Integration of Information Communication Technology in Education in Central and West Africa:
A Case study of Pioneer Schools in Cameroon

By

ROCARE CAMEROON
EXECUTIVE SUMMARY

This transnational study sets out to better understand how the nature of the conditions in the context of African countries, favour the successful integration of information and communication technology in the school system in order to ensure quality education. From this main premise four specific objectives were considered to have possible implications on the integration process. These specific objectives are:

- Access to ICTs
- Use of ICTs (teaching, pedagogical approaches, learning, production, etc)
- Effects of ICTs
- Sustainability

Built into these objectives are pertinent issues such as gender differences and challenges posed by the integration of ICT in schools. The major problem is that the African context has factors that may limit the scope of the integration process. The imperative rests in establishing a balance between ICT as a curriculum content material and as a medium for teaching and learning. Examining these concerns requires a theoretical framework.

The basic theoretical premise for the study emerges from constructivism; social constructivism and self integrated learning theories. The principle in these theories focus on student-centred pedagogy where there is a shift from teaching to learning and students are not only active learners but are assume responsibility for their learning.

The case study research methodology is used for this study as it is an approach where the researcher explores a single entity (“the case”) limited by time and activity (a programme, event, process, institution, or social group) and collects detailed information by using a variety of data collection procedures during a sustained period of time. Case studies are valuable in the sense that they provide qualitative explanation that is consistent with the inductive model of thinking.
To respond to the objectives, data were collected from six sources:

- Official and other written documents
- Literature on ICTs in schools
- Opinion surveys
- Interviews
- Focus group discussions
- Observations

Official surveys for teachers and students permitted the collection of quantitative data. Individual interviews were conducted with school principals, heads of computer centres, teachers, students and parents of the eight selected schools. To reinforce interviews, focus group discussions were conducted with the teachers and students for more qualitative information. Observations were also carried out in all the eight sites to see the nature of the practices and the availability of resources. The total sample for the qualitative data is 226 selected through multistage sampling technique involving purposeful and judgmental procedures.

Both qualitative and quantitative methods were used in data analyses. In qualitative data, responses were coded, summarised and reported in relation to the specific research objectives as provided by the different groups of respondents. In some cases percentages are indicated for visibility of the responses for comparative purposes. Pertinent information from qualitative data is reported directly. Quantitative data were analyzed statistically in terms of frequencies, percentages using the SPSS statistical package. Appropriate tables, histograms, and pie charts to reflect respondents’ responses to each item of the different objectives of the survey instruments are provided.

Under access and conditions favourable for the integration of ICT in schools, the results show that some private schools introduced ICTs in 1990, 1998, and 1999 as opposed to public schools where the Presidency of the Republic introduced ICTs in schools in 2002. All eight schools have Internet connection with some accessing it for pedagogical purposes depending on the discipline and software used. Generally speaking, the access to teacher to training (10% - 100%) is problematic and is probably the main issue to be addressed if the ICT integration is to be successful as teachers in public schools are dependent on monitors for
information for their teaching activities. The access rate for students as pointed out by school principals is regulated by a formal school timetable with periods of free access. The proportion (15.4% to 100%) of students with e-mail addresses varies from school to school as a function of age, socio-cultural context, level of education and beliefs on the impact of access to the student’s moral development. Parents were not contacted at the introduction of ICT in school. Parents also affirm that their children (50% to 75%) go to Cyber Cafés.

The use of ICTs in all eight schools differs in scope from curriculum content material to pedagogical and administrative tools. Administratively, School Principals use ICTs to monitor personnel, record examination results, categorise library books, and create student files, report cards, and identity cards. Pedagogically ICTs are used to prepare lessons, and do research (teachers and students). The students’ positive attitude to ICTs has been recorded by teachers and parents.

Taking effect into account, it was evident that ICTs have had a motivating effect on students as found in responses obtained in all the eight schools; influx of students during hours of use, afternoon classes and Cyber Cafés attendance. Gender differences are not apparent as both score 19/20 in computer studies. The positive effect of ICTs on teachers was found in the intensity with which they exploit the Internet for teaching materials. Parents confirm increased and active school presence and reduced absenteeism as some of the perceptible effects of the use of ICTs school.

Concerning sustainability, there is a marked difference between public schools which provide free training for teachers but face the burden of maintenance and replacement of computers and private schools which may charge teachers to pay for training in order to have financial resources for the maintenance of machines. Though parents wish that ICTs were used in school, differences emerge as to how they should be sustained. They also want to be sure that the sites their children access are morally appropriate.

All in all, challenges facing the integration of ICTs into Cameroonian schools relate to policy, an explosive school demographic information, poor teacher quality, cultural and moral values cherished by Cameroonian society. The specific recommendation here therefore focuses on the need for a national policy and teacher training, including a firm statement on the identification of partnership.
TABLE OF CONTENTS

1. ICTS AT THE NATIONAL LEVEL  
2. THE PROBLEM  
3. METHODOLOGY  
4. ICT PIONEER SCHOOLS  
5. RESULTS  
6. CONCLUSION  
7. RECOMMENDTIONS  

REFERENCES  
ANNEX A: GRAPHS
<table>
<thead>
<tr>
<th>ACRONYMES</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>IDRC</td>
<td>International Development Research Centre</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organisation</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>PTA</td>
<td>Parent Teachers Association</td>
</tr>
<tr>
<td>R &amp; D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>VSAT</td>
<td>Very Small Aperture Terminals</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
</tbody>
</table>
1. ICTs AR THE NATIONAL LEVEL

1.1 Introduction
Information and Communication Technologies (ICT) simply involve technologies arising from scientific, technical and technological progress in computer sciences, electronic and telecommunications. All these enable us to treat, store retrieve and disseminate valuable information in text, sound and video form, hence an efficient/sophisticated audiovisual technology. Services, which can be used to create an environment for development within ICTs, include television, radio, and Internet.

In an increasing interconnected world, brought about by the application of technological advances to all sectors of society, quality education necessitates the active and innovative exploration of how best to capitalize on the strengths of ICTs, paying little attention to the negative effects of ICTs and the development of national and international partnerships within educational institutions, business and industry. As a consequence, there is a pressing need to reconceptualise and to restructure our educational enterprise, so as to tackle the technological challenges of this millennium.

ICT is the driving force of major changes reshaping the world’s economic, social and cultural configurations in the advent of electronic media, radical transformation in the way people acquire knowledge, and new teaching and learning approaches. Rapid changes and innovations within society and industry require new teaching paradigms. These changes, if well mastered and correctly applied, can reduce the complexity of the educational systems, so as to enable it to be in tune with modern technologies in teaching and learning that brings hope of offering the most effective training to the greatest number of people.

1.2 ICTs at the national level

1.2.1 Brief country overview
Cameroon has colonial and contemporary socio-political and linguistic experiences, especially her bilingualism in English and French with ten administrative provinces, two of which are English-speaking (29%) and eight French-speaking (71%). Cameroon has a
population of 16 million which is made up of about 279 ethnic groups. It has an annual growth rate of 2.36% with 42.1% within the age range of 0-14 years.

It has one of the best-endowed primary commodity economies in Sub-Saharan Africa owing to its oil resources and favourable agricultural conditions. The main exports are cocoa, coffee, rubber, cotton, bananas, petrol, timber, and aluminium.

Cameroon’s 475,442 square kilometres is triangular in shape, with a coastline border to the West by the Gulf of Guinea with access to the Atlantic Ocean. Cameroon’s land boundaries are Nigeria to the west, the plains of the Lake Chad basin northwards, the Republic of Chad, and Central African Republic to the East and Equatorial Guinea, Gabon, and Congo Brazzaville to the south. Plateaus and mountain chains characterise the relief of Cameroon. The four types of vegetation are Savannah, humid grassland, rich volcanic soil, and equatorial forest. The climate is of the equatorial, tropical, and Sahelian types with two major seasons, dry and wet.
1.3 Selected schools
The schools selected for this study are situated in Garoua in the North Province, Bamenda in the Northwest province, Bafoussam in the West, Douala in the Littoral and Yaoundé in the Centre. The geographical distance spread of the study attempts to respond to the diversities that characterise the nation.

Table 1. School enrolment at all levels in 2003/2004

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery</td>
<td>88 789</td>
<td>87 181</td>
<td>175 970</td>
</tr>
<tr>
<td>Primary</td>
<td>1 577 626</td>
<td>1 329 106</td>
<td>2 906 732</td>
</tr>
<tr>
<td>Secondary</td>
<td>406 401</td>
<td>355 652</td>
<td>762 053</td>
</tr>
<tr>
<td>Teacher Education</td>
<td>1 945</td>
<td>3123</td>
<td>5 068</td>
</tr>
<tr>
<td>Total</td>
<td>2 074 761</td>
<td>1 775 062</td>
<td>3 849 823</td>
</tr>
</tbody>
</table>

The impressive schooling rate in Cameroon is evident in the number of children attending school. A bulk of the children enrolled at all levels of the school ladder is at the primary level (75%). In Cameroon, the government does not only provide education. Partnership has been a critical element in the provision of education. These partnerships manifest themselves in the way the private sector works hand-in-hand with the Government. As such there are 4 916 private schools in Cameroon. The teacher situation in both government and private schools is presented in Table 2.

Table 2. Distribution of teachers at all levels in both government and private schools for 2003/2004

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Government</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery</td>
<td>3 622</td>
<td>5260</td>
<td>8 882</td>
</tr>
<tr>
<td>Primary</td>
<td>38 872</td>
<td>16394</td>
<td>55 266</td>
</tr>
<tr>
<td>Secondary</td>
<td>15 489</td>
<td>8193</td>
<td>23 682</td>
</tr>
<tr>
<td>Teacher Education</td>
<td>1 312</td>
<td>71</td>
<td>1 383</td>
</tr>
<tr>
<td>Total</td>
<td>59 295</td>
<td>29 918</td>
<td>89 213</td>
</tr>
</tbody>
</table>
Examining these figures, it is evident that the private sectors contribute 33.5% of the total number of teachers. The question of quality and quantity remains problematic besides the issue concerning adequacy of training, in particular in the use of ICT as a pedagogical tool. Compounded with this, is the lack of teachers throughout the whole school system. The figure shows clearly a greater belief in education than ever before, and a greater government’s resolutions to give Cameroonians the best opportunities to enable them meet the challenges of this age of globalisation and inter-connectedness. This is demonstrated in the Government’s strategy to institute ICT in the school system as a curriculum content material and as a pedagogical tool.

1.4 ICTs in the country

Since 1990, Cameroon, has been facing an unprecedented economic crisis and has understood that ICT was one of the ways out of the economic slump. In 1992, ICT was introduced in all secondary schools. Furthermore, the Government has conducted awareness-raising campaigns with the population and has allowed the launch of several Internet Service Providers (ISP).
1.5 ICT policy in the education sector

After examining ICTs in the country as a whole, there is a need to explore policy with regard to ICT in the education sector. In the year 2000, during the drafting of the document of the strategic plan of the education sector, the Minister of National Education asked for the first time that the experts in charge of the computer sector should take into account the phenomenon of globalisation into their proposals. In other words, to include in the aforementioned document, a strategy of integration of ICTs in schools.

In his message on February 10th 2001, to the youth of Cameroon, the President of the Republic promised “the introduction and the generalization of the learning of computing in schools, and the endowment of at least one computer room with access to the Internet network”. The impact of this presidential speech resulted in the introduction of ICTs in schools of general secondary and teacher training institutions in 2002.

In 2002, the Head of State inaugurated two multimedia centres in secondary schools. Five other institutions were added to the list of those who received this presidential gift in 2003. Currently, five other secondary schools are undergoing the same process of integration. Equipping other secondary schools is under discussion. Official ICT programmes were given to secondary schools in 2003, while secondary education teacher training colleges offer ICT courses - particularly as a pedagogical tool.

Against this background, pioneer ICT schools provide the essential conditions to meet successful integration of ICTs in the school system at this experimental stage. The five pioneer government schools are not only strategically located but there exist synergistic effects where learning, teaching and administrative needs are being moved from traditional pedagogic and administrative culture to an ICT-driven culture. Accordingly, in some private schools already using ICT, relevant pedagogical materials are not only processed but also computerised. In the same vein, learning and teaching are shifting from memorisation, where the model is teacher-centred towards a more constructivist approach where the model is pupil-centred, with pupils assuming more responsibility because of increased development in research skills through the use of ICT.

In spite of this political will, the computers and other relevant material remain in short supply in schools. Meanwhile, focus on teaching ICT is more on the mastery of theoretical issues.
All in all challenges facing the integration of ICT into Cameroon schools relate to policy, explosive school demographic information, poor teacher quality, cultural and moral values so treasured by contemporary Cameroonian society. The specific recommendation here therefore focuses on a national policy and teacher training, including a firm statement on the identification of partnerships.
2. THE PROBLEM

Despite the fact that Cameroon and other African countries are in the initial stage of integrating ICT in the teaching-learning process, there are some examples of successful programmes that have already been implemented. According to Cronje and Conza (2002), the World Bank Institute launched the World Link for Development Programs to expand access to digital learning resources and to address the growing digital divide between the technology have-nots and the have-nots. This programme offered training in the use of ICT in the classroom for teaching and learning. Initially, it was designed to connect secondary school students and teachers from forty developing countries. The World Links programme is now a non-profit organization that is separated from the World Bank Institute (Hawkins, 2000; World Links 2001; McGhee and Kozma, 2000). Ghana, Mauritania, Mozambique, Senegal, South Africa, Uganda and Zimbabwe were the first African countries to participate in the programme.

The International Development Research Centre (IDRC) also launched a program called Acacia in 1997 with the major intention to support and address the use of ICT in Sub Saharan Africa. Though the initial intention was to support telecentric projects, some funds were later directed to support emerging school projects in Uganda, Mozambique, Senegal and South Africa. The official document states “Acacia Initiative is an international effort to empower Sub-Saharan African communities with the ability to apply information and communication technologies to their own social and economic development” (IDRC 2001). From all indications, Acacia was formed to work with the following:

a) Rural and disadvantaged communities
b) Women and youth groups

The important reason advanced by IRDC was that in rural areas there are no internet networks and this leads to the isolation of these communities as they cannot use ICT in the school system like their counterparts in urban areas. Consequently, IRDC stretched its funding to Schoolnet Africa where many countries benefit from these important resources. One of the major successes of Acacia program is that it offers financial and technical support and encourages teachers’ and students’ participation in international workshops and conferences.
The Ministry of Education in Botswana and the Internet Learning Trust (Interaid) are also showing some successful strides in the area of integrating ICT in learning and teaching. They are working on innovative projects to facilitate the tasks of teachers. In collaboration with Mereway Middle School in Northampton and the various schools in Botswana there are all indications that teachers and students will be involved in international link projects that will greatly increase their access to knowledge.

According to IRDC 2001, Namibia is also registering a significant success in integrating ICT in their school system. High profile people who have a good vision for the effective integration of ICTs have attributed the Schoolnet Namibia project’s success.

Distance education and open-learning is providing hope, creating opportunities and transforming the dreams of millions of people who desperately need to increase their world of knowledge. Distance education programs, meticulously and properly designed, are a viable and effective strategy for in-service teacher training and can consequently improve the quality of education. Studies documented since the integration of ICT in distance education show that there is no significant difference in student learning between teaching through open and distance education than through conventional teaching.

Great strides have been made in distance education and open-learning in Africa through the use of ICT. From all indications, ICTs are conquering Africa’s valleys and plains. By 1998, a total of 159 institutions in 31 countries were already using distance education as a delivery system for instruction. This figure has undoubtedly increased by now, since there are so many new initiatives being put in place by IDRC, Association for the Development of Education in Africa (ADEA) and the World Bank. According to Pityana (2004), “with peace and democratization, there is population growth, rising prosperity, a thirst for knowledge, and a need to bridge the skills gap, all in the context of rising expectations. This is a golden opportunity for open and distance education”.

The improvement of what already exists is very important for African countries. The development of national distance education policies, including guidelines, the support of regional institution entities to help build capacity and research in distance education and open learning are vital. For African countries to reduce the so-called “digital divide”, they have to embark on moves towards access to quality education by investing in purposeful ICT.
The use of the computers in Cameroon secondary general and technical education is not new. Unfortunately, no research has been carried out to find out the state of affairs within the school system.

Many developed countries are already advanced in the use of ICTs in education. The rate at which it is evolving and the slow rate at which Cameroon secondary schools are using ICTs in the educational system is a matter for concern. The literature review on the application of ICTs in the school system of the developed countries in relation to the teacher-computer ratio indicates that ICTs as a teaching support mechanism, suggests that Cameroon is not keeping pace with educational innovation.

In 1995 when educational experts met in Yaoundé to see how the educational system could be improved upon, nothing was mentioned on the application of ICTs in the classroom. The Cameroon Education Law of 98/004 of 14th April 1998 does not make mention of ICTs in the school system. The teachers’ training colleges have not yet made provision for ICTs application, implying that the teaching corps is to a great extent computer illiterate.

The rationale around many of the arguments against the use of computers in the school system focuses more on the deployment of critical resources at times of economic and fiscal hardship than on a discussion of research projects, which should be selected according to specific agendas. Clark (1985) argued that there is no medium (including computers), which has any distinct advantage over another. He maintained that it is the uncontrolled effects of instructional method and content, together with a novelty effect, which account for any learning improvements that may be observed. A meta-analysis by Fletcher Flinn and Gravatt (1995) revealed a learning advantage for Computer Assisted Instruction (CAI), but they stated that this gain in proficiency was often the result of poor research design, which did not show the difference between the quality of software and computer use.

They remind us that achievement gains are only one of a number of criteria from which we should determine the advantages of any educational intervention. They recommend the consideration of other issues such as time savings for students and teachers, cost effectiveness; the presentation of realistic problems that requires inquiry and collaborative problem solving, and forms of evaluation as equal and valid measures of any instructional programmes.
It is thus apparent that discussions on the important issues surrounding the use of ICT in schools are emotional and the results of research studies about their impact are equivocal. What is generally recognized is that ICTs are an important part of our lives today, but there are divergent views about the role that schools should play in promoting the fluency and the use of the machines, and their primacy as resources in our classrooms.

Generally, the arguments against computers tend to focus on the fact that in times when financial resources are limited, policy makers should not be spending money on machines, but rather on people and on maintaining the status quo in the teaching and learning practices. At the other end of the spectrum, supporters of the use of ICT in schools say that they need to be integrated into education so that our children can learn in new and dynamic ways and be prepared for the challenges of life in the 21st century.
3. METHODOLOGY

3.1 Justification for case study approach.
Creswell (1994, page 12) cited Merriam (1988) and Yin (1989) as saying that a case study is an approach where the researcher explores a single entity or phenomenon “the case” bounded by time and activity and collects detailed information by using a variety of data collection procedures during a sustained period of time. Case study is valuable for this study in the sense that it provides qualitative explanation that is consistent with the inductive model of thinking. On this account the concept of “pattern theories” emerges and Neumann (1991, Page 38) says pattern theories use metaphors or analogies so that relationship “makes sense”. Data obtained from the objectives of this study addressed the concept of the integration process of ICT in the school system.

3.2 Process for selection of cases.
Many factors were taken into consideration such as gender, level of education, and enrolment figures for the school (500 pupils for primary and 1 500 students for secondary). As such selection was not necessarily based on a statistical model but more on the significance of the case for the objectives of the study. Furthermore, it was thought that a pioneer school ought to be characterised by the following:

1. Teacher trained in ICTs
2. Ownership of a sufficient number of computers to allow every pupil access to a computer for at least two hours for lesson purposes and at least two hours for personal use
3. Use of ICTs as a pedagogical tool (teaching, learning, auto-learning and research);
4. Intranet connected with Internet 24 hours a day
5. Access by the educational community to information related to the establishment (school results, needs of school teachers, timetable etc.)
6. Assurance of the perenisation of achievements in ICTs

From information collected from the various structures in charge of primary, secondary, general and technical, teacher education a list of schools that could fill the above criteria were established. Furthermore each of these schools was evaluated against the set criteria to enable
the researchers to emerge with a list of 20 pioneer schools considered as having best integrated ICTs. Finally to emerge with the eight selected schools the aforementioned six criteria were exploited in addition to such considerations as the geographical spread, school type (public/private), level (primary/secondary), and language (French/English).

Table 3: Sample for the Study

<table>
<thead>
<tr>
<th>Name</th>
<th>Rural / Urban</th>
<th>Gov/ Private</th>
<th>Mixed/ non</th>
<th>Privileged/ Underprivileged</th>
<th>Denomination</th>
<th>Francophone/ Anglophone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilingual Secondary School of Essos Yaoundé</td>
<td>Urban</td>
<td>Public</td>
<td>Mixed</td>
<td>Privileged</td>
<td>Lay</td>
<td>Bilingual</td>
</tr>
<tr>
<td>Technical Secondary School of Garoua</td>
<td>Urban</td>
<td>Public</td>
<td>Mixed</td>
<td>Privileged</td>
<td>Lay</td>
<td>Francophone</td>
</tr>
<tr>
<td>Bilingual Secondary School of Bamenda</td>
<td>Urban</td>
<td>Public</td>
<td>Mixed</td>
<td>Privileged</td>
<td>Lay</td>
<td>Bilingual</td>
</tr>
<tr>
<td>Technical Secondary School of Bafoussam</td>
<td>Urban</td>
<td>Public</td>
<td>Mixed</td>
<td>Privileged</td>
<td>Lay</td>
<td>Francophone</td>
</tr>
<tr>
<td>Ecole Oiselets Bafoussam</td>
<td>Urban</td>
<td>Private</td>
<td>Mixed</td>
<td>Privileged</td>
<td>Lay</td>
<td>Bilingual</td>
</tr>
</tbody>
</table>
3.3 Data Collection.

Both qualitative and quantitative methods of data collection were used given that this study attempts to be both exploratory and descriptive.

Classroom observations were conducted in all the schools to permit an insight into the actual ICT integration process in a naturalistic context. The observation was carried out following a guide that had four main sections with each section addressing specific concerns. Though structured, the researchers carried out a semi-participant observation while interacting with the students and teachers in pedagogical activities.

Three visits were made to the schools, one conceptual through the review of documents in the Ministry of National Education, followed by initial contact with the schools and later contact for data collection. The results of the second visit provided the basis for the selection of the pioneer schools. The data collection process then proceeded in Yaoundé as well as in the other towns to ensure conformity with the process.

This survey used the following data collecting approaches:

- Semi-directed interviews with parents
- Focus group discussions with pupils and teachers
- Video-taped classroom observations
- Photographs of school environments
- School documents on ICT
- Questionnaires for quantitative data obtained from both pupils and teachers

The researchers spent a full day in each of the schools as it was often difficult to meet the principals who were busy with end of term activities. After contact had been established with the school principals, the quantitative data collection was carried out with the students in their classrooms while teachers were contacted in the staff room. The questionnaires were filled in and returned on the spot.

Some adjustments were made to the teachers’ interviews, as it was necessary to interview non-monitors to share the balance in teachers’ experiences. Section four of the data collection instrument was addressed to the heads of the Multimedia Centres as these were better placed
to provide the required information. Regarding the focus group discussions, the team identified five discussion areas: the value of ICT, challenges, functioning, problems and suggestions.

3.4 Data analysis methods

As the study employs both qualitative and quantitative strategies, data analysis responds to the nature of collected data. Transcribed qualitative data was coded, categorised, and interpreted on the basis of the issues generated from the research questions by the different actors in the study. Quantitative data was analysed using descriptive statistics.
4. ICT PIONEER SCHOOLS

4.1 Overview of Pioneer Schools.

Table 4. Selected Schools

<table>
<thead>
<tr>
<th>School and e-mail</th>
<th>Year</th>
<th>Type</th>
<th>Language</th>
<th>N° of Students</th>
<th>Teachers</th>
<th>N° of Computers</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lycée Bilingue Yaoundé <a href="mailto:libiya@hotmail.com">libiya@hotmail.com</a></td>
<td>1977</td>
<td>Bilingual Secondary Grammar (Government)</td>
<td>Bilingual</td>
<td>4 541</td>
<td>170</td>
<td>72 computers</td>
<td>4</td>
</tr>
<tr>
<td>Lycée General Leclerc Yaoundé <a href="mailto:lyceegeneralleclerc@yahoo.fr">lyceegeneralleclerc@yahoo.fr</a></td>
<td>1952</td>
<td>Secondary Grammar (Government)</td>
<td>French</td>
<td>5 202</td>
<td>188</td>
<td>67 computers</td>
<td>7</td>
</tr>
<tr>
<td>Lycée Technique de Bafoussam <a href="mailto:lyteechbaf@yahoo.fr">lyteechbaf@yahoo.fr</a></td>
<td>1990</td>
<td>Secondary Technical (Government)</td>
<td>French</td>
<td>1 416</td>
<td>111</td>
<td>14 computers</td>
<td>1</td>
</tr>
<tr>
<td>Lycée Joss Douala <a href="mailto:lyteechbaf@yahoo.fr">lyteechbaf@yahoo.fr</a></td>
<td>1951</td>
<td>Secondary Grammar (Government)</td>
<td>French</td>
<td>2 497</td>
<td>95</td>
<td>75 computers</td>
<td>4</td>
</tr>
<tr>
<td>Ecole primaire et Maternelle les Oiselets <a href="mailto:oiseletsbaf@yahoo.fr">oiseletsbaf@yahoo.fr</a></td>
<td>1998</td>
<td>Primary (Private)</td>
<td>French</td>
<td>600</td>
<td>18</td>
<td>7 computers</td>
<td>1</td>
</tr>
<tr>
<td>Collège Des Lauréats Douala <a href="mailto:laureats@camnet.cm">laureats@camnet.cm</a></td>
<td>1999</td>
<td>Secondary Grammar (Private)</td>
<td>French</td>
<td>900</td>
<td>71</td>
<td>26 computers</td>
<td>4</td>
</tr>
<tr>
<td>Longla Comprehensive College Bamenda <a href="mailto:Lec1962@yahoo.com">Lec1962@yahoo.com</a></td>
<td>1962</td>
<td>Comprehensive College (Private)</td>
<td>English</td>
<td>2382</td>
<td>94</td>
<td>70 computers</td>
<td>2</td>
</tr>
<tr>
<td>Lycée Technique Garoua</td>
<td>1975</td>
<td>Secondary Technical (Government)</td>
<td>French</td>
<td>1175</td>
<td>65</td>
<td>67 computers</td>
<td>2</td>
</tr>
</tbody>
</table>
The eight selected schools that were located in the provincial headquarters were made up of a bilingual secondary school, an English-speaking school, two private schools and five French-speaking schools. All the Government schools had Internet connection provided by the Government of the Republic of Cameroon except Lycée Technique Bafoussam that was connected by the Parent Teachers Association (PTA). All the private schools were connected using school funds. The schools used programmes such as Word, Excel, and PowerPoint. The computers were kept in a computer laboratory commonly called the Multimedia Centre. This has computers connected to the Internet, as well as printers and scanners that teachers and students have daily access to.

A Multimedia Centre is managed by a Centre Head who draws up a timetable for teachers and students to take turns in using the ICTs. The Heads of the Multimedia Centres are selected from teachers of science and are then given special training. They in turn train other teachers and students. Because of this extra ICT teaching some teachers claim that they should recieve financial remuneration.

4.2 Brief Synthesis of School Visits.

The visit to all schools for actual data collection started from April through May 2004. Quantitative data was collected. After contacting the principals, the researchers then proceeded to meet teachers and students. In some schools, especially in Douala it was difficult to access parents. In others, the access was either facilitated by the school principal or the P.T.A (Parent Teachers’ Association). In Garoua there were administrative problems because of conflict related to which Ministry controlled the project. However it was resolved by the intensity of the interview with head of the centre including documentation related specifically to this school.

4.3 Presentation of each of the schools visited

Lycée General Leclerc, Yaoundé. Centre Province (French Speaking)

Lycée Général Leclerc is a mixed, French-speaking secondary general, public institution that was created 1952 in Yaoundé in the Centre Province of the Republic of Cameroon. Besides the teaching staff there are 66 administrative technical and support staff for the day-to-day running of the school.
The main socio-economic activities of the Yaoundé inhabitants include farming, arts and crafts and small scale trading. At least 90% of the students go to school by taxi.

Lycée Général Leclerc, one of the oldest and most prestigious institutions in French-speaking Cameroon has 67, networked computers in two laboratories inaugurated by the President of the Republic of Cameroon in 2001.

For pedagogic purposes, Microsoft PowerPoint, Excel, and Word are used. Didactic material is produced on CDs. All students in the school have access to computers following a specific timetable. While teachers undergo self-training, the students are trained by a staff of seven.

The integration of ICT has been facilitated by the nature of the school and the socio-economic level of the parents of the students. Organization and plan for access and use by student is well thought out although inadequate. Two issues make this school stand out. Firstly, the students’ perception of responsible behaviour when using the computer as related to cultural beliefs about morals and the type of appropriate knowledge. Secondly, teachers are determined to move away from traditional ways of doing things and move towards using ICT to improve teaching and learning. Though inadequate, the physical structure in terms of size has potential for expansion. Material resources exist but the increased school enrolment is problematic in terms of meeting demand for access. The absence of trained teachers in ICT is an added problem for successful integration.

Lycée Bilingue Essoss, Yaoundé, Centre Province (Bilingual)
This is a bilingual public secondary general institution situated in the urban area of the city of Yaoundé; the school has a non-academic staff of 20 paid by both the school council and the PTA. It has a total of 72 networked computers where PowerPoint, Excel and Word have been used for pedagogic purposes since the inauguration of the Multimedia Centre by the President of the Republic in 2001.

Four multimedia monitors assure training of teachers and students while the maintenance of the computers is contracted out to a local company which is funded by the State and parents.

In this school the Principal focuses on strategies to ensure sustainability by contacting non-governmental organisations (NGO) for material and training facilities. Besides emphasising the training of teachers, there is a strong connection between the monitors and other teachers to access pedagogical material. As in the Lycée Général Leclerc, much effort is made to use ICT in teaching.

**Lycée Joss, Douala. Littoral Province (French Speaking).**

This is a mixed, public, secondary general, French-speaking institution in the urban centre of Douala. This city is made up of more than two million inhabitants who mainly carry out small scale trading.

Lycée Joss has a non-academic staff of 16. There are 75-networked computers located in two rooms for both teachers and students respectively. The training of the head of the Multimedia Centre (who in turn trains teachers and students) was carried out by CFA-STEFENSON. Meanwhile, CFAO-TECHNOLOGY has a contract funded by the State for the maintenance of the computers.

The focus here is on sustainability through consultations with parents, NGO and enterprises. The personality of he principal is a factor for success as was the evident in this school.
**College des Laureate Douala (Bonamoussadi), Littoral province (French-speaking).**

It is a lay private, mixed French-speaking general institution situated in the city of Douala whose 2 000 000 inhabitants are principally engaged in commercial activities for their livelihoods.

The college has 26 computers made available by the school owner in 1999. They are located one room where they are used for pedagogical purposes. All the students and 35% of teachers have access to the computers.

The four trainers who ensure the training of teachers in the computer department are made up of a holder of a Masters in Computer Sciences, a holder of a BSc in Mathematics, a BTS in Computer Maintenance and a DUT in Computer Literacy. The ICT trainers are not part of the public service personnel.

Meanwhile, the training of students is carried out by the holder of a DUT in Computer Literacy. The holder of a BTS in computer maintenance carries out repairs which are funded by the school.

The peculiarity of this school is seen in its capacity to ensure continuous maintenance services. The organisation and management process require constant monitoring to ensure success.

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**Oiselets Bilingual Primary and Nursery School, Bafoussam in the Western Province (French-speaking)**
This is a mixed lay private elementary and nursery school found in a semi-urban zone in Bafoussam. The school is made up of three non-academic staff.

The seven computers in this school were provided by the proprietor in 1999 and had Internet connection in 2004. Though the teachers are yet to receive formal ICT training, there is an ICT teacher who teaches the pupils besides ensuring the maintenance of the equipment. The special aspect here is that one finds very young children who can access ICT within a well-organized setting. However, the school lacks a well-designed program to meet the specific ICT needs of these youngsters.

**Technical High School, Bafoussam. Western Province (French-speaking).**

Constructed thanks to the Canadian Cooperation about 3 Km from Bafoussam town centre, the poor state of the road makes it difficult to access this Technical High School. The school has a non-academic staff of 33.

The school has 14 computers that got Internet connection in November 2000. Training of some teachers was carried out by RESOCOM, a local private training centre while data processing teachers train the students of the school in ICT. Meanwhile, WISE COMPUTERS, a private company, is in charge of the maintenance of computers.

The unique aspect of the school is the good will from the teachers and the local community to work together in order to ensure successful integration of ICT.

**Technical High School Garoua, North Province (French-speaking).**

This is the first second cycle technical school in the North Province of Cameroon since it facilitates further studies for holders of CAP (Certificat d’Aptitude Professionnelle) in Garoua. The principal activities of the inhabitants of Garoua are farming and animal rearing. The school has 67 computers in use though not formally inaugurated. There are also a number of workshops for typing, drawing, dress making, cooking and electronics.
It is curious to note that despite the fact that this school is located in the Extreme Northern Province, one would have expected some reticence in the use of ICT in this area, but it was noted that students and teachers were very enthusiastic in its use in the teaching learning process.

This is a lay private mixed institution which undertakes technical, grammar and commercial education for the English speaking subsystem in Bamenda town whose inhabitants mainly carry out farming, arts and craft and commercial activities.

The 70 computers in this school were made available by the Principal in 1997. All the teachers and some lower form students (248) have access to the Multimedia Centre. The school has a non-academic staff of 20. In addition to the World Bank sponsored ICT training in 2002, this college organizes ICT classes for teachers. There is also a nine-month ICT Diploma course offered in collaboration with a UK based college. The ICT training of students is handled by the school management together with a former Peace Corps volunteer.

By instituting a cyber café in the school campus, continuous ICT access not only for the public but also for the students is ensured. Collaboration with the Peace Corps, Delta computers and World Bank is equally something worth emulating. Furthermore, the charisma of the Principal is seen an enabling factor for access to resources and for sustainability.
5. RESULTS

5.1 Summary of Preliminary findings including strengths and weaknesses of ICT school integration processes.
Emerging from the overview of the eight pioneer schools are these findings highlighting some major strengths and weaknesses of the ICT integration processes:

- ICT effects on the students is evident in the move from reproduction of knowledge to producing their own knowledge
- Teachers need better ICT training so that students will be helped to learn to navigate through great amount of information, to analyze and make decisions
- Pioneer schools are experimenting pupil centred approach with great difficulties;
- Some teachers are resisting change on ignorance and lack of skills
- All the schools are attempting to introduce ICT in an old curriculum as ICT is being used to strengthen poor pedagogical process that has not responded favourably to provide quality education
- Lastly, no policy in any of these schools demonstrated a new curriculum framework to embrace the dynamic nature of ICT

5.2 Analysis of qualitative data
This section presents the qualitative results of the data collected from the eight pioneer schools by research questions and the four groups of respondents under the following four objectives of the study, emerging from the research questions:

1. Conditions of access and the processes favouring successful integration of ICT in schools
2. Pedagogical approaches adapted to the use of ICT in the African context
3. The Effects of the integration of ICT
4. Important factors that would contribute to the sustainability of the integration of ICT in schools
The results to be presented were obtained through individual interviews, Focus Group Discussion (FGD) and classroom observations. Such qualitative findings were obtained from school Principals, teachers (some of who are monitors), Head of Computer Centres, students and their parents.

Other issues of interest from the data necessitated specific focus such as:

- Gender differences
- Values of ICT in schools
- Challenges of ICTs in Schools with a focus on policy

5.3 Access and conditions favourable for the integration of ICT in schools

In discussing the objectives of access, use and effects, it is important to mention the nuance that exists as these concepts are discussed because use and effects can only be referred to if there is access. In the same light, the conditions favourable for the integration of ICT have implications for these issues addressed by the research questions. While ICT in public schools was introduced in 2002 following the President of the Republic’s speech to the youth of Cameroon on February 10th 2000 in private schools ICT came through private initiatives and individual effort since 1998 and 1999.

5.3.1 Students’ access to ICT

It varies from school to school depending on the demographic situation of the school, the number of ICT material resources, spatial and temporary factors. But for Lycée Bilingue Yaoundé and Lycée General Leclerc, Yaoundé where students access ICT following a specific schedule (once every two weeks), in the other pioneer schools ICT access is on a daily basis.

5.3.2 Students’ access to e-mail.

There was variation in the proportion of students who affirmed that they have an e-mail address depending on their socio-cultural context and their parental beliefs on the impact of access to the students’ moral development. This view is influenced by the level of parental education and availability of computer-internet in the home. Data showed that students varied as follows in possessing e-mail: 100% in Lycée Bilingue Yaoundé, 83.3% in Lycée Leclerc
Yaoundé, 53.3% in Lycée Technique Bafoussam and 15.4% in Ecole Maternel and Primaire Bilingue les Oiselets, Bafoussam.

5.3.3 *Condition for teachers’ access to computers and Internet.*

School principals illustrated some variation in access. For example, all teachers of Lycée General Leclerc Yaoundé have access to ICT. Contrarily, only 10% of teachers who are trained access ICT in Lycée Bilingue de Yaoundé. In this school, heads of Departments go to the computer centre every week to obtain information to be shared with colleagues. Access in Lycée Joss is very dynamic as evident in the Principal’s words:

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50% d'enseignants utilisent les TICs ; 40% pour des études predoctorales :
Un chef de centre multimedia et trois moniteurs ont été formés et assurent régulièrement la formation des enseignants à partir d'un emploi du temps élaboré à cet effet.
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But this same observation cannot hold true for college Lauréats where only 25-30% have access as pointed out by the principal.

5.3.4 *Teacher ICT training issues*

Some of the teachers received self-sponsored training while others were initiated into ICT by monitors. This is confirmed by the Principal of the Lycée Technique Bafoussam who said:

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"La proportion d'enseignant qui utilisent les TICs est de 50%. Je m'assure que les enseignants sont bien formés en organisant les sessions d'initiation à l'informatique. Certain ont pu se former de manière privée et détiennent des certificats.
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This same view is shared by the head teacher of Ecole Maternel et Primaire Bilingue les Oiselets, Bafoussam. Generally speaking, the access of teachers to ICT training is very problematic and is probably the main domain to be addressed if the process of ICT integration is to be successful within the school milieu.
5.3.5 **Parent perspectives on student use of ICT at home, school and in cyber cafés**

Parents learnt about the introduction of ICT in schools from their children, PTA meetings, radio or television as in public schools ICT is a gift from the President of the Republic.

The percentage of parents with computers at home ranges from 33.3% in Bafoussam to 60.5% in Yaoundé. These computers at home are used by all members of the family to acquire computer literacy, research work (60%), and writing texts. This was confirmed by parents in Bafoussam, Garoua, Yaoundé and Bamenda.

But for Lycée Bilingue, Yaoundé (60%), Lycée General Leclerc (50%) and Les Oislets, all the parents in the five other schools affirmed that their children go to cyber cafés.

5.3.6 **ICT user access ratio**

Putting together teachers and students by school and by computer, it is evident that the ICT user/computer ratio ranges form 18 users per computer in Garoua Lycée Technique to 109 users per computer in Bafoussam LT. (See Appendix). The number of computers therefore conveys a weak parameter in encouraging access and the process of ICT integration in Cameroonian schools.

Solutions to these problems differ from public to private school. In schools where ICT equipment was provided by government, attention is still focused on the state to remedy the situation. But in private schools, the individuals are seeking new ways of expanding their stock of computers. For instance, the Principal of Longla Comprehensive College, Bamenda sounded quite hopeful that he is awaiting a consignment of 60 computers to add to the existing stock of 70.

5.4 **Use of ICT in schools**

All the principals admitted ICT is used in the schools, but they differ in the extent and capacity for use as illustrated below.

5.4.1 **ICT use in administration**

The main activities include creating students’ files, monitoring personnel, managing reports cards and students’ identity cards, recording examination results and categorising library books.
5.4.2 Use of ICT for training of students and teachers

There is emphasis on ensuring computer literacy and access to better results as pointed out by the Principal of Lycée de Joss Douala:

"L’objectif général est de faire en sorte que tous les élèves soient capables d’utiliser l’outil informatique pour accéder régulièrement aux ressources pédagogiques sur l’Internet afin d’améliorer leurs connaissances et ainsi rivaliser avec les autres élèves du monde et même des pays développés. Ceci passe par la maîtrise de l’outil informatique par les enseignants. Cette maîtrise nécessite trois étapes à savoir : l’initiation, l’appropriation et l’intégration dans leur curriculum"

Strengthening the above view, the Principal of Collège Lauréats Douala held that they use ICT to “intégrer les élèves dans l’évolution du monde d’aujourd’hui pour leur meilleur insertion tout en étant vigilant.”

5.5 Factors facilitating ICT use in schools

Teachers held that it is too difficult to draw conclusions on issues of material resources, time, organisation and activities. However, responses from Lycée Bilingue Yaoundé, Lycée Général Leclerc Yaoundé, Lycée Technique de Bafoussam and Lycée Technique de Garoua show that the time (16 h 30) reserved for teachers to use ICT is not convenient as this makes teachers dependent on the monitors and Centre Heads for pedagogic information. All the same, activities rich in pedagogic material motivate teachers to use ICT. As such Les Oiselets said the choice of pedagogic activities is very important. To the Head of the computer unit in Lycée Bilingue Yaoundé, what motivates teachers is that there are programmes for teachers to follow to enable them learn Word, Excel and Internet.

5.6 Using ICT to improve pedagogy

The teachers use ICT once a week and at most 5 days a week for research, calculating marks, and preparation of lessons. In Lycée Bilingue Yaoundé the Head of the Computer Unit said, “Science teachers particularly those teaching geometry make profuse use of the multimedia centre to search for information.” In the case of Lycée Technique de Garoua, the Internet is exploited in teaching such subjects as Accounts, Management and Computer literacy lessons. In all the schools, there is very rigid classroom control of ICT learning activities whereby
teachers move round the classroom, organize group work to ensure effective student participation in ICT activities.

Emerging from classrooms observations, it was evident that the pedagogical approach was highly didactic, punctuated with questions, explanations, reactions and problem solving. Software was used in class. The lessons which were very interactive started with an introduction to computer studies and the use of the Internet. This approach addresses the social constructivist theory in learning that focuses on peer tutoring, collaborative learning and cooperation.

5.7 Using ICTs in research
Both teachers and students use ICT to carry out research. Teachers in all eight schools indicated that the ICT is useful to students because it enables them to obtain information, do research, learn, understand and communicate better. The teachers use ICT for documentation, to access teaching and learning material for their classroom use. In most cases, monitors download information for teachers who make such requests.

5.8 Using ICTs to develop curriculum content material
Both teachers and students draw valuable material from the Internet. Students hold that they use ICT for typing, printing, doing assignments, opening files, making portraits, designing flags, drawing, doing exercises, sending and receiving messages, getting information on football, mathematics, physics and statistics. With ICT students and teachers gain more curriculum content material, more explanations, learn better. As such, a student in Lycée Joss gave an added view: “Oui, lorsque je ne peux pas faire des exercices à la maison, je le fais à l’école grâce à l’Internet.” Another student added that ‘on apprend mieux avec l’ordinateur car il est précis. Il y a des explications mieux données’.

5.9 ICT use and students' attitude
On the whole their attitude is positive. This is found in this response from a student of Lycée Bilingue Essos Yaoundé: “yes, it enriches me with information as a student”, “yes, it is interactive”, “yes, helps me understand my lesson”, “Yes, it helps me to understand my lessons,” “yes, helps me to know many things as my teacher.” This positive attitude is addressed more by boys than girls. For instance, in Lycée Joss, Douala, a girl remarked; “très important d’utiliser l’outil informatique a la base de la mondialisation, aide à tous les projets
In College Laureat, Doula, both boys and girls demonstrated same positive (100%) reaction:

"Bien sur l'ordinateur est un moyen de communication, deux, l'ordinateur sera l'une des grandes technologies de ce monde, trios, l'utilisation de l'ordinateur est indispensable de nos jours dans les bureaux, les banques et les écoles."

5.10 Gender and competence in ICT use
Student’s competence was assessed by their classmates on the basis of the students’ speed in manipulating the computer, typing with ease and the ease with which they solved the problems of their classmates who run into difficulty and do not turn to the monitor for help. As was found in Lycée Bilingue de Yaoundé, such competent students have a computer in their homes. Whilst in most schools boys emerged as experts, in Longla Comprehensive College Bamenda about five girls as against three boys were identified as experts who teach others, connect the computer, and manipulate the computer besides scoring high evaluation marks.

On gender, Lycée Bilingue, Yaoundé reported 66.7% comparability between boys and girls, yet 16.7 stated that boys get too distracted while girls concentrate more. Lycée Leclerc showed 50 of the students questioned saying boys are better than girls while 33.3% felt that they are the same but another 16.7% said boys are more distracted than girls. In Longla 66.7% said boys and girls are comparable in performance. Yet, 33.3% stress that girls are interested and show better understanding of ICT. In Oiselets 30% say both boys and girls are the same and 23% feel boys are better than girls, while another 23% say girls are much better than boys.

5.11 Value component perspectives of ICT use
From Focus Group Discussion with teachers and students the value of ICT to pedagogic practices and school administration were addressed. For instance, teachers said access to ICT provides pedagogical material that can be used by students as well as by teachers, commenting that this will help to initiate students into computer not only as a curriculum content material but also as a medium for accessing information.
On their parts, parents in Lycée Bilingue Yaoundé added that the value of ICT emerges where it is used to “Obtain more information”; “Obtain facts for exposition”; “Improve knowledge”; and “Computer is very good”

5.12 The Effects of ICT

ICT motivating effect on students
The integration of ICT has had a motivating effect on students as evident in the responses obtained from each principal of the eight schools. For instance, the principal of Lice Bilingue, Yaoundé said “yes, especially for the science students, since arts students have their books to use”. This is because science textbooks are very expensive and consequently few students can afford them, thereby depending largely on the Internet for material. The “influx during the hours of ICT use and other hours” makes the principal of Lycée General Leclerc note that ICT has a motivating effect on students. The same strong affirmation was obtained from the principal of Lycée Joss, Douala:

“De manière affirmative, les TIC favorisent l'intérêt des élèves pour l'école. Les élèves vont au centre multimédia enrichir les connaissances : préparent leur exposés, télécharger des exercices avec les autres élèves ou de certaines écoles sur des projets”.

In les Oiselets, Bafoussam the Head teacher said the children are very happy during ICT lessons. The principal of Lycée Technique Bafoussam postulated that

``les technologies favorisent énormément l'intérêt des élèves pour l'école. Les exemples portent sur l'attitude des enfants qui ne veulent pas laisser les machines respirer. Ils sont très attentifs”.

On the whole, the principal observed that ICT excites the students and generates more interest in school among them. The Cyber Café attendance and afternoon computer classes are evidence of this interest. This high motivation, collaboration, attention and participation is evident among 5ème and 6ème students for whom computer studies is an examination discipline.
**ICT effect and gender differences**

There was slight variation in opinion as to the issue of differences between boys and girls on the effect of ICT. While the teacher (50%) of Lycée Bilingue, Yaoundé and those of Lycée Leclerc (50%), Yaoundé contend that there is no gender difference; the principal of Longla Comprehensive College Bamenda was very categorical as he stated that girls had more interest in ICT than boys. The example given is the rate of girls’ registration in the computer laboratory and the cyber café. However, the principal saw no gender difference in the case with which ICT is used. It was interesting to note here that in the schools the teachers highlighted that girls are more focused once they have gained mastery in manipulating the computer. Up to 75% of the children go to cyber café. This is the case because this demands financing and most parents hesitate because they do not have control over what is watched or done.

**ICT effects from parents’ perspective**

Some, if not most of the parents mentioned that their children talk about the ICT and they find that they are very excited. In all this a warning voice emerged calling for attention to the fact that students should not be rendered so ICT independent to the extent that they put aside their innate creative abilities. Of course, there are parents who said they forbid their children to use computers and e-mail. Evidently, children use computer at home aided by the parents, older siblings or an ICT teacher hired for that purpose. Furthermore they observed that their children’s notes are not only better but also well presented. They are more assiduous and stay longer in school.

**ICT and students increased communication**

Parents mentioned improvement in their children’s language competence, computational skills and how critical they have become. Others narrate stories; teach siblings songs and poems. The children make mention of sites they use as Google and Yahoo. They use words like navigation and other emerging new jargon. Some even go as far as describing the parts of the computer.

**ICT and teacher competence**

All teachers in the study at varying degree are at ease when using the computer. This is exemplified in their demonstration of positive attitudes in the intensity of the concentration and the maximum use of the computer for learning.
5.13 Sustainability of ICT in schools

*Sustainability through ICT training facilities and resources*

Except for one of the private schools, training of ICT teachers is carried out at varying degree. In the government schools in particular there is a programme for continuous training of teachers by CFA Stephenson from Paris for six months before the insertion of the programme. Moreover studies are still going on to ensure the continuous training of ICT teachers. The ministry and some private schools organize two-week seminars for this purpose on determined intervals. But in private schools the participants pay for the ICT training, thus making training not obligatory. A question of sustainability that was silent in the instrument but evolved in the discussion was sustainability in financial terms. In government schools the principals can not ask parents to contribute to the integration of ICT as it is a government initiated programme. However the proposal to sustain the integration process by principals indicated that they would look for ways to include this financial expectation in their school budget. This will become very vital when they contract with CFA Stephenson from Paris will end and the burden of maintenance becomes that of the institution. The private schools do not have this kind of problem, as they are independent in this concern.

*ICT sustainability and teacher support*

Parents are in support of ICT integration in schools. But there are differences in opinions as to how this is to be sustained. Parents are also very concerned about control of what their children should access or learn. On this account parents would want to be sure that sites accessed are morally good so that children access relevant information of good value. To ensure that all this works well, there must be computers in quantity and quality with a good maintenance scheme. There should be continuous supply of electricity to avoid destruction of the machines with regular power cuts. PTA’s have often contributed in constructing classrooms, employ teachers and purchase school equipments. When questioned, it was found that parents are willing to support the ICT project but they would want to be asked. Already in private schools some financial expectations are built into the fees being paid by students so as to enhance ICT sustainability.

*ICT sustainability through policy implementation*

From all indications it was clear that the absence of a firm policy-guiding core ICT issues such as programme design, teacher training and sustainability of the ICT integration process
impedes sustainability. For ICT integration process to succeed and achieve its objectives, firm
government policy must be elaborated and implemented. In the case of programmes, a
national programme for computer studies must be put in place in order to give not only a
progressive orientation but also to give indicators for monitoring and evaluating the process.

5.14 Analysis of quantitative data

Students interviewed

Total = 11 552; Girls = 5 690, Boys = 5 862

The ages of students interviewed

There were equal about the age of 12, 13, 14, and 15. For students above 16 years there were
more boys than girls.

Use of ICT by students

There were equal number of boys to girls who had an e-mail i.e. Boys 42% and girls 41%.

Frequency of use of ICT at school, cyber and at home

More students use the computer in school than at home and cyber café irrespective of gender.
Occasional use of computers was very high (65%) in school and there was no difference in
gender.

Frequency of Use of ICT in different school disciplines by students

A high proportion of students do not always use ICT in the learning of language (54% girls
and 60% boys), natural and physical sciences (61% girls and 59% boys) as well as history and
geography (64% girls and 65% boys). It is curious that they always use ICT for other
unspecified activities with many more girls than boys at this level.

Activities in which students use ICT at school

At school, a large proportion of students use ICT mainly for computer literacy (55% girls,
48% boys) and doing school-related activities such as research and typing of texts (34
girls, 41% boys) with significant gender disparity. While many more girls (61%) focus on computer literacy, the boys (54%) on their part use ICT for typing of texts. It would appear there is a restriction on students not to use ICT for non academic activities, as the students (68%) held that they “never” use ICT at school for email correspondences, for participation in online chats, for the exploration of Internet sites or on any other activities.

**Activities in which students use ICT outside the school**

The students said they “never” use ICT outside the school context for the production of texts, research (39% girls, 35% boys), listening and downloading of music (45% girls, 32% boys), participation in online chats (42% girls, 34% boys) and the exploration of Internet sites (59% girls, 53% boys). Besides, there are some students who use ICT outside the school for the listening and downloading of music as well as for the exploration of the Internet with the boys outnumbering the girls in these domains.

**Effects of ICT on students**

Many more boys (38%) than girls (33%) affirmed that ICT greatly facilitates the production of schoolwork. The students, most especially the girls (34%) said that the computer is something “very important.”

**Teachers interviewed**

Total = 220; Males = 138, Girls = 78.

**Frequency of use of ICT at school, cyber and at home by teachers**

When asked the frequency at which teachers used ICT, 26% of the males and 13% females affirmed that on the average they use ICTs at cyberecafés. Meanwhile at home, only 9% female and 12.3% males make use of the ICTs. However, within the school context, 13.3% females and 21% males use ICTs.

**Activities in which teachers ICT**

As far as activities carried out on the computer were concerned, it was found that, 12.6% females and 18% males manipulate the computer only to learn its functions. In addition, 17% female as opposed to 27% males use computers to carry out school work. On the other hand,
14% females and 26% males engaged on the computer to carry out e-mail correspondences. Meanwhile an average of only 3% females and 7% males use computers to participate in online chats. As far as visiting of internet sites is concerned, at least 10% female as opposed to 23% males use the computer for this purpose.

**Knowledge of computer programs by teachers**

When asked to do a self evaluation of their knowledge of computer programs, it was found that on the average teachers displayed their capabilities as follows:

- Microsoft Word 42.6%
- Hotmail, Yahoo 41.6%
- Google 32.6%
- Microsoft Explorer 31.6%
- Microsoft Excel 26.3%
- Microsoft PowerPoint 20%
- Microsoft Front Page 9.3%

**Discussion**

It was clear from the findings of the qualitative data that the integration of ICT is not just a matter of furnishing schools with computers without training teachers. It is not just substituting or allocating few hours on the timetable for computer literacy skill development. ICT integration is using the computers effectively and efficiently in the general content areas to allow students to learn how to apply computer skills in meaningful ways. (Dockstader, 1999). On this account discrete computer skills take on new meaning when they are integrated within the curriculum. Integration is incorporating ICT in a manner that enhances student learning. Such integration should be curriculum driven usage not the reverse and also using well-supported software.

In addressing the conditions for the integration of ICT, in schools teachers’ sense of ownership in the choice of project, content area and skills to be developed require much focus, if not the integration objectives will not be realised. The reasons for integrating ICT
necessitate that teachers play a vital role. Dockstader (1999) gave many reasons for the integration of ICT in schools:

1. Gives depth to content-area curriculum,
2. Intrinsic need to learn technology,
3. Increased academic engagement because of high student motivation,
4. Students are able to move beyond knowledge and comprehension to application and analysis and so many others.

From teachers’ perspectives, it was clear that they felt they were ill prepared to integrate ICT into the curriculum. On this account the ideal way to prepare them for incorporating ICT into the classrooms is by integrating it into their training curriculum. Our results point out the fact that an obstacle towards integration is the lack of the skills in use in ICT in teaching. The gap between personal use and use in teaching is enormous.

What became clear from the study is that access made both teachers and students potential participants in the great enterprise of knowledge construction because of the availability of information. On this account we observe some shift from textbook-based schooling to web-supported community of inquiry. However the culture of inquiry in schools has been a pedagogical ideal as evident in the writings of Dewey (1939) and Bruner (1966), though it had not been an enduring reality. Knowledge resources available in content –thin textbooks and limited libraries could not sustain inquiry-oriented pedagogy.

Access and more especially equity of access particularly from a gender perspective were evident but what was not clear is related to equity with regards to disadvantaged students. Dede (1998) pointed out that most of society’s current attempts to shrink the widened equality gap that new educational technologies could create focus on access and literacy. On this account extra effort is made to increase the amount of computers and communication available. The issue of time and scheduling presented a challenge for access. Another problem was not being able to locate software needed for particular disciplines. Internet censorship was seen by parents as a major problem. Marcroft (1998) in this regard affirmed that filtering brings peace to the minds of educators and parents. Teachers’ effort to monitor students through software support will enable parents to welcome the internet, knowing schools have
taken safety precaution in place. Besides teachers can be the filter as they move about in class interacting with the students during session.

To conclude this discussion, Dede had mentioned four types of improvement as a result of access to ICT. These are:

- Increased learner motivation
- Advanced topics mastered
- Students acting as experts,
- Better out comes on standardized test.

The most striking of all these is increased learner motivation that was evident from the responses obtained. Students were very excited because they were exposed to learning experiences that was not limited to information assimilation and teaching by telling. Guided inquiry, project-based collaboration, and mentoring relationships were reported to have evoked increased learner motivation. Schools therefore are challenged to plan for long-term acquisition, installation, operation, maintenance, and replacement of these systems, which create virtual windows to the world.
6. CONCLUSIONS

This transnational study sets out to better understand how the nature of the conditions in the context of African countries, favours the successful integration of information communication technology in the school system to ensure quality education. From this main premise four specific objectives stated were considered to have possible implications on the integration process. These specific objects are:

- Access to ICTs
- Use of ICTs (teaching, pedagogical approaches, learning, production, etc.)
- Effects of ICTs
- Sustainability

Built in these objectives are pertinent issues such as: gender differences and challenges posed by the integration of ICT in schools. The major problem posed is that the African contexts have factors that may limit the scope of the integration process. The imperative rests in establishing a balance between ICT as a curriculum content material and as a medium for teaching and learning. Searching for these concerns requires a theoretical framework.

**Access and conditions favourable for the integration of ICT in schools**

It is evident from the results that the access to ICT has existed in some private schools in Cameroon since 1990, 1998, 1999 respectively; this was only recently introduced in public schools by the Presidency of the Republic since 2002. The access rate for teachers in all the schools varies from 10% to 100%. The access rate for students as pointed out by the principals is regulated by a formal school timetable with periods of free access.

The access problem for teachers is every similar in all the eight schools. As observed in the public institutions, some of the teachers were initiated to ICT by monitors while others have received self-sponsored training. Generally speaking, the access of teachers to training is very problematic and is probably the main domain to be addressed if the process of ICT integration must be successful within the school milieu. While some teachers access ICT everyday others do so once or twice a week for one or two hours. Most have access more outside school because of time factor. It is for this reason that in public schools, teachers depend on monitors for information for their teaching activities and are not able to accompany their students to the
centre. A determinant of access for teachers is tied to the number of computers available in schools and space. It was evident that the number of computers conveys a weak parameter in ensuring access and the process of ICT integration, particularly if these are matched against each school enrolment. Measures to motivate teachers’ access to ICT during school hours are a critical element.

All eight schools have Internet connection and some schools access the Internet more for pedagogical purposes. In some of the schools students’ and teachers’ access is more flexible and within a specific timetabling. In other cases students use the centre once for two hours every two weeks. Another set of students use the centre everyday for two hours and is examined.

The proportion (15.4%-100%) of students with e-mail varies from school to school. The duration of such ownership spans from four months to four years. Attribution to such variance in access could be as a function of age, socio-cultural context of the students, level of parents’ education, availability of computer-internet in the home and parental beliefs on the impact of access to the student’s moral development.

Parents were not contacted during the introduction of ICT in the schools though they were eventually informed by their children, in PTA meetings and through the radio after it had been set up. Reasons for non-sensitization particularly in the public schools were because it does not require any additional payment from the parents. Some private schools believe that informing the parents will mean that they will want to have control over the affairs of the school.

Most parents don’t have computers at home, since they think they are too costly. The percentage range of parents having computers at is from 33.3% to 60.5%, however 50% to 75% of their children go to cyber cafes. This is the case because this demands financing and most parents hesitate because they do not have control over what is watched or done.

Use
From the eight schools visited the Principals unanimously agreed that they use ICT in their school but they differ in their scope of usage. Some schools indicated that they use ICT for both administrative and pedagogical purposes. Administratively they use ICT to monitor
personnel, record examination results, and categorize library books. Others extend their scope to include creating students’ files, managing report cards and students’ ID cards, Use in some schools as observed is limited to managing computer programs and making the students computer literate through training. Pedagogically ICT is used to prepare lessons, evaluate and access information, training of teachers and students’ and research work for both teachers and students. In short ICT is used both as a curriculum content material and as a pedagogical tool.

Teachers use ICT at least once a week and at most 5 days a week. It was evident that the most important use to which ICT is put is in the area of research, calculating marks, typing and those who have Internet communicate. The teachers feel that ICT is an indispensable pedagogical tool, as it opens one up to the rest of the world. The teachers in all eight schools indicated that ICT is useful to students because it enables them to obtain information, do research, learn better, understand better and communicate. In all the schools, teachers ensure effective student participation in ICT activities.

Students’ reaction to questions on use highlighted the importance of ICT on their learning as it permits them to know more about the environment improves knowledge, helps them to learn easily especially the English language. On the whole students’ attitude towards working with the computer was very positive as it enriches them with information. This positive attitude was the same for both boys and girls at varying degree. However when in difficulty they consult the monitors, peers who are more proficient and some times they try to solve the problems on their own. Students like using the computer for typing, printing, doing assignments, opening files, making portraits, designing flags, drawing exercises, receiving and sending messages, music, getting information on football and doing statistics. Notions of gender differences vary again where positive view is for either boys or girls or both.

Parents are very aware that their children use computer at school to obtain more information for their assignment, improve knowledge. Parents think computer is very good but student use must be controlled. About 33.3% to 42.8% parents use computers at home is for small research activities and other small works others for typing purposes and for writing texts.

The Effects of ICT
The integration of ICT has had a motivating effect on students as evident in the responses obtained from each principal of the eight schools especially for the sciences since arts
students have their books to use. The principals make reference to the influx of students during the hours of use and other hours. Computers excite the students and generated more interest in school among them. The cyber café attendance and afternoon computer classes are evidence of this interest. In all of these schools the main examples given and the reduced absenteeism demonstrate the positive effect of the integration of ICT as a result of the manifested interest of the students.

The issue of differences between boys and girls as they use ICT and their attitudes towards ICT generated yet again an overall positive consensus among all the principals in respect of high motivation among the pupils, yet with only slight variations in emphasis made. Gender differences are not that apparent as both boys and girls visit the centre with the same intensity, carry out research work and obtain scores such as 19/20 in computer studies. Girls concentrate more than boys once mastery has been attained.

The issue of effect was addressed in relation to teacher competence. All teachers in the study at varying degree are at ease when using the computer. This is exemplified in their demonstration of positive attitudes in the intensity of the concentration and the maximum use they make in the exploitation of the computer for learning. Through the use of the computer, higher order cognitive processes are addressed such high motivation, attention that is selective because of high degree of concentration provoked including increased participation and collaboration greatly recommended in today’s pedagogical practices. Teachers recorded no gender difference at varying degree. However 66.7% posited that their pupils are at ease with the computer, the rest 33.3% hold an opposite view. Teachers did not mention any significant gender differences but reiterated the ease with which all the students work with the computer. However teachers highlighted gender differences only in the sense that girls are more focused once they have gained mastery of manipulating the computer. On the other hand about 80% of the teachers contended that the students focus more on learning task when working with the computer, while 20% postulated that they don’t always concentrate on the learning task.

Effect was also determined from parents’ opinions. Some, if not most parents mentioned that their children talk about the computer and Internet and they find that they are very excited. Of course there are parents who say they forbid their children to use computers and e-mails. The span of what they talk about is not only wide but also diverse. They say they communicate very fast using electronic mail. They make mention of sites they use such as
'Google' and 'Yahoo'. Their vocabulary and knowledge of the computer have increased. On account of the above they are observable changes as related to increase desire to communicate and what they are able to do with the computer. Parents mentioned improvement in their children’s language competence, computational skills, and how critical they have become. Others tell narrate stories, teach other siblings songs and poems.

In short children are more anxious to go to school and on time especially if computer studies are the first lesson. Furthermore, they observe that their children’s notes are not only better but also better presented. They are more assiduous and stay longer in school. On the whole parents are implicitly addressing increased and active school presence or attendance, reduced absenteeism or truancy, thus increased retention rate.

**Sustainability**

A major concern in this area is related to training facilities and resources. Except for one of the private schools training of teachers for ICT are carried out at varying degree. In the Government schools in particular there is a programme for continuous training of teachers by the monitors. The Ministry and some private schools organise two weeks seminars for this purpose at a regular pace. But in private schools the participants pay for the training thus making training not obligatory. A question of sustainability that was silent in the instrument but evoked in discussion was sustainability in financial terms. In government schools the principals can not ask parents to contribute to the integration of ICT as it is a Government initiated program. Principals are reflecting on a possible strategy to deal with the burden of maintenance and replacement of computers. The private schools do not have this kind of problem as they are independent in this concern.

As concerns parents’ wishes that computers should be used in school, they were all very positive. But as to how this should be sustained generated differences in opinion. Parents are very concerned about what the child accesses or learns. On this account parents would want to be sure that sites accessed are appropriate. To ensure that all this works well there must be computers in quantity and quality with a good maintenance scheme. There should be continuous supply of electricity to avoid destruction of the machine with regular power cuts. Computers should serve more pedagogical purposes. Apart from these parents are willing to support the project but they would want to be asked. In private schools some financial expectations are built into the fees to be paid by students.
Conclusion

These experimental schools are responding timidly to the information age through the use of ICT that today permeates all aspects of pupil’s lives. Yet it would seem that specific policy about the use of ICT in schools is not well focused. The use of ICT in educational settings is marginal and often peripheral, acting as an “add on” to the regular classroom work in many instances. We could say that these schools are the crossroads in terms of their use of ICT in schools where ICT is used to perpetuate and reinforce what has been taught in the traditional way. The attempt however is to use computer for theoretical knowledge in computer (curriculum content material) than for pedagogical purposes.

Integration of ICT into Cameroon schools is an important value component of government’s policy to modernize the future citizens of Cameroon through opening them up to the outside world particularly as the world is becoming more and more a global village. From this government perspective, the spill over effect has been evident from Focus Group Discussions with teachers and students where both are addressing the value that access to computer and Internet has brought to pedagogical practices and to school administration. From this value component, challenges were posed that span in all dimensions of the integration process.

Challenges relates to policy, explosive school demographic information, poor teacher quality, and moral concerns which the integration process must address. From all indications it was clear that there is absence of a firm policy guiding core issues such as, program design, teacher training and sustainability. For the process to succeed and achieve its objectives, firm government policy must be addressed. In the case of programmes, a national programme for computer studies must be put in place in order to give not only a progressive orientation but also to give indicators for monitoring and evaluating the process. The pedagogical dimension of the use of ICT ought to be clearly stated. Without an improvement in the number and quality of teachers with specialist skill, the project would encounter difficulty.

From classroom observation we found about 3 – 5 students per computer. Access will be limited, thus the quality concern may not be achieved. As the machines are few and breakdown is evident, with no firm strategy for immediate replacement, the problem of continuous maintenance becomes crucial. In which case, the provision of a maintenance scheme should be a dominant clause in any service addressing the integration process. The
inadequacy of the functioning of the Internet as a result of the existence of few Internet points, irregular supply of electricity, and inadequate or absence of software are issues to be considered.

It was clear from discussions with teachers, students and even parents that the absence of a control mechanism in the computer centres, cyber cafes, at times at home makes children engage in watching pornographic films, playing games and chatting. Amongst other things these are the problems this study reports which pose challenges for the integration of ICT in Cameroon schools. A critical element is the challenge it poses on cultural and moral values so treasured by the Cameroonian contemporary society.

The major concern of the Cameroonian team and its focus as a result is the program for training specialist teachers in using ICT as a pedagogical tool. The aforementioned leads to suggestions which if the above situation were ameliorated a sound and serene atmosphere for ICT integration in Cameroon school system would have been consolidated.
7. RECOMMENDATIONS

Recommendations to government

By government we mean here the local and urban councils, Non-governmental departments (ministries of Education, Transport, Finance, Defence, National security etc). Training should be a compulsory and compensated policy for all personnel in all organizations. This will facilitate access to information flow and reduce unnecessary physical movement of files and personnel from provincial headquarters to Yaoundé. Government should reduce or eliminate import duties on ICT equipments which are used for training. This will greatly reduce the hardware and software prices currently in Cameroon and as consequence will motivate people to buy these equipments. For illustrative purposes, one will recall that the ministry of Higher Education encouraged university lecturers buying and supplying teachers with desktops and laptops at greatly reduced taxes.

Cameroon government through the various departments should order their software and hardware directly fro: the factories rather than through fourth and fifth parties commonly called “fournisseurs”. This is because by the time the products reach end users, it is about four times more expensive than the factory price. Why should government departments with bigger budgets buy from “fournisseurs” who have meagre budgets? Government departments should create ICT departments which will be responsible for designing teaching programs, advising them on current training needs with respect to technological advancement. Government should avoid looking for foreign experts for technical expertise because they are very expensive. For instance, an expert from Paris will be very expensive because of the following reasons:

1. Telephone bills for consultation between France and Cameroon.
2. Airfare from France to Cameroon.
3. Out of station allowance which may be ten times that of a local expert.
4. Housing allowance which might be about ten times that of an local expert.
5. Car allowance which is extremely very high.
It is very clear that the foreign experts may give expert advice but government should train their own experts in their polytechniques who will understand needs of the country better. Indigenous experts should be trained so that they can assure sustainability of projects. Many projects done by expatriates are bound to fail because certain technical specifications are never usually released to the end users. The Government gave the contract of computerizing the pioneer schools but no one within these schools has the technical reports in case there is breakdown. Nobody knows what is to be replaced or when and where; for this reason the government is in danger because if there is a breakdown somewhere it will be forced to bring in an expert or allow the project to fail.

An example in mind to buttress this fact is the bilingual training centre at ENS whose doors have not been opened for close to twenty years because of lack of technical specifications and as a consequence, lack of little or no maintenance. The objectives of CFA Stephenson are very attractive on paper, “une mise en place progressive et suivie avec la participation du CFA Stephenson … enseignement secondary et enseignement technique lycées et collèges.”

**Recommendations for schools**

The integration of Information and Communication Technologies can be very effective in the teaching–learning process if the following conditions are fulfilled.

1. Willingness of the school administrator to facilitate access to ICT by teachers, students, and the administrative staff. The willingness can arise from the fact that money allocated for the equipment be used judiciously rather than embezzling it. The school administrators should be committed people.

2. The renovation of buildings. Most of the classrooms in Cameroon were built before the idea that ICTs would be used during this technological age. Most of the classes do not have electrical installations, air conditioners, window protectors and solid doors. It is therefore difficult to use electrical installations in such classes.

3. Training of the school administrators on how to use ICT for administrative purposes. The school administrators should be trained on how to use Excel, PowerPoint, Net meeting, Messenger and Yahoo Messenger. Excel is an excellent programme for school administrators. They can use it for calculating marks and also for storing important data for the school for easy access to any body. The chat programs can be
used for easy communication with the staff, students, and parents alike. Net meeting is one of those programmes that can effectively be used for organising virtual meetings.

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

5. Effective supervision of the multimedia centres. The school administrators should make an inventory of the equipment in the centres and make sure they inspect the state of the centre and the equipment on a regular basis.

**Recommendations for teachers**

Teachers use technology to access information, model problem solving, and develop simulations that provide greater understanding of how technology is used in the work world. Teachers should continue to use technology to guide and engage students in self-directed learning activities. Efforts to introduce more advanced interactive and open-ended technology applications will require significant professional development opportunities and a sufficient critical mass of technology resources before they can benefit students. There also has to be an appropriate matching of teachers' knowledge of both the content and appropriate uses of technology and the desired learning objectives.

Teachers should increase the number of hours they go to Internet to search for information to update their teaching. Through their Internet connections, they will have access to resources that even a few years ago would have been impossible even for university researchers.

Teachers’ active participation in seminars and workshops is highly recommended. Ideally both teachers and students should have access to data that can be used to meet accountability expectations. Professional development is aligned with research and best practices where teachers participate in just-in-time study groups, online seminars, action research, and collaboration with colleagues. The teacher is also an administrator at a lower level in the classroom. ICT can be used to increase administrative efficiency and effectiveness in the classroom. For this reasons, classroom teachers should improve their skills in simple programs like Excel, Word and PowerPoint. It has been noted that a teacher may have the best
computer, the most sophisticated curriculum software, and the fastest Internet connection but if that teacher doesn't know how to use any of that, it's not going to improve the teaching learning process. Teachers must be provided with instruction and practice in integrating the curriculum with the technology and become familiar with hardware and software.

Teachers are supposed to encourage students to use ICT for learning purposes. Teacher roles consisted of finding time in the day to send students to a computer lab for drill and practice or electronic tutorials; and student roles usually consisted of selecting predetermined correct answers within such programs.

Teachers are the main actors in the educational process. Fortunately, in Cameroon, there is a teacher’s trade union called CATU. If they organize themselves and draw up an ICT policy it will go a long way to encourage government to train them either in the teacher’s centre or in the teacher training colleges. They should endeavour to go in for seminars and workshops aimed at integrating ICT in the educational process. It is true the salaries do not permit them to buy computers and also to go to cybercafés regularly, but they can organize themselves in common initiative groups and apply for financial assistance from international donors so as to open community-learning centres.

**Further Research**
The outcomes of the study lead to the formulation of the following recommendations for further research:

1. Effects of ICT on learning
2. Extent to which schools and community (partnership) can make technology available to all students
3. How can ICT be helpful in educating low performing students?
4. Comparative study on the technology “poor” and technology “rich” and school achievement
5. Research on the nature of technology-enabled pedagogy in relation to traditional pedagogy
6. Economic realities in the integration of ICT
7. ICT and self directed learning or individualized instructions
8. School reforms and pedagogy in integration process of ICT
9. ICT and teacher education

10. Core skills in teaching with ICT: the case of teacher education
REFERENCES


Hawkins, 2000; World Links 2001. E-mail message to coordinators@world-links.org


APPENDIX A: Graphs

Students with e-mail addresses

<table>
<thead>
<tr>
<th>Possession</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Number of students with e-mail addresses by gender:
- Girls: Yes - 2500, No - 3000
- Boys: Yes - 2000, No - 2500

Students Use of ICT in School

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
</tr>
<tr>
<td>Rarely</td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td></td>
</tr>
</tbody>
</table>

Frequency of students using ICT in school by gender:
- Girls: Never - 100, Rarely - 200, Occasionally - 300, Often - 4500, Always - 0
- Boys: Never - 0, Rarely - 100, Occasionally - 200, Often - 4000, Always - 500
Student Use of ICT in Languages

- Never
- Occasionally
- Always

Frequency

Number

Girls
Boys

Student Use of ICT in Mathematics

- Never
- Occasionally
- Always

Frequency

Number

Girls
Boys
Student Use of ICT in Natural Sciences

Student Use of ICT in Physical Sciences
Students Use of ICT in History and Geography

Students Use of ICT to learn the functions
Students Use of ICT for Internet Exploration

Frequency

Number

Girls
Boys

Frequency

Number

Girls
Boys
Student Use of ICT Outside School for e-mail

Student Use of ICT Outside School for Music
Students Use of ICT Outside School for Chat

Students Use of ICT Outside School for Internet Exploration
Frequency of use of ICT at Home by teachers

Frequency of ICT use by teachers in school

Frequency of use of ICT in manipulating the computers

Frequency of Use of ICT for research by teachers
Sending messages (e-mail)

Number of teachers

Frequency

- Never
- Rarely
- Occasionally
- Often
- Always

%

Ladies
Men