde, 1995). It embodied the desire to socialize and to live in symbiosis with nature (Tapé, 1994). In the 1500s, formal education began to be introduced into Africa to educate commissioned personnel under the colonial powers: the French, English, and Portuguese. Today, although still under the influence of these two educational traditions—which occasionally gives rise to tension—the African continent is developing its own ways of teaching and learning.

In this article we propose that schools should embrace their social and cultural environment, and that information and communications technologies (ICT) play an important role in this process. However—make no mistake—, even though ICT are here to stay and will undoubtedly contribute to positive change in Africa, they are not a panacea, not a cure for struggling educational systems or other social ills.

To restore balance to African education, lessen tensions in schools, and promote nourishing environments, learning should relate to real-life situations, and it should also combine the characteristics and approaches of pre-colonial educational systems with those of formal and modern systems. Uniting these educational approaches could enable schools to reinforce African culture and at the same time be open to society and the world. In this way education would benefit today's youth and societies by helping them situate themselves in the larger world so that Africa may better contribute its knowledge to its own development and—more broadly speaking—to global knowledge, or the knowledge society.

Our argument is primarily based on sociological and psychological theories and supported by empirical data (interviews, questionnaires, and classroom observations) gathered from over 107 schools and universities in 12 countries in West Africa, Central Africa, East Africa, and southern Africa. We relate the perspectives and experiences of students, teachers, and principals and other education administrators across the continent who are using ICT to open their schools to culture and society.

Objective

In this article, we seek a deeper understanding of the role played by ICT in opening schools to their social and cultural surroundings. This includes better understanding how ICT enable different actors in African schools to actively participate in the knowledge society, particularly through the production and dissemination of African knowledge.

Reconciling two educational approaches

The introduction of ICT into African education systems provides a rare opportunity to embrace pre-colonial values and educational approaches—which we call *informal* education—and incorporate them into modern, formal education systems. Traditional education has the dual objectives that are common to almost all education systems: human education and technical training through learning in actual life situations. The goal is not to turn out simple technocrats, but to form moral, sociable human beings. As for formal education, it is appropriate for specific activities and contexts according to the times (Tapé, 1994, pp. 111-112).

Table 1 below presents the characteristics of informal and formal education. As it is practiced in Africa, formal education generally favours cognitive development over human development and its contribution to the community. Herein lies part of the problem when it comes to youth integrating their communities and relating their learning meaningfully and productively to the life of the community. At the same time, informal education systems resist change, whereas modern societies are constantly changing and require African teachers and learners to be flexible and readily adaptable.

There is therefore a gap between life and learning, and between the two educational approaches, which need to be reconciled rather than opposed so that schools can move toward sustainable, meaningful education. We will show how teachers and learners in African schools are using technologies to open up schools, and to creatively and effectively combine informal and formal education and traditional and modern outlooks and approaches.

Table 1: Comparison of characteristics of informal and formal education in Africa

Informal education	**Formal education**
1. Activities are integrated with daily life	1. Activities are separate from daily life
2. Personalized learning: teachers are members of the family and/or community	2. Impersonal learning: teachers are rarely family or community members
3. Few or no defined programs	3. Defined teaching methods and programs
4. Learning by observation and imitation	4. Learning by verbal exchange and inquiry
5. Students are motivated to contribute to society and participate in the adult world	5. Less social motivation; more cognitive motivation based on problem solving

Source: Tapé (1994, p. 111)

Written in 1964, the words of Abdou Moumouni (1998), educator, intellectual, and university president from Niger, still ring true—a half century after independence from French colonial rule (p. 16):

> Colonial education is simply juxtaposed to traditional African education, which is ignored and despised. Any viable new conception of education meant to reflect the current situation and perspectives of Black Africa must... borrow from traditional education certain aspects and integrate them into a modern and advanced educational system.

The use of ICT by students and teachers, their increasing integration into teaching and learning in African schools, and the changes in mindset and practice required for their use is an opportunity to do just the sort of mixing Moumouni invites. Part of the evolution in pedagogical approaches we witness, as we will see later, comes about organically because of the open and interactive nature of ICT. But for wider systemic change and more connectivity between learning and living, more intertwining of informal or traditional and formal or modern approaches to education, these organic shifts need to be undergirded by supportive policies and practices informed by understanding of the shifts at work.

Reconciling youth and their environment

If African education is to join the 21st century, a key challenge is to provide citizens with the cognitive, technical, ethical, and social skills they need (Audigier, 1999). In other words, while not neglecting the required disciplinary knowledge and competencies, education must prepare students to think and act as responsible citizens. Africa cannot simply churn out graduates with practically no opportunities to use their acquired knowledge other than to serve the inadequate governments that preside over many African countries. Education should be seen as a vehicle for developing citizenship, not just by imparting cognitive skills—which enable graduates to build—but also by developing attitudes to inspire them, values to guide them, and knowledge and empowerment to sustain them.

It is a matter of reconciling youth and their environment by means of a culturally and socio-economically grounded learning process. ICT is useful because it enables questioning, overcomes certain barriers, changes relationships—to oneself, to knowledge, to adults, and to society—and leads to a better understanding of social dynamics so that citizens may more actively participate in society.

Sustainable, meaningful education

Education systems around the world are concerned with providing students with sustainable, meaningful education that is relevant to their lives. The ideal situation is that students acquire knowledge that they can use for continuous learning and problem solving in their communities. In this respect, African countries are doing their share of reflection. At a number of meetings of regional economic groups (ECOWAS, ECCAS, SADC[2]) and continental and international groups such as the African Union, ADEA,[3] CONFEMEN,[4] and the Commonwealth, education specialists have stressed that a good education means that students not only embrace the knowledge proposed by their schools, but that they also use it in their classrooms, societies, cultures, and economies. Thus, the member countries of CONFEMEN decided to introduce a competency-based approach into their schools, even though this approach has received much criticism (Hirtt, 2009). In Cameroon, for example, the approach led to improved classroom practices and curricular innovations that led to reduced grade repetition rates of primary school students (Bipoupout, 2007).

Such advances have not tempered the lively discussions on the difficulties African students have in using their school learning to understand, interpret, and solve problems in their communities. This difficulty has been attributed to many factors such as the kind of knowledge taught, teaching conditions, and pedagogical approaches. The fact is, it is not easy for African students to acquire and make effective use of knowledge that is highly exogenous to their culture and environment—all the more so when schools lack proper teaching materials and continue to use teacher-centered methods.

These substantial concerns about education point to issues of individual and collective student participation in the learning process. Theorists such as Piaget (1896–1980) and Vygotsky (1896–1934) have much to tell us about the meaning of learning. For Piaget (1967), concepts are acquired more easily and effectively when students learn by reconstructing knowledge. It is a matter of having students focus on current issues that make learning meaningful. This approach is more effective than an exclusively transmissive approach, first because it is a source of motivation and second—and primarily—because a truly progressive understanding is enabled by the back-and-forth of the inquiry process, trial and error, and the testing of generated hypotheses (Hirtt, 2009, p. 21). Similarly, the discovery education method

[2] Economic Community of West African States (ECOWAS), Economic Community of Central African States (ECCAS), Southern African Development Community (SADC)

[3] Association for the Development of Education in Africa (ADEA)

[4] Conférence des ministres de l'éducation ayant le français en partage (CONFEMEN); Conference of Ministers of Education in French-speaking Countries

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(Bruner, 1996) allows children to experience things so they may appreciate the results and process them in a more nuanced and interesting way.

According to Vygotsky (1978, 1986), what shapes child development is cultural mediation, i.e., social interactions between the child and significant people in that child's life as well as historical influences. As in traditional African education, the critical aspect is the reciprocal relationship between the individual and society—a society defined by its culture and history.

In contrast to Piaget's view, it is not so much *conflict* as *collaboration* that primarily acts on cognitive development, which is not produced in isolation. Cognitive development grows alongside language, social, and physical development. We use in this paper this social constructivist theory as a lens through which to examine the interactions among students, between students and their teachers, and between students and knowledge as they use ICT—particularly the internet—in the learning process.

Best education practices

Many of the most effective teaching and learning methods are based on contextualizing education programs and approaches. This involves integrating new knowledge into subjects and courses and enabling students to become fully engaged citizens. Knowledge is contextualized when it is acquired through partaking in an activity that involves interaction with the society and culture that either produces or uses that knowledge.

The underlying principle for all these practices is that learning does not mean just accumulating knowledge—through a more or less teacher-directed process—but also knowing how to put that knowledge into context and reuse it in other contexts. It involves what—in the particular classrooms investigated here—we may term *grounding knowledge in real life*, using the actual experiences of African children. Gauthier (1997) states that theoretical learning not based on experience or practical, hands-on knowledge is liable to produce meaningless ideas—therefore invalid or useless. Sometimes what is learned in African classrooms is so far removed from the lived lives of African young people that it remains strange and unembedded.

The curricula of many countries of the world are tied to the history and culture of its people while also opening to the world. The curricula in many African countries, which have progressively integrated

knowledge from African societies, are still overly tied to their colonial heritages and outlooks while continuing in some instances to ignore or denigrate African experiences. It is in incorporating real-life issues and problems from students' multiple worlds—both nearby and faraway—that they build understanding and acquire increasingly grounded, meaningful and useful knowledge. The aim is to teach students—citizens and future leaders—who not only seek to learn more and more deeply but who also understand culture, democracy, civic values, appropriate behaviour, and social action. Linking learning to life and life to learning helps students contextualize their knowledge and create new relationships to knowledge, themselves, and society.

Role of ICT in linking learning to life for African students

Many studies have been conducted on the contribution of ICT to teaching and learning (e.g., Karsenti & Ngamo, 2007). Although the conclusions are mixed as to the actual effectiveness of ICT in education, the overall results suggest that the effectiveness depends more on the way they are introduced than on education systems as such.

All aspects of teaching are impacted by ICT, and rather than setting technology and teaching in opposition to each other, it appears more fruitful to explore the educational advantages that ICT have to offer in the complex process of teaching and learning in Africa.

Method

The data presented here were gathered in the context of the Panafrican Research Agenda on the Pedagogical Integration of ICT (PanAf). The objective of PanAf Phase 1 was to better understand how the pedagogical integration of ICT can improve the quality of teaching and learning in Africa. National teams of researchers across the continent conducted a mixed methodology research design at the school scale. The main activity in the initial two-year phase was the development of an Observatory on ICT in African education, modelled on observatories in other research disciplines, such as oceanography, which have successfully gathered, organized, and updated data for researchers and practitioners in specific fields. The PanAf indicators were developed through a highly participatory process involving researchers—male and female—from universities in 12 different African countries at a workshop held in Dakar in September

2006. The approximately 180 ensuing indicators related to the use of ICT include education policies, access, teacher training, usage, impact, management, gender, language, etc.

Both qualitative and quantitative research methods were used to gather Observatory data. Brought together in one place and made freely available by PanAf's African research network, unprecedented new data provided a baseline for future research and collaborative efforts on the pedagogical integration of ICT in Africa. Observatory data are intended to support policy development initiatives—particularly those related to teacher training—as well as theoretical papers and more practical publications like teaching manuals. During PanAf Phase 1, partnership agreements were signed with a number of organizations—including the World Bank's InfoDev and the UNESCO Institute for Statistics (UIS).

Besides producing enriching information and organizing it via a user-friendly interface, the research process contributes to capacity building in African universities, with a particular focus on research methodology and the pedagogical integration of ICT, a sector that can spur educational and social change in the 21st century. A newsletter was created to report on PanAf activities. Special mechanisms were put in place to encourage all participating researchers to contribute to the newsletter and to prepare scholarly articles for publication based on knowledge and analyses generated by project fieldwork. As part of the communication strategy, each participating country held a policy dialogue workshop.

The PanAf network consists of national research teams based for the most part at faculties of education in 12 countries in West, East, Central, and southern Africa. A joint management team between the Educational Research Network for West and Central Africa (ERNWACA) and the Université de Montréal (www.crifpe.ca) is responsible for continent-wide scientific, technical, and administrative coordination. National committees are responsible for content uploaded to the Observatory, and an International Scientific Committee oversees the quality of the research undertaken by the PanAf network. The Observatory was assessed in part by a statistical analysis of internet traffic and an online survey. Lessons learned are documented and continuously incorporated as the project evolves.

Participants

Data were gathered from 231,425 students, 8,377 teachers, and over 500 principals and other education specialists in 107 schools and universities in 12 African countries: Cameroon, Central African Republic,

Congo (Brazza), Cote d'Ivoire, Ghana, Gambia, Kenya, Mali, Mozambique, Senegal, South Africa, and Uganda .

Methodological strengths

A key strength of the study is the research methodology. Multi-case studies are rarely encountered in the education research field, although this approach is well suited to the issues, research question, and objectives of the Panafrican Research Agenda on the Pedagogical Integration of ICT. Yin's (2003) original multi-case study facilitated identifying basic convergences between ICT and teaching/learning in a wide variety of learning situations. Moreover, it was useful in distinguishing innovations particular to each situation. According to Merriam (1988), an investigation conducted in different settings obtains a more global, complete, and extensive perspective on a phenomenon. Similarly, Van der Maren (1995, p. 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 (1990, p. 37) also state that the explanatory strength of the case study lies in the structural coherence of the relations between the case components and the coherence of the variations of these relations over time. The explanatory strength therefore derives from the depth of the case analysis, and not the number of analysis units studied.

Main data collection instruments

In addition, as suggested by Yin (2003), the investigative methods in a multi-case study must be standardized to a certain extent. It would therefore be important for researchers to use similar data collection instruments as far as possible. The research program that we undertook included four main data collection instruments: survey questionnaires, interviews (individual and group), discussion groups with learners, and collection of supporting documents, products, and publications. As explained by Krathwohl (1998) and Van der Maren (1995), the survey questionnaire has the advantage of rapid contact with a large number of people. It was very useful for our research project, particularly to obtain responses on the diverse indicators, which required consultations with specific populations (e.g., students, educators). For example, to obtain responses on an indicator of learner and educator ICT usage, national teams could administer the survey questionnaires to a large number of subjects relatively rapidly and easily. Lessard-Hébert, Goyette & Boutin (1997) describe 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 is less likely to obtain meaningful research data (Ibid). During the interview, the subject should always be encouraged to speak on the issue at hand. According to Mishler, it is essential to keep the subject directly on topic. Finally, the conclusion is the last step of the interview (Ibid). At this point, the interviewer should ensure a complete understanding of what the respondent wanted to say by summing up the responses so the interviewee may corroborate them. This constitutes a form of triangulation (Stake, 1995), because the subject is "confronted" (Huberman & Miles, 1994) with the collected data. For this research project, we drew up an interview guide so that the interviews were semi-structured (Sedlack & Stanley, 1992). For instance, the interviews were structured to enable the national teams to better understand the difficulties that teachers encounter in the pedagogical integration of ICT in different settings in Africa. Aside from discussing the general use of the methodological approach, the methodology workshop served as a forum to agree and train researchers on how to conduct the interviews. The compendium of textual data was gathered, organized, analyzed and synthesized into diverse documents relevant to the Observatory indicators. A project coordinator compiled the ICT policies from all African countries.

At least four methodological aspects are noteworthy in PanAf Phase 1. First, the research fieldwork used school-scale questionnaires, and the interviews with educators and learners were recorded. The project indicators were both quantitative and qualitative, and therefore the fieldwork instruments required both numerical and text-based responses. Second, summary analyses of the qualitative responses were uploaded in real time to www.observatoiretic.org by the network's national experts. These analyses were accompanied by the raw data (mp3 files of recorded interviews, scanned completed questionnaires, lesson plans provided by teachers, etc.) and were continuously updated as new information was gathered (data points on the Observatory are clearly time-stamped). Third, in no way did PanAf Phase 1 aim to be nationally "representative" in its selection of schools. Rather, the research aimed to share real examples of leadership, best practices, and challenges in a selection of African schools that already had and were using computers. The Observatory indicators were concentrated at the school (institutional) scale, whereas national data were simply compilations of the results from the selected schools. At the national scale there are complementary direct links to InfoDev and UIS data. Fourth, although we realize that mobile handsets, DVD players, television, and radio play important roles

in technology-enhanced learning in Africa, the definition of ICT in education was limited to "computer use in schools" in PanAf Phase 1 for purposes of inter-institutional and international comparability.

Results

Below we present the PanAf results that pertain to our research objectives, which were to 1/ better understand the role played by ICT in opening schools to their social and cultural surroundings and 2/ better understand how ICT enable different actors in African schools to actively participate in the knowledge society.

Profile of African educational institutions based on empirical evidence

To illustrate how African teachers and learners are pioneering ICT and using it to link learning to life and life to learning, we drew on the results of the national research teams in 12 countries in West, East, Central, and southern Africa. These teams collected data from a total of 107 educational intuitions—from primary schools to universities—from 2007 to 2009. The interviews with teachers, learners, and principals/directors were synthesized by the researchers, organized according to a variety of indicators of the pedagogical integration of ICT, and made available as open data on the PanAf Observatory.

The institutions included 18 tertiary institutions, 20 primary schools, 5 combined primary and secondary schools, and 64 secondary schools. Of the 107 institutions, 29% were private and the remainder public. Of the total sample, 76% were located in urban areas, 15% in semi-urban areas, and 9% in rural areas. Although the number of female students and teachers in elementary schools exceeded the number of male students and teachers, only 46% of the 231,425 students in the 107 schools studied were female and 33% of the 8,377 teachers were women. In teacher training institutions, 41% of students and 23% of instructors were women.

Pedagogical uses of ICT in varied African learning settings

PanAf Phase 1 shed light on the pedagogical use of ICT in varied African learning settings, such as student learning, education programs, teaching practices, online education (e-education), professional development, evaluation, and so on. Results of both the transnational research project on ICT integration in African ICT pioneer schools (see Karsenti, Toure, Maïga & Ngamo, 2005) and PanAf Phase 1

clearly show that ICT use has been inadequately documented in Africa compared to other parts of the world. This view is supported by UNESCO (2004, p. 135):

> […] monitoring and evaluation are the weakest components in most ICT in education programs. 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 program. Evaluation, both formative and summative, means that policies, practices, and activities are documented, interpreted and analyzed.

Pedagogical ICT integration initiatives have been incorporated into a variety of situations, such as visual projection, preparing class notes, and distance self-learning. A promising research approach is to provide an overview of the diverse experimental uses of ICT in learning. Long-term ICT initiatives, both national and continental, have not yet been clearly monitored or evaluated. Another urgent concern is 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 only facilitate the use, processing, and production of relevant information. No matter how powerful the hardware, it serves no educational purpose if it is not used for the 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 importance. Africa is not at the point where it can use ICT to provide its people with a better education or to take advantage of the investment potential and opportunities they offer. Nevertheless, several countries are convinced that ICT use is an undeniably sound economic development strategy when viewed as an investment for the future. This raises the possibility of ICT use for African development and a restructuring of knowledge based on consideration of local African realities.

Teachers and students are discovering new ways to learn

The recently collected data from 107 educational institutions[5] in a dozen countries in Africa show that teachers and learners are using information and communication technologies to transform the ways they teach and learn. Learners are becoming more active and responsible for their learning and teachers are learning to facilitate learning processes rather than trying to transmit knowledge to passive bench sitters. Moreover, lesson content has become more concrete and connected to life. Students enjoy this

[5] Data downloaded from the Observatory in November 2009 for this paper came from 107 institutions, however the data and number of institutions on the Observatory evolves and grows each day.

type of learning more, which motivates both teachers and learners and leads to better performance and deeper, better quality learning.

To better understand the teaching and learning process in Africa, it would be useful to present some of the data gathered from a variety of African schools.

"ICT create an appealing work environment that stimulates students to learn and participate. The internet provides a way to do research more easily and with more results in order to prepare for classes." The use of ICT helps update teaching materials. One student stated that, *"They [teachers] can do research that is the most in-depth, the most recent, the most relevant, and the richest possible so that they can make slide presentations using PowerPoint."* ICT use also increases student motivation. According to one teacher, they can be used to center the teaching on the students, who can then use images, sound, and reflective work in combination. PowerPoint presentations also capture the students' attention, engage them to participate, diversify the delivery, and make the class accessible to large groups of students.

In the syntheses of interviews with teachers in countries from sub-Saharan Africa, it is evident that teachers now "go beyond the book" in using the internet to update their lessons, and students do the same to learn their lessons: *"Instead of being limited to book knowledge, the computer provides access to recent, real-life information on a given subject." "Before the internet came along, the educators at the École Nationale des Instituteurs (ENI) in Brazzaville derived their lessons from schoolbooks. However, some of the information in these books is outdated or even missing. With ICT, although it is less developed at the ENI in Brazzaville due to the lack of internet access, educators are using them to enrich and update their teaching."*

Students also report that using the Internet helps them to *"learn without being aware of it."* Teachers therefore use ICT to attract learners to their subjects and get them to engage more deeply with the concepts. Teachers say that *"where ICT is involved [...] learner participation is high and their attention span is much greater than when conventional facilitation methods are used."* Both teachers and learners express their enjoyment in the learning process, but they also talk about better performance. Students explain that surfing the internet for several hours does not adversely affect their academic work. In fact, students are motivated by the potential to visualize and interact on the internet. Faculty observe that the quality of assignments and projects has improved. This better performance motivates teachers in turn.

Teachers also explain that using ICT helps them prepare better lesson plans, which they are also able to share more easily with other teachers, pedagogical advisors, and the school director or principal, as the case may be. Not only are their lessons more up-to-date and filled with more concrete examples, but some teachers say that faster access to information reduces their preparation time. They say they are more efficient and effective in their teaching. Furthermore, ICT allows them to store and retrieve their work more easily. Here we have a paradox, because many scholars claim that lack of time is one of the greatest impediments when it comes to learning how to integrate ICT into teaching. Yet the interviews with teachers show that they are comfortable with ICT and that they actually save time, not only in preparing their lessons but also in the classroom. With a map projected or printed from the internet, teachers can save ten minutes in the classroom because they do not have to draw it on the blackboard, as is done in many African classrooms. This provides more time for engaging and interacting with students.

The gains in efficiency and time—as well as confidentiality—are also seen in evaluation practices. The most widely used application by teachers for this purpose is an Excel spreadsheet to track and calculate students' grades. For certain subjects, teachers also use self-correcting drills where students can immediately know whether or not their answers are correct. The use of ICT offers more possibilities for self-assessment and lets teachers make better use of their time reviewing and evaluating selected homework and exams. Student monitoring (in Uganda) "*has greatly improved within the institution, and by a click of a button the administrators can obtain any students' details."* In some cases, this capability is being extended to students and parents, either via the internet, text messages to parents' cell phones, or parents' phone calls to access audio messages stored on the school server regarding their children's performance. Finally, teachers and school administrators explain that, before ICT, student exams went through more hands, thereby increasing opportunities for access to exam questions before the actual exam. Teachers explain that this type of cheating decreases when they can type the exam themselves.

With the use of ICT and the socio-constructive methods it requires, relationships among students, between students and teachers, and between students and teachers are changing.

Students who use the internet for learning become more active and more responsible for their own learning. Instead of merely receiving knowledge, students engage with new knowledge, weaving it into their previous experience and knowledge to construct their understanding. The new knowledge is therefore more deeply internalized. Researchers who have been observing these processes in African

schools, along with teachers, school administrators, and parents attest to the fact that students have taken their learning into their own hands through inquiry-based learning and constructivist instructional strategies.

Lecturers and learners seem to appreciate the more fluid communications and improved interactions afforded by the use of ICT, according to the interviews conducted at teacher training institutions across the continent. At the teacher training institution at Cheikh Anta Diop University in Senegal, trainers are saying that "[t]*he students can easily find out on their own outside the school what the teacher is going to do next week."* Learners appreciate the efficiency and transparency of having course programs online. They know where the course is going and can organize themselves accordingly, instead of the *"wait and see what happens"* approach that has characterized teaching in Africa—even at the university level.

Beyond accessing course materials online, students can discuss academic topics with their lecturers via online chat (Adult Education, Makerere University, Uganda), email, and mobile phones (University of Education at Winneba in Ghana). For better or for worse, "*teachers continue communicating with the learners even during holidays through the internet, hence facilitating self-directed learning [...] ensur[ing] continued communication with the learners even when they are on vacation"* (Kenya Technical Teachers College).

Teachers use ICT to collaborate among themselves in several ways. For example, they use the internet to "*search for and exchange information among teachers from the same institution and with others from other universities around the world"* (Universidade Pedagógica, Mozambique). A number of teachers trained in ICT integration train other teachers in turn on the use of computers for teaching.

The teacher is described as a facilitator who does not impose but discreetly guides: "*The ICT teachers at my school have become guides, facilitators, rather than holders of knowledge."* Using ICT has provided teachers and lecturers the opportunity and flexibility to diversify teaching methods and try out new pedagogical approaches (University of the Gambia; University of Education, Winneba, Ghana), and this sort of experimentation is necessary so that teachers can develop their practice and evolve toward more constructivist approaches. A good number of lecturers have seized upon the intrinsic values of ICT to support student-centered, activity-based, project-based learning and integrate it into their lessons. Inquiry-based learning—almost impossible in the information-poor conditions that prevail in many formal learning settings in Africa (Tchombe, 2006, p. 42)—is now possible thanks to ICT.

Using ICT to root and to open

Student and teacher use of ICT seems to allow schools across the continent both to root themselves in their own realities and to open more meaningfully to realities beyond their immediate environment. An interviewee at a teacher training institute in the capital city of Central African Republic explained: *"With ICT, I learn about what happens elsewhere, in other institutions. I develop myself and my culture each day."*

At Winneba's University of Education in Ghana, Windy Bay radio station takes lectures to communities across the country and brings their views into discussions around educational and other social issues. Students sit in the comfort of their campus or rented rooms to take notes and ask questions using telephones and text messages. These publicly aired "live" seminars, workshops, and lectures open the eyes of the community to the activities of the university and draw the community into the university, promoting dialogue between the university and world beyond.[6]

Such use of radio, internet and other ICT put educational institutions and programs in interaction with plural and multidimensional perspectives. ICT make it easier to communicate with the world, and this makes its way into teaching practices, into what is taught, and into how learners engage with knowledge. Educators and researchers in Central African Republic explain how African teachers dialogue with other teachers including other African teachers about course content, thanks to internet, and speculate that use of ICT for such sharing across borders influences teachers and their teaching and will influence curriculum content over time.

While some deplore the predominance of English language and "western" content on the internet, educators explain how ICT use allows them to enrich the curriculum by using multimedia equipment to incorporate local teaching and learning materials. In the data on the PanAf Observatory, we find statements such as the following: *"There are vast amounts of web-based resources on African history and culture as well as other works by Africans in various domains that the university can refer to and use."*

[6] www.uew.edu.gh/index.php?page=radio-windy-bay-98-3fm

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An educator at Wits School of Education in South Africa discussed the *"importance of the development of online learning materials in the indigenous African languages of the country, for use in both schools and other educational contexts. There is a significant dearth of such resources in the country. ... [T]he impact of ICTs could be significant in empowering these other languages for use in education in relation to English."* As the PanAf research explains, *"One member of the teaching staff, in the African languages area, is particularly committed in her academic research and teaching to the development of online learning materials in Zulu. One respondent mentioned the strong commitment of many in the school to [...] the use of ICT in the development of multilingual approaches to teaching and learning in South African schools."*

Conclusion

Teachers throughout Africa, despite the difficulties of access to information and communication technologies (ICT) and difficult access to training on the use of ICT, are actively integrating them into their teaching. Learners also use ICT and are increasingly called upon to use them. The effects of the progressive integration of ICT in education in Africa are many. Teachers evolve their teaching by integrating constructivist approaches. Learners become more active and responsible for their learning. The process of teaching and learning becomes more interactive and more open.

Just as pedagogical styles evolve, so does course content, which was a prisoner of textbooks before. Learning materials are updated and enriched by research on the internet. And the process takes into account the interests of learners and of African and international realities. There is a lot more "conversation" between school and community.

Learners explain that with ICT, the relationships with their teachers change. Contact becomes more frequent and personalized. Relations are less formal. However, educational systems are slow to adapt. The dynamism of many teachers interviewed by the PanAf researchers leads us to wonder what the consequences would be if educational systems would support and catch up with these pioneering teachers, whose actions suggest promising paths for the future.

We tried in this paper, through the presentation and discussion of "open" data from the PanAf Observatory on the experience of teachers and learners of many educational institutions in Africa, to demonstrate how the use of ICT makes learning more meaningful and lasting. The use of ICT can open up positive teaching and learning opportunities, as well as better link schools to various communities and

possibly open educational systems in Africa to integrating both traditional and modern ways of learning and knowing. These developments should serve learners in Africa, to the extent that they contribute to the development of critical thinking, in harmony with the culture and values of African solidarity and contribution to society.

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