Integration of ICTs into the curriculum of Cameroon primary and secondary schools: A review of current status, barriers and proposed strategies for effective Integration

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ABSTRACT

Many sub-Saharan African countries are progressively integrating information and communication technologies (ICTs) into their education systems especially in primary and secondary schools. These efforts that are seen in both private and public schools to bring technologies into the classroom are just starting but are encountering a lot of difficulties. Cameroon, a Sub-Saharan African country, is not an exception to the situation in this group of countries. ICTs were officially introduced in schools in Cameroon since 2001 and since then many initiatives have been carried out but the difficulties supersede the progress. Based on available research, this study focuses on the current status of ICTs in Cameroon primary and secondary schools. It gives a brief description of the country's education system, and reviews major initiatives that have been carried out so far in the integration of ICTs in primary and secondary schools. It further identifies and analyzes some barriers that cause ICT integration into curriculum ineffective. Lastly, it recommends some strategies to overcome the barriers, and guidelines for a contextualized and effective ICT integration.

Key words: ICT integration；curriculum；primary and secondary schools；barriers; strategies；Cameroon.

INTRODUCTION

The importance of technology in education has drawn the attention of educationists since the beginning of the motion pictures in the early 20s, but computers were accessible to teachers and students only in the mid-70s when they were introduced in education (Brush T. cited in Hew, K. F. &Thomas, B. 2007). From that time to present, research has shown that curriculum that integrates technology has lots of advantages. Some of these advantages include the motivation and improvement of students' learning (Sivin-Kachala & Bialo 2000). This believe in the efficacy of technology in education has led many governments to set up programmes to integrate technology into their education systems. It is for the same reasons that Cameroon has also been making attempts to integrate technology into its curriculum since 2001. However, this zeal is yet to be successful due to common barriers that usually affect even developed nations like the United States and other developed countries that are believed to be experts in the use of technology in education (Becker 2000). One of such a barrier which is a very important aspect of technology integration into education and common with most Sub-Saharan African countries like Comoros, Congo, Guinea, Lesotho, and Madagascar and Cameroon in particular, is the absence of a clear vision and planned strategy for ICT integration in Education (Wallet, P. & Beatriz 2015). Others include the lack of technological resources, the lack of Knowledge and skills as well as the attitudes and beliefs of teachers and parents etc.

Given that data and the analysis of constant evaluation and research enables the improvement of ICT use in education (Tilya, F. 2008), the main purpose of this paper is to first of all review major initiatives that have been carried out in the country to integrate ICTs into primary and secondary

schools. Second, it analyzes the current situation and the barriers identified from the analysis, and lastly, it proposes some useful strategies that can help to remedy the situation. The opening section briefly describes Cameroon's education system.

CAMEROON EDUCATION SYSTEM

Cameroon's education system is a legacy of the British and French colonial administrations. Thus, the education system is divided into two sub-systems which are the French-speaking sub-system and the English-speaking sub-system respectively. There are eight State-run universities and a good number of private universities: two Anglo-Saxon style universities and six others run on the francophone model.

Table1: The structure of primary and secondary education of the two sub-systems

The Cameroon Primary and Secondary Education Sub-systems					
The French-speaking sub-system			The English-speaking sub-system		
Duration	Certificate Obtained			Duration	Certificate Obtained
2- 3 years of Nursery education (Kindergartens)	No Certificate obtained			2- 3 years of Nursery education (Kindergartens)	No Certificate obtained
6 years of primary (elementary education)	CEP (Certificat d'Études Primaires)			6 years of primary (elementary education)	FSLC (First School Living Certificate)
2 years of Post primary rural artisan training	Testimonial			2 years of Post primary rural artisan training	Testimonial
4 years of middle school training	BEPC (Brevet d'Étude du Premier Cycle)	General Secondary Education		5 years of middle school	The General certificate of Education – Ordinary Level (GCE O/L)
3 years of High School	Probatoire and BACCalauréat			2 years of High School	The General certificate of Education- Advanced Level (GCE A/L)
4 years of middle school	CAP (Capacité d'Aptitude Professionnelle	Technical Secondary Education		4 years of middle school	CAP (Capacité d'Aptitude Professionnelle
3 years of High School	Probatoire and BACCalauréat			3 years of High School	Probatoire and BACCalauréat

The structure of the primary and secondary education of the two sub-systems presents some salient similarities and differences. The duration of nursery education and post primary education is 2-3 years and 2 years respectively and at the end of post primary artisan training in both sub-

systems, students obtain a testimonial. Primary education in both sub-systems takes 6 years. The technical secondary education in both sub-systems runs on the francophone model. While secondary education in the French sub-system lasts for 4 years and 3 years for its 1st and 2nd cycles respectively, the English sub-system takes 5 years and 2 years in the 1st and 2nd cycles respectively. Even though the two systems exist separately and maintain different evaluation methods as well as certification, primary education nationwide is compulsory through the age of fourteen. However，this right to free education is not yet available, accessible, and adaptable but largely acceptable when it is available (Djoyou, K. S. A. 2011).

MINISTRIES IN CHARGE OF EDUCATION

The management of education is decentralised under five ministries:
- The Ministry of Basic Education (MINEDUB): in charge of nursery, primary and teacher training education;
- The Ministry of Secondary Education (MINESEC) is in charge of general and technical secondary education;
- The Ministry of Higher Education (MINESUP) is in charge of University and professional higher education;
- The Ministry of Employment and Vocational Training (MINEFP) is in charge of vocational training for all school leavers to ease their integration into the social and professional world;
- The Ministry of sports and physical education (MINSEP): is in charge of all youths sporting activities.

All these ministries are guided by the Cameroon education law. However, the Ministry of Economy, Planning and Regional Development (2013) recently noted that their multiplicity impedes the harmonious operation in the sector of education and makes coordination very difficult. It added that as a result, it is very difficult to access sector statistics, given that existing information systems are even more subsector by subsector in nature and the necessary flows are difficult to regulate. To ease both coordination and statistical flows, the authors of this article support the recommendation made at the recent regional and national consultations which suggested the establishment/setting up of a single Ministry of National Education with departments of education at regional and divisional levels.

ICT INTEGRATION INTO THE CURRICULUM OF PRIMARY AND SECONDARY SCHOOLS

An overview of initiatives undertaken

Between 1998 and 1999 private efforts were made in private and mission schools like College François Xavier Vogt to use ICTs in education whereas it was in 2001 that they were introduced in public schools in Cameroon. In secondary schools, they were actually introduced in 1998 but only became operational four years later with the setting up of the general inspectorate in charge of Computer Science (Fouda et al. 2013). In fact, before the ministries of education could provide the ICT curricula, several private primary and general secondary and technical schools in major cities had acquired computers and begun to provide courses on ICTs and with ICTs (Karsenti et al. 2012). It was later in February 2001 that the President of the Republic called for the orientation of education toward the knowledge economy in his address to the Cameroon youths (République du Cameroun cited in Mbangwana 2008). This led to the official introduction of ICTs in general and technical secondary schools and since then many schools have been receiving presidential grants in the form of Multimedia Resource Centres with Internet connection (Mbangwana 2008).

Government involvement in the area of ICTs seriously began with the development of the policy document and the general strategy for the integration of ICTs in all sectors by the National Agency of ICTs (ANTIC) and the setting up of Multimedia Resource Centres in some primary and secondary schools (Government Bilingual High school Yaounde, *Lycée Général Leclerc*, Yaounde and Government Bilingual High School, Joss, Douala), and some primary schools like *École des* "*Champions*" of the Chantal Biya Foundation.

By 2003, official ICT programmes for secondary schools were conceived (ERNWACA-Cameroon 2005) and ICT syllabuses and National Sequential Schemes of work published in 2008 were made available to Nursery, Primary and Teacher Training Education. Textbooks have also been written and validated by the National Book Commission to facilitate the teaching of ICTs (République 2007a cited in Mbangwana 2008). République also made mention of the draft strategy to implement the national ICT policy in basic education which was applicable from 2007-2015 that was developed in 2007. The strategy targeted at training teachers and head teachers in the importance and how to use ICTs in teaching and learning as well as in school administration. Based on training objectives, national guidelines were also included in the teaching of ICTs in preschool and primary schools. The guidelines were based on six modules for each level including the skills to develop which were: the discovery and presentation skills, application skills, knowledge construction skills, health and safety issues related to ethics and equity (République 2007).

Due to the lack of teaching staff, infrastructure and finance, the State went into a partnership with private contractors and Parent/Teacher Associations (PTA) in 2005 to supply computer equipment and the provision of finance respectively (Fouda et al. 2013).

In 2007, the field of Computer Science and Educational Technologies was established at the Higher Teacher Training College (HTTC) Yaounde (Centre Region) to train general secondary school ICT and Computer Science teachers. The following year, a similar field was established at the Higher Teacher Training College, Maroua (Far North Region). In 2009, an information management system was set up at the Higher Teacher Training College, Bamenda (North West Region) to train technical secondary school teachers. This led to the institution of Information Technology as a school subject in January 2011, which entered into force in February of the same year; IT was introduced as a compulsory subject in all MINESEC official examinations.

Apart from government initiatives, non-governmental organizations like ADCOME have also contributed at regional levels to bridge the digital divide in secondary schools in the southwest region of the country through their CIAC project (Computer and Internet Access Centres). Nganji, J. et al. (2010) says ADCOME's initial objective was to bring internet closer to the people at low cost in 2000. In 2001, motivated by the achievement of this objective, it further launched the CIAC project to install computers and internet as well as providing training for teachers in secondary schools with the first pilot school being the Baptist High School Buea.

However, even though 96.23 per cent of public primary schools pupils and secondary school students are taught ICT lessons and 100 per cent of Teacher Training Colleges teaching ICTs to student teachers, a greater part of the training is still theoretical due to the chronic lack of resources and infrastructure (ERNWACA-Cameroon 2010; Ndonfack N. 2010). ERNWACA (Educational Research Network for West and Central Africa) carried out a joint research with PAQUEB in 2009 and in 2010 and found that 87 per cent of all teaching is only theory since only 3 per cent of all public primary schools have computers.

MINESEC, partnering with MTN foundation based on the 2013 partnership agreement (Camerpost 2013), launched the first competition in 2014 to reward teachers who integrate ICTs in teaching techniques and methods to improve learning. The objective of the competition is to

motivate teachers in the use of technologies without discrimination, to stimulate the quest for research in innovative teaching methods and contribute toward achieving quality education. The competition is open to both public and private secondary school teachers nationwide (Tawong, C. 2015).

From the foregoing, it is obvious that most of the initiatives carried out in the country so far have not been largely successful. However, they are promising. Despite apparent challenges such as connecting more Cameroon schools to a nationwide network and the Internet, providing schools with technological resources, training more teachers and financing ICT integration projects, there exist success stories like that of "Les Champions FCB", a remote school in Memiam situated in the Centre Region which can boast that all students are provided with computers (Karsenti, T. et al. 2012); the setting up of SIGIPES (Système Intégré de Gestion Informatisée du Personnel de L'État et de La Solde) which means an Integrated Computerized State Personnel and Payroll Management System handles personnel and payroll data, an online registration system for the competitive entrance examination into the Higher Teacher Training College and the online registration of both old and new students at the university of Yaounde I has been operational since 2011 and 2012 respectively. Multimedia Resource Centres (MRC) have been setup in universities and professional schools and in some public secondary schools; the training of monitors who manage the MRCs, the creation of platforms for learning; the interconnection of the eight state universities and the establishment of training departments in professional schools and universities and most are now operational (2007). What is most promising is the continuous training of teachers both in the use of ICTs in teaching as a tool and as a discipline in the various Teacher Training Colleges.

BODIES IN CHARGE OF ICTS IN EDUCATION

The main bodies in charge of ICT Education in Cameroon are MINEDUB, MINESEC, the National ICT Agency (ANTIC) and NEPAD which is a non Cameroon government organization.

MINEDUB and MINESEC have been carrying out remarkable projects since the introduction of ICTS in schools under their ministries. MINEDUB has been working through PAQUEB (Projet Pilote pour L'Amélioration de la Qualité de L'Éducation de Base) meaning Pilot Project to improve the quality of Basic Education concerning the implementation of the one laptop per child project in Cameroon.

MINESEC for its part has been opening multi media centres and GRID (2014) says it can now boast that, 80 per cent of secondary schools have computer rooms and 60 per cent have computers.

Microsoft recently partnered with the university of Douala and Yoomee, the country's first wireless ISP hosted the event of Microsoft education in February 2014 during which the company presented its academic programmes and teaching and learning software for teachers and students (GRID 2014).

ANTIC (Agence Nationale des Technologies de l'Information et de la Communication) known in English as National ICT Agency, drafted the first national policy for the development of ICTs in 2007. ANTIC is in charge of cyber security, cyber crime and fraud related issues. It also lays down rules and recommendations for schools and parents to use in preventing children from accessing illegal and immoral contents by setting and blocking undesired websites.

The New Partnership for Africa Development (NEPAD), a non-Cameroon government organisation is in charge of the e- Schools project in Cameroon. The e-schools initiatives operate

in many African countries with the aim of providing primary and secondary school pupils and students with ICT skills and Knowledge in order to enable them to be competent in the emerging information society (GRID 2014).

THE CURRENT STATUS OF ICTS IN PRIMARY AND SECONDARY SCHOOLS

In his research that draws from a transnational study done by ERNWACA in 2005 on ICT education in west and central Africa, and in which 8 primary and secondary schools were selected from Cameroon, Nangue (2010) noted that ICT integration into schools in Cameroon corresponds to the three first levels of the Miller Model which are introduction, entry and intermediate stages. These three phases are quite present in the schools under their study since computers were installed, and teaching and training had begun. However, for a better understanding of the situation of ICTs in Cameroon primary and secondary schools, it is very important to look at the current situation not only in the aforementioned segment of schools but also in the entire nation.

A general low penetration of ICTs into the country and in schools in particular

A cross-section examination of the available reports from Sub-Saharan African countries has shown that a vast majority are yet to apply the ICT integration process in schools or are still at the introduction phase of the process (Farell and Isaacs 2007; Nangue 2010 cited in Nangue 2011). Available research carried out by MINPOSTEL (2006) cited in Fouda et al. (2013) in Cameroon on the use of ICTs in the different administrative structures revealed the following statistics:

- 66.6 per cent do not have computers;
- 6.2 per cent have a few computers;
- 9.3 per cent have Access to Internet connection;
- Only 3 per cent of public schools have access to limited ICTs, thus teaching remains purely theoretical: and
- 10.8 per cent have accessible Websites.

In terms of Internet usage, as at June 2012, the number of Internet users was 1,006,494 making up 5 per cent of the population[1]. From December 2012, there were 562,480 Facebook users which is equal to a penetration rate of 2.8 per cent.[2]

Table 2: Cameroon Internet usage and population statistics

Year	Internet users	population	Per centage	GNI p.c	Usage source
2000	20,000	16,853,500	0.1%	US$600	ITU[3]
2006	370,000	18,467,692	2.0%	US$ 1,010	ITU
2009	725,000	18,879,301	3.8%	US$ 1,153	ITU
2011	783,956	19,711.791	3.9%	US$ 1,210	ITU
2012	1,006,494	20,129,878	5.0%	US$ 1,170	ITU

Note: per capita GNI in US dollars, source: World Bank, Atlas method[4]

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[1] http://www.internetworldstats.com/ [consulted on 12 November 2014]

[2] http://www.internetworldstats.com/[consulted on 12 November 2014]

[3] ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies – ICTs. ITU is committed to connecting the entire world's people – wherever they live and whatever their means.

Due to poor connection or no connection at all to the Internet, the majority of educational institutions in Cameroon do not have Internet connection. Furthermore, since 2008 that the official syllabus for primary schools was effectively applied, only 1.2 per cent of teachers have done in-service training on the practical use of ICTs and 67.2 per cent of the training skills acquired through pedagogic day trainings are basically theoretical (Nkwenti N. 2010).

The chronic lack of infrastructure and equipment

Fouda et al. (2013) noted in their research that the 2009/2010 school year statistics reveal that out of over 1,000 secondary schools in Cameroon, only 100 have the necessary equipment to teach Computer Science. They further exemplify that Yaounde, the political capital of Cameroon with a student population of 94,267, has only 1,159 computers giving a percentage of 81 students for 1 desktop.

On the basis of a 2009/2010 study, only 3 % of all public primary schools have computers and 87 % of all ICT teaching is theoretical (ERNWACA-Cameroon 2010).

Due to lack of finance, most ICT integration projects suffer sustainability since no budget is allocated for the purchase of technological equipment. For instance in his country profile report, Tetang, T.J. (2007) notes that:

> *Projects rely on external funding which puts their sustainability into question. Moreover, government secondary and primary schools have a low purchasing power, and no budget has been allotted to them to support ICT-related activities in schools. Most computers used in schools are donations. Since most of the online learning resources accessible through the government secondary school learning platform CAM-EDUC are in French, it acts as a hindrance* for the English speaking-community. Worse still, all those online resources are not based in Cameroon but located in Europe *(p.2)*.

Therefore, there is an urgent need to empower national stakeholders in order for them to be able to produce and contextualize online learning materials.

Inadequate number of qualified trained teachers

Available research on professional development for teachers in ICTs attest that little or no teacher professional training in ICTs has been conducted in primary and secondary schools (Tetang, T.J. 2007; Mbangwana 2008; Nangue 2011; Fouda et al. 2013; Nkwenti N. 2015).

In secondary schools, between 2003 and 2010, there were no qualified teachers except part-timers who were either graduate students in Computer Sciences or teachers of other disciplines like Mathematics, Physics, etc. who had little or no knowledge in Computer Science pedagogy. Fouda et al. (2013) reveal that since the 2010-2011academic year, Higher Teacher Training colleges train 300 Computer Science and ICT teachers to cater for a student population of more than 1,200,000; a ratio of 1 teacher for 400 students. Presently, more and more teachers are trained in Computer Science and ICT pedagogy. This means that by 2015, Cameroon was boasting of 1,000 Computer Science and ICT secondary school teachers. However, this number is still not enough since there are still many schools without qualified teachers. In addition, principals, in-service teachers of other disciplines and all other staff in the management of education that could constitute relays to disseminate ICTs in the educational system, have no

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[4] http://internetworldstats.com/af/cm.htm [Retrieved on 2014/11/12]

access to professional training. Heads of institution and Computer Science pedagogic Inspectors of other disciplines- Mathematics, Physics etc. do not undergo any form of professional training in the use of ICTs that would enable them to take up their new responsibilities (Fouda et al. 2013; Tetang, T.J. 2007; Karsenti et al. 2012).

The situation in primary schools is not so different from that of secondary schools. Available research reveals that very little or no training has been carried out for in-service teachers to initiate them in the use of ICTs or to improve their skills and knowledge since its introduction in schools in 2001 (Inspectorate of Pedagogy in charge of ICTs, annual reports, 2009, 2010, 2011). In the little cases where it is conducted, it is done in the form of a pedagogy seminar (Inspectorate General of Pedagogy 2004; Nkwenti N. 2010, cited in Nkwenti N. 2011). The one day seminars are held once in a term giving a total of 3 days per academic year, say 18 hours of effective instruction (Nkwenti N. 2015). This is absolutely insignificant given that technologies evolve rapidly.

The lack of qualified teaching staff is closely linked to the lack of permanent technical assistance in Schools with ICT laboratories. As a result, when systems break down, it takes a longer period to repair them and since many classroom teachers do not have the opportunity to undertake professional development, they usually feel frustrated and discouraged when they meet the least challenges.

Lack of support from school administrators

As graduates of the first batch of teachers trained in Computer Science and ICTs, the authors of this article and colleagues had bitter and frustrating experiences with their school principals. After two years of teaching experience, most teachers complained that their relationship with their principals and teachers of other disciplines was not a cordial one. In one public school in Yaounde the first author experienced acute lack of support from the principal and colleagues of other disciplines, and resistance from the part-time teachers, who were mostly Computer Science graduates that were already teaching the ICT course without any pedagogical training. Any attempt to correct or give pedagogic advice to the graduates most often led to misunderstandings. The principal never took complaints about the computer lab into account. This also led to lack of motivation. Support from administrators and colleagues is said to be an important motivating factor for teachers to make the effort to integrate ICTs into their lessons (Manternach-Wigans 1999; Moseley & Higgins 1999) cited in Charles (2012). Nonetheless, the attitude of school principals and their staff can be justified by the fact that most of them are ignorant about the use and importance of ICTs in education.

BARRIERS OF EFFECTIVE INTEGRATION OF ICTS INTO CURRICULUM

The implementation of initiatives carried out so far have not really been successful because of some barriers based mostly on findings done by some Cameroon researchers and African research groups like (Tetang, T.J. 2007; République 2007c; Mbangwa 2008; Nangue 2010; Fouda et al. 2013); (ERNWANA-Cameroon 2005; MINEpostel 2006; Karsenti & Harper-Merrett 2012) the barriers discussed below were identified.

Lack of technological resources

Generally speaking, the lack of technology includes insufficient computers, peripherals, and software (Karagiorgi 2005; O'Mahony 2003; Pelgrum 2001; Sandholtz, Ringstaff & Dwyer 1997 cited in Hew, K. F. &Thomas, B. 2007). Elsewhere, they have been classified by Hew, K. F. &Thomas, B. (2007) to be (a) technology, (b) access to available technology, (c) time, and (d)

technical support.

They further state that without adequate technological resources, teachers will never have the opportunity to integrate technology into curriculum. Like in all developing countries, the majority of primary and secondary schools in Cameroon lack computer equipment, peripherals, and software needed for an effective ICT integration. Nonetheless, Fabry & Higgs cited in Hew, K. F. &Thomas, B. (2007) argue that:

> *Even in cases where technology is abundant, there is no guarantee that teachers have easy access to those resources. Access to technology is more than merely the availability of technology in a school; it involves providing the proper amount and right types of technology in locations where teachers and students can use them (p.226).*

Unfortunately, teachers and students in some schools in the country have computers but do not have access to them. This is the case of schools in remote areas where the available computers are either locked up in computer labs or in the principal's office. This situation can be explained by the lack of permanent technical support staff in schools with computer labs (Mbangwana 2008; Nangue 2010; Karsenti & Harper-Merrett. 2012, Fouda et al. 2013). Thus, when there is a break down, it takes a longer period of time to repair them. Nangue (2010), for example, in his research conducted in four selected schools in the Western Region of Cameroon, states that the non-existence and inaccessibility of ICT infrastructure, as well as the lack of training and technical support prevent the use of computers in preparing lessons. In addition to the problem of lack of technologies like computers and Internet access in the classroom is the problem of power supply. Even where there is supply of the above-mentioned technologies, electric power supply is not regular. This explains why Mbangwana (2008) comments that the regular use of the Internet is often compromised by irregular supply of electricity.

Knowledge and skills of school administrators and in-service subject teachers
Little or no specific technology knowledge and skills, technology pedagogical knowledge and skills as well as technology related classroom management knowledge are major barriers in the process of technology integration (Hew, K. F. &Thomas, B. 2007). According to Nangue (2010), only 26.2 per cent of the teachers in Cameroon had received formal training by 2010. Fouda et al. (2013) add that school principals and in-service teachers do not undergo any form of professional training in the use of ICTs that would enable them to take up their new responsibilities in the information age. Since no training is provided for in-service teachers, interested teachers themselves seek training at IAI (African Institute of Computer Science) and other institutions that offer IT training in the country (Djemeni, M. T. 2007). However doubts may be casted on the effectiveness of the knowledge and skills they receive. Due to this absence or limited opportunities for professional development, teachers usually feel frustrated when faced with the least challenge in using any educational technology tool. Thus, the need for professional development for teachers becomes very urgent.

Absence of a clear vision and planned strategy for ICTs in education

Tetang, T.J. (2007); Nangue (2010) & Fouda et al. (2013) all demonstrate that there is a lack of a clear vision and an ICT policy guiding the use and teaching of ICTs in Cameroon primary and secondary schools. Thomas, B. cited in Hew, K. F. &Thomas, B. (2007), stated that the lack of School ICT policies, the non-existence of an ICT integration plan, the reliance on sponsors and donors which is not always guaranteed also affects effective ICT integration in the classroom. Without such a vision, Fishman & Pinkard (2001) concur that:

> *It is likely that teachers and administrators limit their thinking about technology to "boxes*

and wires" or isolated computer skills (p.70).

Also, in Cameroon, when ICT syllabuses are designed, the teachers do not participate in the designing but simply ordered to use them without really understanding the content and objectives. This also goes a long way to hindering the integration process.

Attitudes and beliefs of teachers and parents

Attitudes and beliefs in the adoption and integration of technology are often associated with teachers. In this article, we include parents: Teacher attitudes and beliefs towards technology is said to be another major barrier to technology integration (Hermans, Tondeur, Valcke, & Van Braak 2006). According to Simpson, Koballa, Oliver, and Crawley (1994) attitudes can be defined as specific feelings that indicate whether a person likes or dislikes something. When it comes to integrating technology in education it can be regarded as whether teachers like or dislike using technology in their teaching.

Richardson, cited in Hew, K. F. &Thomas, B. (2007) defines beliefs on the other hand as "premises or suppositions about something that are felt to be true". In the case of Cameroon, none of these seem to be relevant. Rather, the majority of teachers show no interest in acquiring knowledge in the use of technology and its integration in teaching. Maybe it is because technology has not yet created a real impact in the country. In some schools where technology is available, teachers refuse to be trained by their colleagues who run the school Multimedia Resources Centres. This is the case of Miss Duanla Pauline, an ICT teacher in Government High School Mbouda, who says each time she invites some of her colleagues of other disciplines to come and take basic ICT lessons, for example, how to manage students' grades, they show no interest. Similarly, Ambazo, whom upon arrival at *École Les Champions FCB* of Memiam, invited teachers for training but the majority showed no interest except for two whose skills have now relatively increased (Karsenti et al. 2012). In the same way that many teachers are not interested in technology integration, the Parent/Teacher Associations seem also not to show any interest in teachers' use of technology to teach their kids as they do not cooperate with teachers. Carlson and Gadio (2002) assert that:

> *Parents are the natural source of financial support to sustain technology at the school level in most developing countries given that their children are the direct beneficiaries of technology-enhanced learning (p.124).*

Contrary to this assertion, Karsenti, T. and colleagues note in their research that the parents of some pilot schools in Cameroon like *Lycée de Mvomeka'a* and *École Les Champions FCB of Memiam,* do not give any contribution to improve and enrich the working conditions of the IT infrastructure or maintain existing equipment. They however point out that it is because they have no idea about the importance or the use of ICTs in education. Thus, there is an urgent need to educate not only teachers but parents as well on the importance of ICTs in education.

STRATEGIES TO OVERCOME BARRIERS

Whether a country is just in the beginning stage of introducing ICTs into schools or it is in the second stage development (having implemented ICTs for 10 or more years) and is seeing farther development of the use of ICTs in education; both cases are still evolving and there are no hard and fast guidelines available. Pelgrum, W. J. and Law (2003) assert that planners are confronted with the task. Cameroon planners are therefore not an exception to that assertion. In order to overcome the barriers that hinder successful ICT integration into Cameroon primary and secondary schools curriculum, this study proposes the following strategies.

A shared vision and technology integration plan

A shared vision of teaching is very important for a nation's development because it acts as a powerful over comer of barriers caused by leadership in the use of technology (Sandholtz et al. 1997; Tearle 2004). Having a shared vision and technology integration plan enables school heads and teachers to have a common ground on which they can communicate rationally how technology can be used, as well as a place to begin, a goal to achieve, and a guide along the way (Lim and Khine 2006). In order to achieve this goal therefore, Staples et al. cited in Hew, K. F. &Thomas, B. (2007) suggest that:

> *When making a shared vision for technology integration, the most important issue is to address the specific relationship between technology and particular curriculum content areas because a commitment to the curriculum is a critical scaffold for technology (p.234).*

What this means is that the augmentation of students' learning outcomes should be the focus of any plan for ICT integration in teaching and learning. For that reason both teachers and stakeholders in education should all be involved in the creation of the plan for the common good of students. Many researchers agree that teachers, in particular, should be involved in the making of this very important decision because their participation has proven to be one of those aspects for effective large scale ICT integration in schools (Eshet et al. 2000; Bowman, Newman, & Masterson 2001; Roblyer M. D. & Doering H. D. 2013).

The above justifications for the need and importance of a shared vision and ICT integration plan shows that without a clear vision, a country's process of ICT integration into its educational system is bound to be slow or suffer from ineffective integration. Great technology advanced Nations like America and China which is seen as one of the world's leading countries in technology in education today, each have a shared vision and technology integration plan in education. America's most recent plan among the previously published ones is the NEPT 2010-2020 which was published in March 2010. China's State Education Commission also published its 10-year development plan of educational informatization (2011-2020) (the equivalence of ICT in education the western world) (Zeng, H. et al. 2012) which outlines the vision for the future of information technology in the Chinese education system. It is therefore imperative for Cameroon as a baby nation in ICT integration to have such a vision and plan that involves not only administrators but also the teachers because they are responsible for the actual implementation of the integration plan in the classroom. The main objective of the plan should be the enhancement of student learning with technology, through and about technology.

When the vision has been unanimously formed and approved by the various actors there is the need to prepare a technology integration plan that outlines the different guidelines required to implement the vision. Some practical advice offered by Pinkard (2001) on how to facilitate the development of a technology development plan is to form a committee comprised of teachers, administrators and resource persons in education, and in technology (educational technology experts). Cameroon is rich in such resource persons who have studied both at home and in technology advanced countries and are willing to help facilitate this change. The use of such persons can be helpful in addressing any questions teachers who must be involved in the designing of the strategy plan, and administrators may have in the process.

Overcoming scarcity of technology

According to Hew, K. F. &Thomas, B. (2007), previous studies indicate that there are three strategies to conquer the lack of technological equipments barrier: (i) the use of low-cost thin terminal computers because they are affordable by schools, present few technical and maintenance problems for teachers to address, occupy less space, thereby helping in space

management issues. For a context like Cameroon, they can be obtained from Chinese computer companies like Lenovo. (ii) Technology should be introduced into one or two subject areas at a time so that teachers and students may have sufficient technological resources (Tearle P. 2004); (iii) access to technology issues may be addressed using two strategies according to Johnson & Johnson (1992). The first one is by placing several computers in the classroom, instead of placing them in centralized locations. In this way there is a high probability that teachers with computers in the classroom will use them in their lessons than colleagues who need to go to the computer lab. The second is by rotating groups of students through the limited number of computers in the classroom. By using the rotation approach, teachers design various learning activities such as reading centres, computer centres etc. that constitute learning centres and through which the groups of students are rotated to take turns ensuring that each learner has the opportunity to use the computer (Sandholtz et al. 1997).

If the approaches of using such cheaper computer systems, gradually introducing technology into one or two subject areas in schools with computers in major cities like Yaounde and Douala, and computers placed in the classrooms and students rotated in groups through the limited number of computers are considered, this will go a long way to solving or lessening the problem of scarcity of computer resources.

For the purchase of cheap computers, principals and headmasters should not always wait upon the government to provide for the ICT resources. They should go into honest partnership with parents and see to it that pupils and students are not left behind in this information technology age. In order for this to be possible, the state and school heads will have to sensitize parents on the importance and uses of ICTs in the education of their children.

To solve the problem of lack of technical support in the case of Cameroon, second cycle secondary school students (i.e. high school students) in both sub-systems who show interest in technology can be trained to manage simple software related problems instead of recruiting professional technicians that maybe very costly for schools for nothing. Technicians can only be hired when problems are beyond the students' abilities or if they are hardware related in primary schools where the learners are still very young. *This strategy enables teachers to focus more on carrying out and managing learning and teaching activities* Lim et al. 2003.

Professional development of pre-service and in-service teachers

Professional development for both pre-service and in-service teachers is key to technology integration in education. Teachers need to be educated on why and how technology can help them improve their students' learning outcomes and even their personal development.

Given that pre-service secondary and primary school teacher training has begun in the different teacher training colleges in the country, teacher trainees should be trained with ICTs and allowed to apply them in their learning activities while in school to guarantee that they will use them to enhance their teaching activities once they are on the field. This can be helpful because teachers tend to teach the way they were taught and thus, *if they are given time to practice, they can learn how to share and collaborate with colleagues and it is likely that they will apply technology in their teaching upon graduation (Divaharan, S. & Ping, L. C. 2010).*

Beside the basic training of school principals and in-service teachers, in-service teachers can be provided with professional development through the design and development of teaching and learning resources. The core of successful ICT integration in education and in teacher ICT education in particular can be attributed to the construction of teaching and learning resources. Since Cameroon does not have advanced technology companies, university students of Computer Science major and student teachers majoring in Instructional Technology and ICTs in

the different higher teacher training colleges can be encouraged to design teaching material for secondary and primary school teachers. Best resources can be awarded with scholarships in the form of school fee reduction or paid in full.

Teacher professional development projects should be carried out so as to encourage the use of ICTs in teaching. The Ministry of Education (MOE) of China implements several projects to promote the use of ICTs, one of the most important being "Professional Development" for teachers in ICTs. Because of this commitment in professional development, a good number of teachers from kindergartens to university level are seen effectively applying technology in their classrooms which is an example for Cameroon to emulate. The various in-service teachers development project should be accompanied with motivating policies, the provision of leave and allowance as well as awards as encouragement and motivation for teachers to be actively involved in the training activities. This could be in the form of salary increase for those who are willing and a decrease in the salary of resistant teachers. Since nobody would want a decrease in salary, all teachers will be compelled to take part in training. More so, trainers also need to be provided with training materials. In this way, both trainers and trainees are ready for the task.

Another way to encourage teachers to develop interest in the use of ICTs is by contextualizing the ICT competency standard for Teachers (ICT-CST) outlined by UNESCO while taking into account local realities in Cameroon. ICT-CST framework that was created by UNESCO personnel in collaboration with industry partners Cisco, Intel and Microsoft focuses on skills that teachers require to bring about three different levels of human capacity development: technology literacy, knowledge deepening, and knowledge creation (Roblyer M. D. and Doering A. H. 2013). This framework might be a starting point to help teachers to be more confident and prepared instead of being resistant if contextualised. After 14 years of ICT integration in education in Cameroon, nothing concrete has been done to empower teachers to take up their roles. Thus, a good way to start could be by contextualizing the UNESCO ICT competency standard for teachers as many beginner countries do. The government should set up standards by imposing examinations on teachers that will be certified at the end upon a pass. When they have the professional skills, their attitudes and beliefs will change and they will have confidence in themselves and develop a positive attitude towards technology in teaching. The early realization of the importance of teacher professional development in the early 2000s made China's ICT education what it is today; who knows, the same approach may change the case of Cameroon in future.

Developing Medium- and Long-term development plans

Most researchers on ICTs in education attest that long-term ICT development plans are more strategic and beneficial than short-term development plans (Pelgrum and Law 2003; Kozma 2012; Zhan, D. 2012). Despite the fact that there are development plans in education in Cameroon, there are no clear development plans for ICTs in education. Perhaps the development of longer ICT development plans could help speed up the integration process of ICT into Cameroon schools.

Sponsoring ICT integration projects

The truth is that the state alone cannot handle all the ICT projects and relying mainly on external funding puts the sustainability of projects into question. Therefore, the different regions should join efforts with government through its ministries of education by providing financial support to projects related to teachers' ICT development projects at Regional level. Also, a good way to lighten this situation would be that school heads should also set aside a budget at the beginning of every school year for the training of teachers and purchase of computer equipment. School heads that carry out such initiatives could be motivated through salary increments or promoted to

higher positions in the ministry.

CONCLUSION AND RECOMMENDATIONS

The above discussion shows that Cameroon has been carrying out so many initiatives on ICT integration in schools since 2001. But the current situation in primary and secondary schools reveals that Cameroon like all Sub-Saharan African countries, is facing a lot of barriers in terms of resources (infrastructure and equipment), inadequate number of qualified teachers with technology-based pedagogy, and permanent technical support staff, the ignorance of school administrators and parents on the uses and importance of ICTs in education, lack of finance, among many others.

A close look at the administration of education and the structure of the country's education system gives the impression that they play a role in the ineffective integration of ICTs in schools; (a) because of too many ministries in charge of education and (b) because of the existence of two sub-systems of education. However, some of the above proposed strategies and the recommendations given below may be helpful if taken into account:

- A larger scale of awareness through media campaigns and professional development still needs to be done especially as far as in-service teachers, school principals and parents are concerned so as to get them interested in the use of ICTs in the classroom. They can also be motivated through incentives and/or promotions. In turn, principals will support their teaching staff and even colleagues will be an encouragement to others. These sensitization initiatives can overcome psychological resistance and influence behaviour and attitudes; inspire all teachers who may still be reluctant to use ICTs, due to prejudices such as the fear of being ridiculed;
- As Swarts, P. (2008) suggests, the pedagogical integration of ICTs into curriculum should be addressed from the following angles: (1) learning ICTs as a discipline; (2) learning through ICTs as a medium or library; and (3) learning with ICTs as pedagogic tools;
- School principals should also set aside a budget at the beginning of every school year for the maintenance of computers and for the payment of a permanent technical assistant;
- ICT integration Policies and implementation strategies should be clearly defined not only by the administration but also with the teachers' participation with the assistance of educational technology experts who can clarify whatever doubts and fears both administrators and teachers may have;
- Equipment and human resource investments should be assessed to identify problem areas and choose the most adapted measures;
- Schools should be equipped with electricity, Internet access, software/hardware required to facilitate the teaching and learning process, but emphasis should not be over laid on the purchase of computer equipment at this early stage, instead, pre-service training and professional development for in-service teachers should be conducted and focused on equipping teachers with knowledge and skills on the use of ICTs as a tool. This will remedy the frustration that teachers may face because of their lack of knowledge and skills. China tried the computer hardware-dominated approach at its early stage of ICT integration in education but it failed, and resorted to some remedial strategies like teacher training, and designing and developing educational resources (Zhao, J. H. 2010). Without teacher training, the presence of computers in computer labs and classrooms is useless.
- An adapted ICT syllabus should be designed that both sub-systems can adopt in order to harmonize integration nationwide and the five ministries should be reduced to one ministry which defines national objectives and instead create departments that manage the different sectors of education and ensure the implementation of specific objectives in the various regions;

- In agreement with Pelgrum,W.J. and Law, N. (2003), the authors of this article strongly suggest that, as a country with a weak economy, Cameroon should carefully study the humble beginnings of countries with stronger economies and contextualise their most successful, adaptable and transferable experiences while taking into account the realities of the local context ; and
- Based on Tilya, F. (2008)'s opinion that data and analysis of constant evaluation and research enables the improvement of ICT use in education, more research in the area of ICT integration into the curriculum of Cameroon primary and secondary schools also still has to be conducted because there is little or no research on it. Research on the level of ICT adoption and integration will enable the identification of problems and facilitate the resolution of problem areas. This explains why these authors are each currently writing a master's thesis related to the problems of ICT integration into primary and secondary schools. Author "A" focuses on professional development for primary and secondary school teachers while author "B" focuses on the teaching of ICTs as a subject in secondary schools based on Chinese experience. Both studies reveal that the Chinese experience in teacher professional development in ICTs and in ICT teaching practice can serve as a valuable reference for Cameroon.

REFERENCES

Becker, H. J., 2000, "Findings from the Teaching, Learning, and Computing survey: Is Larry Cuban Right*?" Education Policy Analysis Archives*, vol.8.no.51.

Bowman, J., Newman, D. L., & Masterson, J., 2001, "Adopting educational technology: Implications for designing interventions ". *Journal of Educational Computing Research, vol.*25 no.1, 81–94.

Bransford, J. D., Brown, A. L., & Cocking, R. R., 2000, "How people learn: Brain, mind, experience, and school ". *Washington, DC: National Academies Press.*

Camerpost 2013. "MTN Foundation launches "Digital Schools" 2015." *http://www.cameroonweb.com/CameroonHomePage/economy/MTN-Foundation-launches-Digital-Schools-2015-323727?lang=*

Carlson, S. and Gaido, C.T., 2002, "Teacher Professional Development in the Use of Technology" *[Online]. Available at: http://www.ictinedtoolkit.org/usere/library/tech_for_ed_chapters/08.pdf.*

Charles,B. A., 2012, "Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature*". International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 2012, Vol. 8, Issue 1, pp. 136-155.

Djemeni ,M. T. (2007). Les Ecoles Normales et les Etablissement Scholaire Face aux TICEs: Le Cas du Cameroun, *Laboratoire EDA.*

Djoyou, K. S. A. 2011, "Realizing the right to primary education in Cameroon". African *Human Rights Law Journal*, 171-193.

ERNWACA-Cameroon 2005, "Integration of Information Communication Technology in Education in Central and West Africa: A Case study of Pioneer Schools in Cameroon". *ERNWACA-Cameroon.* Consulted October 2014 at: www.rocare.org/Rapportfinal_TICICM2005.pdf

ERNWACA-Cameroon 2010, "Integration of Information Communication Technology in Education in Central and West Africa: A Case study of Pioneer Schools in Cameroon. Yaounde". *ERNWACA-Cameroon.* Consulted October 2014 at: http://www.ernwaca.org/panaf/IMG/pdf/Nkwenti-PanAf-policy-dialogue-workshop.pdf

Ertmer, P. A. 2005, "Teacher pedagogical beliefs: The final frontier in our quest for technology integration?" *Educational Technology Research and Development,vol.* 53,no.4, pp.25–39*.*

Eshet, Y., Klemes, J., Henderson, L., &Jalali, S., 2000, "A model of successful technology integration in a school system: Plano's Curriculum Integration Project". *In P. Kommers, & G. Richards (Eds.), Proceedings of world conference on educational multimedia, hypermedia and telecommunications 2000* pp. 310–315. Chesapeake, VA: AACE.

Fabry, D. L. & Higgs, J. R., 1997, "Barriers to the effective use of technology in education: Current status". *Journal of Educational Computing Research, vol.*17, no.4, 385–395.

Fishman, B. J. & Pinkard, N., 2001, "Bringing urban schools into the information age: Planning for technology vs. technology planning ". *Journal of Educational Computing Research,* vol. 25,no.1, pp.63–80.

Fouda N. et al. 2013, "Un Profil de Compétences pour les Professeurs d'Informatique de l'Enseignement Secondaire Camerounais *". Int Rev Educ* DOI   10.1007/s11159-013-9344-6.

GRID 2014, Country Profile-Cameroon *http://www.fosigrid.org/africa/cameroon*

Hermans, R., Tondeur, J., Valcke, M. M., & van Braak, J., 2006, "Educational beliefs as predictors of ICT use in the classroom". Paper presented at the convention of the American*, Educational Research Association,* San Francisco, CA.

Hew, K. F. &Thomas, B. 2007, "Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research*". Education Tech Research Dev (2007) pp. 55:223–252 DOI 10.1007/s11423-006-9022-5.*

Hoffman, R.P. 1996, "Levels of Technology Use and Instructional Innovation". *PhD Thesis,* San Diego State University.

Karsenti, T., Collin, S. & Harper-Merrett, T. 2012, "Pedagogical Integration of ICT: Successes and Challenges from 100+ African Schools ". *Ottawa, ON: IDRC.*

Lim, C. P., & Khine, M. S. 2006, "Managing teachers' barriers to ICT integration in Singapore schools". *Journal of Technology and Teacher Education,* vol*.*14 no.1, pp. 97–125.

Mbangwana, M.A. 2008, "Introduction of ICT in Schools and Classrooms in Cameroon". *In K. Toure, T.M.S. Tchombe, & T. Karsenti (Eds.). "ICT and Changing Mindsets in Education". Bamenda, Cameroon: Langaa; Bamako, Mali: ERNWACA / ROCARE.*

MINISTRY OF ECONOMY, PLANNING AND REGIONAL DEVELOPMENT 2013, Education and Training Sector Strategy Paper (2013-2020); Yaounde , Cameroon

Nangue, C.R. 2010, "Guide lines for the Successful Integration of ICT in Schools in Cameroon Dissertation ". *Nelson Mandela Metropolitan University; Port Elizabeth-South Africa*.

Nangue, C.R. et al 2011, "Factors that impact on the successful integration of ICT in schools in Cameroon". Nelson Mandela Metropolitan University, – South Africa. *http://dspace.nmmu.ac.za:8080/xmlui/bitstream/handle/10948/1311/Calvain%20Raoul%20NANGUE.pdf?sequence=1*

Nganji, J. et al. 2010, "Closing the digital gap in Cameroonian secondary schools through the CIAC project". *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 2010, Vol. 6, Issue 2, pp. 106-114.

Nkwenti N. M. 2010, "ICT Integration in Cameroon Primary Schools: A Case Study of Government Primary Practicing School Angele, South Region". *Master's Dissertation, Kuala Lumpu*r: Open University Malaysia.

Nkwenti N. M. 2015, "Mastery of Active and Shared Learning Processes for Techno-Pedagogy (MASLEPT): A Model for Teacher Professional Development on Technology Integration". *Creative Education,* 6, 32-45. http://dx.doi.org/10.4236/ce.2015.61003

Pelgrum,W.J. and Law, N, 2003, "ICT in education around the world: trends, problems and prospects". UNESCO: *International Institute for Educational Planning www.unesco.org/iiep*

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

République du Cameroun 2007b, "Stratégie de mise en ouvre de la politique TIC dans le secteur de l'éducation de base, 2007-2015". Yaoundé, Cameroun : *Inspection de pédagogie chargée de l'enseignement de l'informatique, Ministère de l'éducation de base.*

République du Cameroun 2007c, "Stratégie nationale de développement des technologies de l'information et de la communication". Yaoundé, Cameroun: Agence nationale des technologies de l'information et de la communication (ANTIC). Consulted October 2014 at: *www.observatoiretic.org/documents/show/87*

Roblyer,M.D,& Doering H.D. 2013, "Integrating Educational Technology into Teaching" (6thed.). *United States of America: Pearson Education,Inc.*

Sandholtz, J. H., Ringstaff, C., & Dwyer, D. 1997, "Teaching with technology: Creating student centered classrooms ". *New York: Teachers College.*

Simpson, R. D., Koballa, T. R. Jr., & Oliver, J. S., & Crawley, F. E. 1994, "Research on the affective dimensions of science learning". In D. White (Eds.), *Handbook of research on science teaching and learning* pp. 211–235. New York: Macmillan.

Sivin- Kachala, J., & Bialo, E. R. 2000, "Research report on the effectiveness of technology in schools". *Washington, DC: Software and Information Industry Association.*

Swarts, P. 2008, ICT as Core and Elective Subject: Issues to Consider. *Global e-schools and communities initiatives http://www.gesci.org/old/files/docman/ICT-as-Core-Elective-Subject.pdf*

Tawong, C. 2015, "Competition to choose the best teacher User and integrator of ICTs by MINESEC–MTN foundation partnership". *http://tobbyvision.blogspot.com/2015/05/competition-to-choose-best-teacher-user.html*

Tearle, P. 2004, "A theoretical and instrumental framework for implementing change in ICT in education". *Cambridge Journal of Education,* vol.34,no.3, pp. 331–351.

Tetang, T. J. 2007, "Survey of ICT and education in Africa: Cameroon Country Report ". Survey of ICT in Education in Cameroon. In: *Survey of ICT and Education in Africa*, *Country Reports*, vol. 2, no. 53. Washington DC, infoDev/World Bank.

Tilya, F. 2008, "IT and Educational Policy in the Sub-Sahara African Region". *In Springer International Handbook of Information Technology in Primary and Secondary Education,* pp 1145-1159.

Wallet, P. & Beatriz 2015, "Information and communication technology (ICT) in education in sub-Saharan Africa: A comparative analysis of basic e-readiness in schools ". *UNESCO Institute for Statistics: information* paper no. 25.

Windschitl, M., & Sahl 2002, "Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture". *American Educational Research Journal,* vol.39, no.1, pp.165–205.

Zhao, J. H. & Xu Fuyin 2010, "The State of ICT Education in China: A Literature Review". *Frontiers of   Education in China,* 2010, Vol. 5, no. 1, 2010, pp.50-73 http://link.springer.com/article/10.1007/s11516-010-0006-1

Zeng, H, et al. 2012, ICT and ODL in education for rural development: Current situation and good practices in China. Beijing: *UNESCO International Research and Training Centre for Rural Education (INRULED)/* Beijing.