

**THE ROLE OF E-LEARNING ON THE PROFESSIONAL
DEVELOPMENT OF STUDENT-TEACHERS IN
CAMEROON**

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DEDICATION

To my parents:

Tansho Tume Kibinkiri, Tansho Julia Kiven;

and

To my dear son:

Kibinkiri Andy Fondzenyuy

UNIVERSITY OF SOUTH AFRICA
COLLEGE OF EDUCATION
CERTIFICATION

The thesis of Kibinkiri Eric Len entitled “**The Role of E-learning on the Professional Development of Student-Teachers in Cameroon**” submitted to the College of Education in partial fulfilment of the requirements for the degree of Doctor of Education in Curriculum Studies in the University of South Africa, has been read, examined and approved by the examination panel composed of:

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ABSTRACT

This study was planned to explore “the role of e-learning on the professional development of student-teachers in Cameroon”. The researcher’s concern with e-learning was sanctioned by the need for a teaching and learning strategy that can help institutions of learning address their problems and improve on their outcome. Seven (7) specific hypotheses were formulated to guide the study. The study also sought to find out challenges faced by student-teachers in the implementation of e-learning. The study involved a mixed methodological approach. In this respect, a survey of 796 student-teachers drawn from eight (8) Primary Government Teacher Training Colleges and three (3) Higher Teacher Training Colleges was carried out. Also, an experiment with 191 student-teachers of the Higher Teacher Training College was conducted using blended learning. Purposive sampling, cluster sampling, simple random sampling and systematic random sampling techniques were applied where necessary to obtain the sample.

Moreover, in the survey, data was collected using a questionnaire while the experimental phase generated data in terms of scores from the first and second test respectively. The student t-test, One-way ANOVA, and Correlation Coefficient were used to test the research hypotheses. Findings of this study offer new evidence that e-learning has a significant influence on the professional development of student-teachers in Cameroon. Findings revealed that slow Internet lines or access speed constitute a serious challenge to effective e-learning in Cameroon (Mean = 3.2852). Findings further suggest that Internet-Based Problem Solving and Computer-Based Direct Instruction have an unprecedented role in fostering the professional development of student teachers in Cameroon. Based on this result, recommendations are made to training institutions to embrace ICTs and become more flexible by adopting learning approaches that are dynamic and multi-dimensional as problems in education are becoming more complex.

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LIST OF ABBREVIATIONS

ACD	Activity Centred Design
ACL	Asynchronous Collaborative Learning
AEL	Asynchronous Experiential Learning
ANOVA	Analysis of Variance
ANTIC	National Agency for Information and Communication Technology
ARPANET	Advanced Research Projects Agency Network
Bbli	Bambili
Bda	Bamenda
BMS	Baptist Missionary Society
CAI	Computer Assisted Instruction
CBDI	Computer-Based Direct Instruction
CBT	Computer-Based Training
CD	Compact Disk
COL	Commonwealth of Learning
DCD	Domain Centred Design
DFID	Department for International Development
ESSP	Education Sector Strategy Plan
E	Electronic
EFA	Education for All
E-group	Electronic Group
E-mail	Electronic Mail
FoED	Faculty of Education
GTTC	Government Teacher Training College
H.T.T.C	Higher Teacher Training College
HND	Higher National Diploma
IBPS	Internet-Based Problem Solving
ICI	Information and Communication Infrastructure
ICT	Information and Communication Technology
ICTs	Information and Communication Technologies
IP	Internet Protocol
IT	Information Technology
LAN	Local Area Network

LCD	Learner Centred Design
LTM	Long Term Memory
Mbyo	Mbalmayo
MDGs	Millennium Development Goals
MINEDUC	Ministry of National Education
OCR	Online Content Representation
OLE	Online Learning Environment
PDA	Personal Digital Assistance
PTA	Parent Teacher Association
SPSS	Statistical Package for Social Sciences
STM	Short Term Memory
TCP	Transmission Control Protocol
TV	Television
VCD	Versatile Compact Disk
U.K.	United Kingdom
U.S.	United States
UDHR	Universal Declaration of Human Rights
UNESCO	United Nations Educational Scientific and Cultural Organisation
WAN	Wide Area Network
WAP	Wireless Application Protocol
WB:	Word Bank
WBI	World Bank Institute
WWW	World Wide Web
Yde	Yaounde
ZPD	Zone of Proximal Development

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter will examine the background of the problem, statement of the problem, purpose of the study, objectives of the study, research questions, and research hypotheses, significance of the study, scope and operational definition of terms.

1.2 Background of the Problem

1.2.1 Historical Background

This section attempts to describe the different eras and policies that have characterized Cameroon's education; the teacher education institutions and most importantly the pedagogic resources that have emerged over the years. Pedagogic resources refers to tools and situations that are capable of teaching on their own or assisting a life teacher to teach effectively. These tools have influenced the development of models, strategies and methods of teaching and learning in education. They ranged from simple media, to advanced media or Information and Communication Technologies (ICTs). Advanced media uses electrical power whereas simple media does not use electrical power.

Worthy of note is the fact that the Cameroon educational system has witnessed consistent evolution in its policies, strategies, methods and practices marked by its political evolution and exigencies. However, to effectively study the ideas and developments that have shaped educational practices in order to conceptualized initial professional training in Cameroon's schools, it is imperative to briefly examine its history. Education in Cameroon has a long history. Indigenous African societies including Cameroon had their own system of education and training of younger ones which included the use of tools before the introduction of western type of education. This type of training was called indigenous education because it was part and parcel of the society. This African practices were not in print or record books. Thus the West referred to that kind of education as "primitive education" because it lacked backup documentations.

However, indigenous or African education was a process which enabled society to teach its younger ones the life patterns of the society so that they can live within the context of their culture. The main objective of this kind of education was to train and integrate the Cameroonian children into working population. Fonkeng (2007:32) points out that African education consisted of activities aimed at developing children's motor or physical skills used for construction, farming, pottery, weaving, hunting, and carving; character and moral training; intellectual skills; vocational development and the development of a sense of belonging and cultural heritage. He further argues that "traditional African education addressed issues of modern education particularly, with reference to the transmission of the cultural heritage in view of continuity and growth for the regulation of life in the society" (Fonkeng, 2007:32). Falola (2000:50) highlights that the learning process was a cultural activity, and collective affair involving the task of socialising.

Also, it is worthy to note that the education process involved the use of rudimentary tools, life-long learning, oral learning, storytelling, collaborative learning, community based and non-formal processes. It responded to societal needs since it focused on the provision of knowledge, skills and attitudes for immediate consumption. Unfortunately, reforms in education over the years seem to overlook their historical base just as colonial education policies ignored and downgraded African cultural knowledge and practices that influenced indigenous education (Tambo, 2000:152). Tamanji (2011:320) concludes that the collaboration between the colonial governments and the western Christian Missionaries resulted in the establishment of colonial formal schools in Cameroon. Consequently, Formal education in Cameroon is closely linked to the West through trade, Evangelisation and Colonisation. Its evolution can be traced or described in terms of the major landmarks in the political evolution of the country. Formal education in Cameroon from 1844 to present can be divided into five cultural epochs as follows:

1.2.1.1 The Pre-Colonial Era in Cameroon (1844-1884)

Shu (2000:1) and Ihims (2003:2) points out that formal education in Cameroon was started by the Baptist Missionary Society (BMS). In the same light, Rudin (1968:121) and Tamanji (2011:41) states that the Reverend Joseph Merrick of the Jamaican-backed London Baptist Missionary Society opened the first primary school in Bimbia

in 1844 with an initial enrolment of 62 children. Since then the school system in Cameroon has grown steadily into a complicated network managed by the government, churches and private individuals. Merrick was followed by Alfred Saker (Fonkeng, 2007:45). A year after the Reverend Joseph Merrick, in 1845, Alfred Saker started building schools and churches in Douala. Tamanji (2011:41) highlights that the second formal school in Cameroon was the Bethel formal school in Douala, founded in 1845 along with a Mission Station by the Reverend Alfred Saker. During that period, schools were concentrated only in the coastal areas that is Victoria (Limbe) and Douala. The Missionaries focused on primary education. Thus Secondary education was not contemplated. The curriculum laid emphasis on English Language, Reading, Writing, Arithmetic, drawing, singing and the study of the Bible. Their curriculum shows that they acknowledged the importance of tools like the Bible in teaching. Unfortunately, these Bibles were not distributed to the indigenes (Ardener, 1968:10). Vernacular was used in teaching. The main objective of schooling was evangelization. The methods, structures and content of the schools responded to the evangelization mission, without reflections on the needs and interests of the people or any consideration for what had existed. The Missionaries were only interested in winning souls for Christ.

1.2.1.2 The Epoch of German Education in Cameroon (1884-1914)

The year 1884 marked the beginning of colonial era in Cameroon. According to Ardener (1968:1) a German-speaking missionary society the Basel Mission took over the work begun by the London based Baptist Missionary Society (BMS) in 1886. The Germans however overtook the British in the race to annex Cameroon on July 12, 1884 (Tamanji, 2011:35 and Ihims, 2003:7). Ngoh (1996:74) points out that the Germans applied the policy of “divide and rule”. He further explains that the Germans created divisions among the Chiefs in order to introduce the German culture in Cameroon. Also, the German masters were regarded as superiors (“master-race theory”). After the annexation of Cameroon, the London based Baptist Missionary Society had to hand over their schools to the Germans. The type of education that developed was predominantly technical and vocational. This type of education implies that there was the use of tools in education to help people develop skills. This also means that the use of instructional materials to learn is not a new phenomenon in Cameroon. The curriculum that evolved emphasized Germanic studies.

However, education was not treated as a matter of priority for more than a decade following the annexation of Cameroon. In addition to the Basel Mission, there were also the German Baptist Mission, the American Presbyterian Mission and the Pallotine Mission. It is worthy to note that the Mission continued to be more active than the Government in the field of Education. The German Authorities introduced a system of financial grants in aid to Mission Schools which taught using the German Language and followed the official prescribed curriculum (Ihims, 2003:10). The major developments in education during this period include: the replacement of the English-speaking Baptist Missionary Society by the Basel Mission because it was German speaking; education ceased to be in the hands of one authority, more religious bodies came in and the government began to take part in the provision of education; schools began to be established further inland, following German exploration and demarcation of the country; the English Language was replaced by the German Language as the medium of teaching, particularly in the higher classes of the elementary school; Government assumed supreme authority in the control of education; syllabuses designed by government began to be used in mission schools; vocational, technical and teacher education was limited

Nevertheless, the period between 1914 and 1922 were the years of the First World War and peace settlement in Cameroon. After the war, the Germans were defeated and Cameroon was partitioned between the French and the British. This period can be described as the dark years in Cameroon educational development. There were problems in switching from German to English in the British occupied area and from German to French in the French-occupied area. Educational activities were either in a standstill or focused only on reorganization by the new government and missionary authorities.

1.2.1.3 The Twin Epoch: French and British Mandates (1922-1946)

This is the period in which the British and the French ruled their respective parts of Cameroon under the supervision of the League of Nations. France administered French Cameroon as an autonomous territory within its colonial empire called French Equatorial Africa. Britain administered British Southern Cameroon as part of Nigeria. British Cameroon and Eastern Nigeria was administered as part of Eastern Nigeria from 1916-1954 (By 1916, Britain already had a colony Nigeria). In

1916 when German Kamerun was partitioned, the British got one-fifth (1/5) and four-fifths (4/5) went to the French (Fonkeng, 2007:83).

1.2.1.4 Education in French Cameroon during the Mandate Period

Tamanji (2011:195) points out that the French like the British and the Germans were geared toward global colonization schemes that would expand their colonial economies. He further explains that the major premise underlining the French educational policy for her African colonies including Cameroon was assimilation, aimed at eliminating African culture, language, and civilization and substituting French culture, language and civilization and the other French colonial education practices from French Gabon (Tamanji, 2011:209). The French believed that their culture was superior to any other culture. They also thought that their Language was superior and that they had as mission to civilize the rest of the world. They believed that African languages were very poor and could not help people to handle certain logical ideas. The school system was set up to select people who mastered French culture that is those who have evolved out of their primitive culture “evolues”. The method of implementing this was by transplanting the educational system in France into their colonies (Orosz, 2008:190). The same schools run in France, time tables, textbooks, and programmes were run in the colonies.

Worthy of note is the fact that the French were excessively active in running education including the creation of schools and the provision of teachers. Fonkeng (2007:93) points out that the training of local professionals in the early years on the French administration was carried out in the higher primary school in Yaounde. This school remained the only form of post primary education in Cameroon between 1921 and 1938. (Fonkeng, 2007:93) further states that the main mission of this school was the training of teachers for elementary schools. Government Order of 1920 specified among other things that only schools which teach exclusively in French and followed the prescribed government syllabus would be recognized and therefore receives financial support from the government. The Order of 1921, which regulated public schools, arranged schools into five categories (Ihims, 2003:98). This include: Village schools; Regional schools; higher primary schools; Domestic science schools and Vocational schools. The primary school system ended with CEPE (the First School Leaving Certificate) while the secondary school system prepared students for

Baccalaureate (Advanced Level) exams which was brought from the University of Bordeaux in France. On his part, Ngoh (1996:136) points out that in 1937; there were 85000 pupils in Mission elementary schools under the Catholic Mission, the French Protestant Mission, the American Protestant Mission and the American Adventist Mission.

1.2.1.5 Education in British Cameroon during the Mandate Period

Education in British Cameroon during this period started off less smoothly than in the French administered sector. The British Missionary Societies arrived very late as compared to French Missionary Societies who arrived very early. Secondly, whereas educational policy for French Cameroon was initiated in Yaounde-Cameroon, educational policy in British Cameroon was initiated not in Buea but in Lagos Nigeria. Thus British Cameroon was treated as a colony of a colony. According to Ngoh (1996:168) the British adopted the policy of “indirect rule” using the chiefs to implement the French culture in Cameroon. They assumed that the local languages were poor for instruction or learning and therefore not a good media for developing the intellect. The schools that emerged in British Cameroon include: Government Schools (located at divisional headquarters); Native Authority (NA) schools; Assisted Mission Schools; Unassisted Mission Schools; Post-primary schools. Ngoh (1996:174) points out that in 1924, government regulations made education uniform and provided infants with free education.

More still, Tamanji (2011:192) states that there were only six government schools which serve as model schools, for example Government School Buea, Mamfe, Kumba, Bamenda, and Victoria. The British government had as a policy not to engage so much in education but to show how schools should be run (“indirect rule”). Fonkeng (2007:133) defines indirect rule as a system of colonial administration whereby native people were ruled through their tribal institutions and natural or traditional leaders. Native Authority Schools functioned as Feeder Schools to the government schools at the Divisional headquarters. They could be compared to Village schools of the French administration. The Assisted Mission Schools were those that met Government set standards. Unassisted Mission Schools were those that did not met Government set standards. Up to the beginning of the Second World War, the school system comprised mainly of Primary Schools. Tamanji (2011:188) and Ihims

(2003:68) argue that, towards the end of the mandate period (1932), the government had opened an Elementary Teacher Training Centre at Kake which later became Government Teacher Training Centre kumba in 1946 for the training of grades II and III teachers respectively. The Basel mission opened one Teacher Training College at Nyassoso in 1944 (Tamanji, 2011:187). The Catholic Mission opened two Teacher Training Colleges at Njinikom and Baseng respectively in 1944. The Baptist opened a Teacher Training Centre at Great Soppo in 1950 (Ihims, 2003:70 and Tamanji, 2011:194).

Moreover, during this period, the education system was expanded to the secondary school level. The Catholic Mission opened the first Secondary Grammar School St Joseph College SASSE in 1939. In 1949, Cameroon Protestant College (CPC) Bali was created ten (10) years later. The Cambridge School certificate exams dominated the curriculum of SASSE and CPC Bali (Tamanji, 2011:194). English was the language of instruction. Tamanji (2011:186) argues that during this period, the majority of the schools were run by the Missions: Catholics, Presbyterians and the Baptists. St Joseph College SASSE was run by MilHil Fathers and a large number of Dutch, followed by a number of Cameroonian Grade II teachers who thought the lower classes. While Latin was compulsory in St Joseph College SASSE, the French Language was compulsory in CPC Bali. In 1956, the first girls school Queen of the Rosary College was opened at Okoyong in Mamfe. These secondary schools adopted the University of Cambridge School Certificate Examination syllabus as well as the West African school certificate examination syllabus. The exam was a grouped certificate examination in which students choose subjects from four basic areas: Language, Maths, Social Studies and Science. To obtain the certificate, you needed to have passed in a number of subjects selected from each of the four groups. The pass mark was calculated on the total score. It was based on the total score that you were classified as Grade II or III teacher. This system continued until 1955. After Independence, the Cambridge and West African School Examinations were replaced by the University of London General Certificate Examination.

In conclusion, the British had an aim in education to educate Cameroonians to become responsible citizens and provide the groundwork for further training. The British first of all transported their system of education to Cameroon and left it in the

hands of the Mission. The irony in it is that the Missions were only interested in running schools for the purpose of Evangelisation.

1.2.1.6 French and British Trusteeships (1946-1960/61)

At the end of the Second World War (1939-1945) a new world body the United Nations Organisation (UNO) was created to replace the League of Nations (Ihims, 2003:55). The trusteeship was one of the six organs of the UNO to take over the supervision of former mandated territories of the defunct League of Nations. Emphasis during this period was laid on post-primary and professional education in both the French and British administered sectors of Cameroon. From 1954, British Southern Cameroon became an autonomous region within the new Nigerian administrative arrangements created by the McPherson constitution. An independent board of education for the Southern Cameroon was set up in Buea. As in French Cameroon, enrolment in primary education tripled but some emphasis was given to secondary and professional education. The main objective was to give the products of schools the skills of running the country's affairs. Consequently, there was great pressure for educational institutions to expand and for higher educational institutions to be created so as to train middle and higher level man power. Scholarships were expensive and the first University was created in Cameroon that is the University of Yaounde in 1962. Also, the situation for general secondary school changed with the creation of the Advanced Teacher Training College Yaounde in 1961 with an annex created in Bambili in 1967

1.2.1.7 The Post Independent Period (1961 to Present)

The real Cameroon education began with independence and unification of French Cameroon and British Southern Cameroon between 1960 and 1961. French Cameroon gained her independence from the French in 1960 while the regions under British control gained independence in 1961 and merged with Francophone Cameroon (Ngho, 2006:243; Fonkeng, 2007:17). The country has adopted French and English as the two official languages with equal status thanks to its dual colonial heritage (The Constitution of the Republic of Cameroon, 1996). The result was the emergence of Bilingual primary, secondary, higher education and teacher education institutions in the country. Worthy of note is the fact that the post independence era was marked by three distinct periods starting from: the Federal period between 1961 and 1972; the

Unitary period between 1972 and 1982 to the Republic from 1982 to present. The period 1961 to 1982 was under Ahmadou Ahidjo as President of Cameroon (Ngoh, 2006:243). President Paul Biya took over from President Ahidjo in 1982 (Ngoh, 2006:328). The major curriculum policies during the Federal period included the policy of Harmonisation, Ruralisation and Bilingualism. Cameroon/World bank Report (2012:11) points out that the country had one of the most effective education systems in Africa during the 1970s and 1980s (the unitary period). As national revenue declined, education development became uneven with periods of growth and decline, similar to the economy. This report further states that primary completion rate increased from 59 percent in 2004 to 72 percent in 2008, and that the repetition rate decreased from 22 percent to about 18 percent, respectively.

Moreover, Cameroon has remained stable since its unification in 1961. In the colonial era, education in terms of pedagogic resources was designed to serve colonial interest. In the years following the achievement of Independence, it had to be oriented towards meeting the needs of national independence and development in all aspects of national life. The educational policy since independence emphasized the extension of educational opportunities to the entire population, the forging of national unity and man power development for economic, social, and political needs of the country. This is the period in which the government became more active in education. Primary and secondary schools expanded and the role of the Ministry of Education was supervisory so that there should be quality, standard and one curriculum or uniformity as seen from the different curriculum policies that were implemented.

Also, higher education institutions unknown in colonial era were being established. The first higher teacher training college (the Higher Teacher Training College Yaounde) was created in 1961. There was greater collaboration between government and voluntary agencies. Parents began to play an important role in education through the Parent Teacher Association (PTA). Since 1995 new orientations in education policy have emerged: Law No 98/004 of 14 April 1998 and Law No 005 of 16 April 2001 on the new guidelines on Higher education. Following these Laws, Cameroon has made tremendous efforts to respond to the need for quality and the demands of Information and Communication Technology and Globalization.

To add, this is the era in which ICTs are taking the centre stage in almost every sector of life in Cameroon. Scientifically as well as pedagogically, it is normal for an

effective teacher to alter his or her strategies, methods and techniques of teaching and learning with the use of pedagogic resources. However, these pedagogic resources have changed since the era of the Missionaries. It is worthy to note that dramatic changes that comes as a result of ICTs poses a great challenge to so many teachers as well as student teachers and consequently to all the stake holders. In fact, significant changes in ICTs and their penetration into the educational system are a growing concern in Cameroon and the world at large. It is an issue that concerns everybody irrespective of ethnicity, region or race. No one is excluded. ICTs have potentials to improve teaching and learning as well as harbours a threat to education if poorly used. In Cameroon today, this is compounded by a range of challenges faced by teachers such as large numbers of students, rapid change in technologies, increase accessibility, ownership, and use of these technologies by students in and out of school.

It is worthy to note that the majority of students in Cameroon are youths. The youth population in Cameroon just like in other Sub Saharan countries in Africa is the largest and will continue to grow because of a slower pace of fertility decline. Consequently, the opportunities that these young people have thanks to ICTs and the choices that they will make will profoundly influence current events and our collective future. If the youth have the desire and want to change the world positively they will given their numbers in the world.

Also, it is interesting to note that every young Cameroonian wants to own and use an ICT gadget. Psychologically, these technologies especially Internet and telephone has change the way people think and behave in society. Socially, the Internet has influenced the dressing style of most Cameroonian youths especially girls. It is now common to find young girls and boys in our major streets and institutions putting on dresses copied from models in the West from the Internet. This has greatly influenced our indigenous culture and identity. Politicians have embraced ICTs and are using social media like Face book, twitter to influence the youths to buy their political ideologies. Economically, Cyber Cafes are generating a lot of income for owners of such businesses and are employing a number of youths. Some Intelligent Cameroonians have benefited from national and international organizations through online advertisement of their expertise and productions. Others have benefited from academic and professional scholarships to study in and out of the country. Finally, the love for the computer, Internet, mobile phones, social media and the keen desire to use

by people in Cameroon is one of the reasons that have inspired me to carry out this study on the role of e-learning on the professional development of student-teachers.

1.2.2 Conceptual Background

The main concepts and models that form the basis for the theoretical framework will be discussed in this section. Nevertheless, it is worthy to note that e-learning has become the protagonist for change in the educational sector. Its approaches and applications, which are supported by pervasive technologies, possess potential benefits for the educational sector and the society as a whole. In order to reap maximum benefits from today's rapid technological advances, Towndrow (2005:515) argues that teachers need to embark on a programme of professional development that is experiential, incremental, and supportive of pedagogic improvement and practice. According to him, teachers must continually improve their strategies and methods in order to remain viable and relevant (Towndrow, 2005:517). Nevertheless, Bottino (2004:557) highlights that progressive consideration must be given to the needs of prospective teachers who will be using technology, the ways in which it will be used, the curriculum objectives, the social context and the ways in which teaching and learning activities are organized. This study is premised on the fact that the initial professional development of prospective teachers is very important for teaching and learning with ICTs in the later years.

Despite the growth in understanding ICTs in governance, business and in the development process, there is still much not known about the concept and practice of e-learning in institutions of learning. However, e-learning is difficult to define because it is multidimensional and dynamic, changing according to context, circumstances and interest. Consequently there are different expressions or typology of e-learning. Naidu (2003:8) defines e-learning as "the systematic use of networked information and communication technology in teaching and learning". Thus e-learning is an all-encompassing term which includes computer-enhanced learning, the use of mobile-technologies such as Personal Digital Assistants (PDAs) and MP3 players to facilitate learning. According to C.O.L (2006), e-learning and online learning are terms that have emerged to describe the application of Information and Communication Technologies (ICTs) to enhance distance education, implement open learning policies, make learning activities more flexible and enable those learning activities to be

distributed among many learning venues. On his part, Perkinson (2005:104) defines e-learning as “instructional content or learning experiences delivered or enabled by electronic technology”. Perkinson (2005:104) further argues that the term covers a wide range of applications and processes, such as Web-Based Learning, Computer Based Learning, Virtual classrooms and digital collaboration. In the same vein, Noe (2008:270) describes e-learning as "a comprehensive training strategy that can include several multimedia techniques (Internet, CD-ROM)". He further argues that a major defining characteristic of e-learning is user interactivity which facilitates learning.

More still, it can be inferred from the above definitions that the term e-learning covers a wide range of applications and processes such as Web-based learning, computer-based learning, virtual classrooms and digital collaboration. E-learning is therefore a modern strategy or method of teaching and learning which is broader than Computer-Based Training (CBT). It is also broader than the term online learning, which generally refers to purely Web-based learning. E-learning which is online or Web-based can be used in conjunction with face-to-face teaching. In this case, the term blended learning is used. Also, where mobile technologies are used, the term mobile learning has become more common.

Moreover, e-learning as a strategy of teaching and learning has the potential to change the process of education in Cameroon. As a matter of fact, it has the capacity to offer student-teachers and teachers numerous opportunities to develop their talents and contribute to the development of their communities. Today, one of the solutions to our problems in education could be e-learning: where instructions can be delivered via all electronic media especially the Web. What is most disturbing is the fact that a majority of student-teachers and their lecturers are not well informed about the potentials of this strategy or method. E-learning came into existence in the late 1990s. But before then, some of its aspects were already taking place. First there was correspondence learning. Then came distance learning. The constant changes coming from new technology, hardware, and software, respectively, is changing the scope and status of e-learning on a daily basis.

Worthy of note is also the fact that since the 1990s, the number of colleges and Universities offering online courses has increased dramatically. Long (2004:16) reported that “in 1999, U.S corporations spent \$ 66 billion on training. About 20 percent of that was expended on e-learning and about 80 percent on traditional

classroom instruction”. On her part, Stacy (2000) cited in Long (2004:16) predicted a projected shift to 60 percent e-learning and 40 percent classroom instruction by 2003. More still, e-learning models give a clearer picture of its evolution. They provide valuable frameworks for understanding the integration of technology and pedagogy and may help to identify key disparities between the current and desired situation. Also, e-learning models have evolved from classroom replication towards models that integrate technology and pedagogical issues. This study will discuss five models showing the evolution of e-learning. These include: the demand-driven learning model by (Mac Donald et al, 2001:19), Instructional design models by (Alexander, 2001:240), the community of inquiry model by (Garrison and Anderson, 2003:28), and Synchronous and Asynchronous models.

In addition, e-learning is a multi-dimensional and an all-encompassing term, which vary depending on the context and the availability of appropriate technologies or Information and Communication Infrastructure (ICI). Thus, as far as this work is concern, e-learning is a modern strategy or method of teaching and learning which involves Computer-Based Direct Instruction, Asynchronous Experiential Learning, Asynchronous Collaborative Learning, Internet Based Problem Solving, Online Content Representation and Online Learning Environments. This study also adopts the Blended learning type of e-learning. Electronic applications and processes involved include Internet, handheld devices (Personal Digital Assistance, simple mobile phones, smart phones, and Tablets), television and digital radio. The study acknowledges the fact that technologies alone will not generate much benefit in education and also the fact that e-learning is not an end itself but rather a means to an end. In this light, Piskurich (2004:131) postulates that basic academic skills are an important part of readiness for e-Learning, especially reading skills and communication skills.

Furthermore, this study is focused on self-directed learning. With modern technology for example simple telephones, tablet phones, Smart Phones, Personal Digital Assistance, computers, radio, and television, student-teachers and their teachers can judiciously pursue self-directed learning. Knowles (1975) cited in Lucy and Guglielmino (2004:26) defines self-directed learning as “a process in which the learner, with or without the help of others, identifies learning needs, defines learning goals, develop and implement a learning plan and evaluates the learning gained”. Tchombe (2005:324) share the view that in the traditional classroom, students learn to

depend on tutors for their motivation, direction, goal setting, progress monitoring, self-assessment, and achievement. Unlike in a typical traditional classroom, self-directed learners are more likely to become lifelong learners. People update and expand their knowledge through self-study which can be done at a distance.

According to C.O.L (2005:2), distance education, which is delivery of learning or training to learners who are separated, mostly by time and space from those who are teaching and training significantly changes the way students and teachers interact. With the aid of modern technology, distance education has the potential to dramatically alter the educational process in Cameroon. Cohn (2000) cited in Long (2004:15) predicted that more than two million learners worldwide enrolled in distance learning programs by 2002. As a matter of fact, the learning environment has expanded to include greater interaction between the learner and the learning content as well as between the learner and the instructor. C.O.L (2005:5) stressed that developing countries must find alternative strategies and methods to conventional education so that people can acquire knowledge and continue to learn. E-learning in particular holds the promise to encourage student-teachers to take responsibilities for the learning process. It also has the potential to promote deep learning. The use of E-learning has the capacity to accommodate all the learning styles of students. On his part, Santrock (2004:247) holds that the Internet is the core of computer-mediated communication. According to Lord Geoffrey Crowther at the inaugural ceremony of the UK Open University, 1969 cited in C.O.L (2006:11),

“The world is caught in a communication revolution, the effects of which will go beyond those of the industrial revolution of two centuries ago. Then the great advance was the invention of machines to multiply potency of Men’s muscles. Now the great advance is the invention of machines to multiply the potency of Men’s minds. As the steam engine was to the first revolution, so the computer is to the second”.

In conclusion, to meet the challenges of an always-evolving high-tech society, this study is designed to find out the role of e-learning on student-teachers’ professional development. More specifically, the role of e-learning on prospective teachers’ communication skills, technical skills suitable for learning, interactivity/interpersonal skills, attitudes towards learning with technology, support

received by ICT teachers, values and principles suitable for learning in the 21st century, performance in educational technology, and the challenges faced by teachers in the implementation of e-learning.

1.2.3 Theoretical Background

This section attempts to describe in brief the different theories that have influenced the growth of e-learning in education. It involves a mixed framework of learning theories (formal education theories, adult learning theory). Worthy of note is the fact that the study involves adolescence and adults. The theorists that will be applied in this study include the behaviourists, cognitivists, constructivists, socio-constructivists and the socio-cultural theories. Notwithstanding, only theories and / theorists that encourage students to take responsibilities for the learning process will be discussed. The theories will equally be discussed in light of their relevance to ICTs and e-learning. These include amongst others: B.F. Skinner, Jerome Bruner, Vygotsky, information processing theories, Howard Gardner, Levy P., Malcolm Knowles, Cole and Engestrom. It is also worthy to note that there has been a progressive move from behaviourism, cognitive theories that emphasise individual thinkers and their isolated minds to theories that emphasize the social nature of cognition and meaning.

According to Passer and Smith (2001:22), Harvard professor, B.F Skinner (1904-1990) believed that the power of the environment could be harnessed for good or evil. On his part, Diessner (2008:134) postulates that Skinner is the most influential psychologists of the behaviourist movement of the 20th century. Skinner is remembered for his contribution in establishing a technology of teaching (“teaching machine”) a device that used his principles of step-by-step instruction in 1953-1956. Behaviourism as a theory of learning has influenced the growth of the Transmission model/Domain Centred Design to instruction. Jerome Bruner’s theory of instruction can be applied to ICTs and e-learning.

Bruner (1956) cited in Santrock (2004:397) emphasized the concept of discovery learning by encouraging teachers to give students more opportunities to learn on their own. Another important theory to this study is the information processing theory. Central to this approach are the cognitive processes of memory and thinking. Santrock (2004:247) maintains that it is an attempt to explain how the human mind works. Like Jean Piaget, Jerome Bruner’s theory of learning and the Information-

Processing theory have influenced the development of the Learner Centred Design to instruction.

Santrock (2004:51) assert that, like Piaget, Vygotsky (1896-1934) “believed children actively construct their knowledge”. However, e-learning has the capacity to help students create their own knowledge. Worthy of note is the fact that Lev Vygotsky’s views of learning have influenced the growth of the cultural approach to instruction. The cultural approach has led to deeper reflection on the penetration of modern Information and Communication Technologies in Education. The development of activity centred design to instruction and Activity theory stemmed from such thinking. Cole and Engestrom's systemic model points out three important mutual relationships involved in every activity (Bottino et al, 1999:283).

Also, Gardner’s theory of multiple intelligences (Gardner, 1983) has led to a lot of research by educators, some of whom are redesigning their curricular to respond to differing student intelligences. According to Passer and Smith (2001:347) Gardner’s multiple intelligences is reshaping many current assessment practices and instruction.

Moreover, Malcolm Knowles’ theory of adult learning (theory of andragogy) can be used as the basis for developing or sustaining any e-learning programme for student-teachers. Knowles (1990) identified characteristics of adult learners that can be used to facilitate learning.

In addition, Levy’s (1997) description of collective intelligence has much to offer educators and students, especially in the articulation of e-learning and online learners. Zembylas and Vrasidas (2005:78) state that “collective intelligence is the inevitable result of intelligent systems which are structurally coupled through electronic mediation”.

Finally, these theories show the progressive shift from behaviourism (theories that emphasise the role of the technology and the individual) to socio-constructivism (theories that focus on pedagogical issues such as instructional design, the social nature of learning and the creation and functioning of online learning communities).

1.2.4 Contextual Background

This section attempts to describe in brief the context within which this study is carried out. However, it is worthy to note that the struggle to attain national and international expectations for education has generated a tremendous demand for education at all levels in Cameroon. Education in Cameroon ranges from nursery, primary, and secondary to tertiary or higher education. The citizen's right to education is embodied in the 2008 reviewed constitution of the Republic of Cameroon, the Universal Declaration of Human Rights (UDHR) of 1948, the United Nations charter and the United Nation Organisation Convention on the Rights of the child which the country has ratified. According to the preamble of the Constitution of the Republic of Cameroon, “the state shall guarantee the child’s right to education; primary education shall be compulsory; the organization and supervision of education at all levels shall be the bounded duty of the state” (Law No. 96-06 of 18 January 1996). In the same light, in the year 2000, the United Nation adopted the Millennium Development Goals targets to be achieved by 2015. The first seven goals, directed at reducing poverty in all its forms, are mutually reinforcing. The number eight goal (global partnership for development) is about the means to achieve the first seven. Goal’s two (Achievement of universal primary education) target of the MDGs requires that countries that signed the Millennium Declaration should ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling (World Bank Atlas of Development Indicators, 2008; World Bank, 2006:33).

Worthy of note is the fact that the government of Cameroon cannot satisfy the incessant demand for education with existing institutions of learning and the human resources available. The quality of education which is as important as the quantity still needs much for the country to attain its objectives and vision of becoming an emerging country by 2035. Fonkeng (2007:4) remarks that there have been both qualitative and quantitative drops in the entire school system. According to Fonkeng (2007:4), “quality is a problem due to lack of teachers or lack of increase in adequate number of qualified and experienced part-time or newly recruited teachers compared to the demand of education”. However, today’s world offers many opportunities thanks to Information and Communication Technologies (ICTs). World Bank (2006:2) remarks that communication technologies have opened up entirely new horizons in information access and retrieval and are revolutionizing the ways in which people and societies

interacts, conduct businesses and compete in international markets. It further argues that education holds the promise for closing the income gap between the rich and the poor countries of the world, but can only be realised when access to education must be expanded and quality improved

On his part, Perkinson (2005:103) argues that the continuing ICT revolution and use of the Internet is primarily responsible for creating our revolution on education. What is most disturbing is the fact that Cameroon is unable to take advantage of these opportunities. Jemez, Kiso and Ridao-Cano (2007:20) points out clearly that despite the enormous progress made in educational outcomes, there are still many young people who lack the basic skills needed for work and life in most developing countries. In Cameroon, people, especially those living in the rural areas drop out of school or never enrol at all due to inaccessibility, school location, high school cost, transportation, busy work schedules and cultural aspects in some specific regions. This is typical of regions considered as education priority zones like the Northern Region and Bakassi in the South West Region.

Moreover, the teaching and learning environment in most teacher education schools in Cameroon is unattractive and provides little or no access to learning resources for student-teachers to learn. Consequently, this prevents them from developing their full initial professional competences necessary for teaching and learning in later years. Prospective teachers experiencing difficult learning conditions find teaching a very frustrating activity and do not cope with its enormous demands especially when they are sent to difficult areas or education priority zones upon graduation. Most schools in Cameroon especially those in the rural areas lack pedagogic resources and a majority of teachers lack knowledge about e-learning. Thus there is a need for an innovative strategy for teaching and learning (e-learning) so that the country can solve some of these problems in the education sector. World Bank (2006:8) postulates that “the most effective reasons for adopting e-learning will continue to be driven by the needs of teaching and learning, not new and available technologies”. Of recent, there has been interest in exploring innovative approaches to increase access and learning opportunities for teachers and students in Cameroon. For example, in 2007, the University of Buea started implementing a pilot distance education program in the Faculty of Education for teachers.

More still, World Bank (2006: 4) remarks that despite great progress in primary schooling in developing countries, the preparation of youths for work and life is still very low. In the same light, WBI (2007:125) reports that many developing countries, however, continue to struggle with difficulties stemming from unresolved problems such as expanding education coverage in a sustainable way, inequalities of access and outcomes, educational quality and relevance, and inflexible governance structures and management practices. In order to overcome some of its problems, the government of Cameroon developed an Education Sector Strategy Plan (E.S.S.P) in 2006 to support comprehensive and sequenced changes in the education sector (Cameroon/World bank Report, 2012:11). Cameroon's Education Sector Strategic Plan (2006) outlines key outcomes for the education sector captured in some of the Millennium Development Goals. The main objectives of the Education Sector Strategic Plan are:

1. Improving universal basic education by 2015 by reducing grade repetition, increasing the number of teachers in the system, reducing pupil-teacher ratios, increasing pedagogical resources in the classroom, and improving educational management and administration;
2. Expanding preschool coverage;
3. Introducing reforms in higher, technical, and secondary education;
4. Regulating access to post-primary education according to the needs of the job market (Cameroon/World bank Report, 2012:12)

In addition, professional development in teacher education institutions as well as in the University is very important to the development of the country. WBI (2007:125) stressed that the role of tertiary education in the construction of knowledge economies is crucial. This is the level at which conceptualization and sophisticated skills are developed. In fact, it is at this level that most of the complicated formulas and models we consume develop. This sophisticated level of thinking shapes policy in various ways and moves the society forward through ideas that improve on human welfare. Fonlon (1969:23) states that "University studies are greater in quality and quantity and that they are more perfect in their intrinsic organization". On her part, Tchombe (2004:340) argues that education in teacher training schools and at the University level has a dual responsibility of generating knowledge through teaching and research and preparing youths for new kinds of responsibilities requiring complex

intellectual and technical skills. Thus teacher education creates and enhances human capital, contributes to the production of social capital (cohesion or social ties), increase economic growth which is an important determinant of economic development and good standards of living (World Bank, 2006:32). However, this does not mean that the other levels or sectors of education are not important. They too play their own part in the development of the society. Unfortunately most of the efforts to improve education in these levels (basic and secondary education) are carried out in isolation paying little attention to training schools that prepares prospective teachers with initial professional competencies.

Also, the government of Cameroon has acknowledged the fact that skills in ICTs are essential for its future work force. The creation of departments in charge of pedagogy and computer science in the ministries of basic education, secondary education and higher education is a clear demonstration of the political will to transform the educational system of Cameroon with Information and Communication Technologies. With the professional approach to teaching and learning with technology, skill development plays an increasing role. This has influenced curriculum provision at the nursery, primary, secondary and tertiary level, for example the introduction of information and communication technology (ICT) as a discipline in the curriculum since 2007 and the creation of a department of Information and Communication Technology in the Higher Teacher Training College Yaounde. Thus teachers at all levels are expected to have at least a minimum level of competence in ICT.

To add, the government of Cameroon place a lot of importance on the education of its citizens. The state budget that is being allocated for education confirms this assertion. In his message to the youths during the celebrations of the 46th edition of the National youth day on the 10th of February, 2012, his Excellency president Paul Biya reiterated that budgetary allocations to ministerial departments responsible for the different levels of education are among the largest in the state budget (Biya, 2012:20). The table below shows the government financial allocations in CFA Millions for secondary and basic education between 2007 and 2009

Table 1.1 State Budget Allocation for Basic and Secondary education between 2007 and 2009

Item	YEAR		
	2007	2008	2009
Total State Budget	2,251,000	2,482,000	2,301,400
Total budget allocated for education	329,632	358,279	402,770
% allocated for education	14.6%	14.4%	17.5%
Budget allocated for Basic Education	121,929	147,396	153,102
% Budget allocated for Basic Education	37.0%	41.1%	38.0%
Budget allocated for Secondary Education	166,824	168156	204,507
% allocated for Secondary Education	50.6%	46.9%	50. 8%

Source: MINEDUB and MINESEC budget documents

More still, the current law on education in Cameroon (Law Number 98/004 of 14th April 1998) seeks to professionalize the Cameroon educational system and also to promote the teaching of Information and Communication Technologies in schools. The April 14, 1998 Law on education in Cameroon is complemented by the Strategic Sector Plan document for education produced by the Ministry of National Education (MINEDUC) at the request of the World Bank (Fonkeng, 2007:5). This plan requires government's engagement to increase resources, optimise their use by pertinent allocation and efficient management of public expenditure. Also, Tambo (2000:69) points out that the promotion of science and technological development in Cameroon is one of the main policy issues to professionalize the education system. According to the National ICT policy and strategy document developed by the National Agency for Information and Communication Technology (ANTIC) in 2007, "information and communications technology skills can be effectively applied to modernize and enhance teaching and learning, management, mobilize new support for education and provide the infrastructure for regional collaboration, cooperation and the pooling of resources to unprecedented levels" (Nkweni, 2007:5).

Moreover, in order to ensure that many Cameroonians are educated, the government tries to locate schools closer to the people. Before 1992, there was only one State University in Cameroon (the University of Yaounde). And between 1992 and 2007, there were already six state Universities and numerous denominational and

private institutions of higher learning. Decree Number 92/74 of 13th April 1992 complemented by Decree Number 93/034 of 19th January 1993 created five new Universities all over the national territory (IAU/UNESCO Information centre on Higher Education, 2004). These were: the University of Yaounde II, Douala, Dschang, Ngaoundere and Buea. The University of Yaounde became University of Yaounde I. Today, the newly created University of Maroua and Bamenda have added the number to eight state Universities in the country.

Also, the state Universities and other higher institutions of learning are fed by both lay private, denominational and government high schools now existent in almost all sub-divisional headquarters; secondary schools and primary schools now situated in almost every village. The measure to have the Cameroonian public have at least basic education is matched by the Head of State's granting of free primary education to all children of school-going age. This policy has led to a drastic shortage of teachers in most institutions of learning due to a high demand for education in the country. In its efforts to increase more teachers at the level of the primary and secondary education, the government has expanded training institutions all over the country. It has provided at least one public teacher training school in each subdivision in the country. At the moment, there are about 60 public teacher education colleges for general education in the country producing Grade One teachers for nursery and primary schools. The country also counts a good number of technical teacher training colleges. Also, the government has approved the functioning of some private teacher training institutions that met up with government standard, for example St. Pius X Teacher Training College Tatum where I started teaching in 2005 before enrolling for a master's programme in education, in the University of Buea.

In addition, the government has expanded the number of public higher teacher training schools in the country. For example the number has increased from four (that is the Higher Teacher Training College Yaounde of the University of Yaounde One where I am currently working as an assistant lecturer, the Higher Teacher Training College Bamenda formally annex to the Higher Teacher Training College Yaounde, the Faculty of Education of the University of Buea where I did my undergraduate and master's programme and the Higher Technical Teacher Training College Douala) to six. The newly created institutions include the Higher Teacher Training College Maroua of the University of Maroua created in 2008 and the Higher Technical teacher

Training College Bamenda of the University of Bamenda created in 2010. The country also has over 60 public and private teacher training colleges preparing teachers of nursery and primary schools.

Also, in Cameroon, the Internet has become a tremendous resource for its citizens. E-mail services, Net phones and Websites are currently available in the provincial capitals and major towns. Though Internet services became operational as early as 1972, it emerged in Cameroon only in the late 1990s. And since then, it has become something of great interest especially among secondary school students, high school students, university students and the community as a whole. Cyber Cafés have been cropping up steadily particularly in the Urban centres. A number of government ministries have been created such as the Ministry of Communication, the Ministry of Post and Telecommunication to take care of telecommunication issues in Cameroon. Also, the government is investing a lot of money in this sector. The government has engaged in a number of projects to promote access to the Internet and its facilities. For example the Optic fibre project with the Chinese in the North to increase Internet access in the country, The government project to create more than 20,000 Community Tele Centres in major towns all over the country by 2015. The government is also spending a lot of resources in the energy sector. Government's vision of an emergent country by 2035. The Cameroonian youth takes particular interest in Internet for scholarships, pen friends, education and other more or less important reasons. Noteworthy is also the fact that most institutions like Universities, socio-political and business groups have already developed their own Websites.

More still, the arrival of mobile phones has greatly altered the information and communication landscape within Cameroon. A number of companies or providers are competing in this sector: CAMTEL, MTN, and ORANGE. The Cameroon government has also made great efforts to respond to the need for quality education, and the demands of globalization. Amongst these could be cited, the liberalization of the audio-visual media sector, the abolition of custom charges for imported communication equipment and the introduction of computers and internet facilities in schools, colleges and Universities. However, Information and Communication Technologies and e-learning in particular carry an informative and transformative power. Consequently, teachers have to develop the ability to demonstrate how these technologies can be used for academic purposes and convey the educational

advantages of computers, Internet, cell phones, audio/videotapes, interactive TV, digital radio and CD-ROM to their students.

Furthermore, the penetration of ICTs in the educational sector has laid the foundation for the knowledge society. However, participation in the knowledge economy requires a new set of human skills. People need to be flexible and be able to continue learning well beyond the traditional age for schooling. Without improved human capital especially in developing countries like Cameroon the effects of the knowledge economy which include amongst others; continuing education, lifelong learning, and continual professional development will not be felt. Consequently these countries will be forced to fall behind and experience intellectual and economic marginalization and isolation. The penetration of ICTs in education has also led to new developments in educational technology, innovative international delivery methods such as e-learning, new concerns about the appropriateness of the curriculum and teaching materials. As a result, prospective teachers have to take greater advantage of modern Information and Communication Technologies (ICTs) in building their world. They need to develop capacities to make maximum use of Blogs, discussion forums, the World Wide Web, and other features of the internet in solving educational problems.

Finally, a lot of research has been carried out in Cameroon like in other countries on the future potentials of Information and Communication Technologies and distance education in the development process. However, little is known about e-learning, more specifically its role on the professional development of student teachers. Worthy of note is the fact that an understanding of ICTs is not the end of the journey of course. Beyond awareness lies proactive involvement for those who really wish to make a difference in education.

1.3 Formulation of the Problem

In Cameroon, there is an urgent need to improve the quality and the quantity of teachers in institutions of learning at all levels of education. According to Cameroon/World bank Report (2012:32) the ban on recruiting teachers in Cameroon throughout the 1990s following the structural adjustment programmes that targeted the salaries of teachers and civil servants during the 1980s and 1990s created a vacuum or gap in the educational sector. Ten years later, the government introduced a contract

teacher programme in primary education which aimed at incorporating all non-civil servant teachers into a single group of contract teachers. That is locally recruited teachers by the Parent Teacher Association (PTA) and those employed in the private sector were to eventually join the official contract-teacher class. Although this programme supported by the International community has led to an increase in the number of teachers over the years especially in education priority zones like the Northern region of Cameroon, the number is still grossly insufficient. A study carried out by the Ministry of Secondary education in 2012 to find out the projected number of student-teachers that will be in Government Teacher Training Colleges and the number that would be needed to teach in Government Primary Schools in Cameroon between 2013 and 2020 corroborate the previous assertion. The expected number of students needed by the government in each year is in line with the budget that would be allocated to this sector.

Table 1.2 *Summary table of projected number of student-teachers and teachers needed between the year 2013 and 2020 in Cameroon*

Year	2013	2014	2015	2016	2017	2018	2019	2020
Student-teachers in public schools	251300	257636	264086	273058	282266	291716	301414	311365
Number needed	5457	5793	6157	6609	7103	7645	8240	8896

Source: Ministry of Secondary Education, 2013 (unpublished)

The above statistics show that the demand for teachers of Basic Education in the coming years will be very high. The table also shows that a good number of student-teachers who will graduate between 2013 and 2020 will not be directly absorbed by the government. The statistics for higher teacher training colleges shows a steady increase in the number of student teachers, for example the evolution of the student population in the Higher Teacher Training College (H.T.T.C) Yaounde from 2005/2006 to 2010/2011.

Table 1.3 *Evolution of student population in H.T.T.C Yaounde (2005-06)*

Institution	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
H.T.T.C Yaounde	3039	3456	4069	4257	4607	4745

(Annual Statistics of the University of Yaounde I, 2012:12)

The statistics above shows a constant increase in the population of student-teachers in the Higher Teacher Training College Yaounde within the past five years. At the level of higher education, admissions to teacher education institutions are limited. The government admits a limited number of student-teachers that would be employed directly upon graduation from the school. Although the government is making a tremendous effort in the area of human and pedagogic resources, there is still a need to increase the number of teachers in schools and to improve the quality of initial training in teacher education establishments. The statistics and profiles of prospective teachers compared to the need reveals that existing institutions of teacher education cannot help the country achieve the goals of Education For All (EFA) and the Millennium Development Goals (MDGs) by 2015.

Moreover, teacher education institutions are faced with a multiplicity of challenges such as: large classroom size; insufficient infrastructure; the introduction of new disciplines like Information and Communication Technology in the curriculum without a corresponding staff to teach; insufficient pedagogic resources; and most importantly ineffective methods and strategies of teaching and learning. Unfortunately, most of the projects especially in the domain of ICTs conceived in basic and secondary education pay little attention to the initial training of student teachers in teacher education institutions. The direct result is poor outcomes to educational investment. Tchombe (2004:338) states that “how learning occurs and is supported has implications for the level of participation and the quality of the end product. Worthy of note is the fact that the solution to the problem of education in Cameroon can only be solved progressively when all the challenges facing this sector have been addressed.

Nevertheless, just as the twin needs to improve the quality and the quantity of teachers become imperative, new strategies and methods of teaching and learning are becoming available thanks to the penetration of Information and Communication Technologies (ICTs) in the educational system. Despite the growth in understanding ICTs in governance, business and in the development process, there is still much not known about the practice of e-Learning in institutions of learning especially teacher education establishments. It is for this reason that I am examining the role of eLearning on the professional development of student teachers in Cameroon. Specifically, I am finding out the extent to which e-learning can influence prospective

teachers 'professional development. That is, the knowledge, skills and attitudes suitable for learning in the 21st century that a student-teacher can build with e-learning and the positive change that can result from this modern method or strategy of teaching to address the problems of education in Cameroon

1.4 Aim and Objectives of the study

The purpose of this study was to explore the role of e-learning on the professional development of student-teachers in Cameroon. It is highly expected that the results provided by this study, if well disseminated, will improve the outcome of education.

1.5 Aim of the Study

1.5.1 Overall aim

The general objective of this study is to find out the extent to which the use of e-learning influenced the professional development of student-teachers in Cameroon.

1.5.2 Objectives

1. To find out the degree to which the use of Computer-Based Direct Instruction influences professional development of student-teachers.
2. To find out the level to which Asynchronous Experiential Learning influences the professional development of student-teachers.
3. To find out the level to which Asynchronous Collaborative Learning influences the professional development of student- teachers.
4. To find out the degree to which Internet-Based Problem Solving influences the professional development of student-teachers.
5. To find out the degree to which Online Content Representation influences the professional development of student-teachers.
6. To find out the level to which Online Learning Environment influences the professional development of student-teachers.
7. To find out the level to which the use of e-learning influence teachers' performance in educational technology?
8. To find out some of the challenges faced by teachers in the implementation of e-learning.

1.6 Research Questions

1.6.1 General Research Question

To what extent has the use of e-learning influenced the professional development of student-teachers in Cameroon?

1.6.2 Specific Research Questions

1. To what degree does the use of Computer-Based Direct Instruction influences professional development of student-teachers?
2. To what level does Asynchronous Experiential Learning influences the professional development of student-teachers?
3. To what level does Asynchronous Collaborative Learning influences the professional development of student- teachers?
4. To what degree does Internet-Based Problem Solving influences the professional development of student-teachers?
5. To what degree does Online Content Representation influences the professional development of student-teachers?
6. To what level does Online Learning Environment influences the professional development of student-teachers?
7. To what level does the use of e-learning influences teachers' performance in educational technology?
8. What are the challenges faced by teachers in the implementation of e-learning?

1.7 Research Hypotheses

1.7.1 General Research Hypotheses

The use of e-learning has a significant influence on the professional development of student-teachers in Cameroon.

1.7.2 Specific Research Hypotheses

Hypotheses 1

Alternative Hypotheses (Ha): Computer-Based Direct Instruction has a significant influence on the professional development of student-teachers.

Hypotheses 2

Alternative Hypotheses (Ha): Asynchronous Experiential Learning has a significant influence on the professional development of student-teachers.

Hypotheses 3

Alternative Hypotheses (Ha): Asynchronous Collaborative Learning has a significant influence on the professional development of student-teachers.

Hypotheses 4

Alternative Hypotheses (Ha): Internet-Based Problem Solving has a significant influence on the professional development of student-teachers.

Hypotheses 5

Alternative Hypotheses (Ha): Online Content Representation has a significant influence on the professional development of student-teachers.

Hypotheses 6

Alternative Hypotheses (Ha): Online Learning Environment has a significant influence on the professional development of student-teachers.

Hypotheses 7

Alternative Hypotheses (Ha): The use of e-learning has a significant influence on the performance of student teachers in educational technology.

1.8 Significance of the Study

This study is very timely bearing in mind the current trends in education all over the world driven by Information and Communication Technologies. The fundamental benefit of this study is in the pedagogic and didactics domain of science of education. This piece of work can help us blend education theories, models, teaching strategies and methods to come out with a credible and acceptable strategy for learning in institutions of learning especially for teacher education schools.

Nevertheless, the applied benefits of this piece of work can be multidimensional. At the personal level, this work will help me to better understand Information and Communication Technologies must especially e-learning. It is going to help me improve on my professional competencies as a lecturer of higher education. The study will help me to earn a terminal degree (PhD) which will permit me to give lectures in and out of Cameroon. It will also motivate me to continue research in the area of e-learning in and out of the country.

Also, it can be beneficial to both student-teachers and teachers already in the field. E-learning as a modern strategy or method of teaching and learning has the capacity to motivate student-teachers and their lecturers to learn. The study can help student-teachers to adopt more socio-constructive methods of teaching and learning. It can also motivate teachers and lecturers to create favourable and sustainable learning environments for students. It has the potential to help prospective teachers as well as their lecturers to have access to a variety of learning resources. This can help them to move successfully from one level of thinking to another. It can also help student-teachers to improve or modify their learning styles. It can improve interactivity in the educational system. It can also facilitate the transition of students from school to the labour market and finally the acquisition of jobs.

More still, At the institutional and community level, It can help institutions like the University of Yaounde I, University of Buea, University of Dschang and others already experimenting distance education. It can also help all institutions of learning to establish a realistic vision and mission statement for e-learning. It can motivate practicing teachers to go in for in-service training in ICT. Above all, this study can solve the problem of large numbers of students in our institutions, insufficient human and material resources. It can also help communities to better promote their cultural values and principles necessary for learning in the 21st century. The study has the potential to improve the effectiveness of teachers there by reducing repetition and drop-out in institutions of learning.

Also, at the level of the government, this study can help the government in its planning for education in the country. For example it can help the government realize its objective of programme budgeting by allocating its financial resources properly in priority zones and areas of education like Information and Communication Technologies and e-learning. Finally, this study has the potential to increase not only the quantity of teachers in the country but also the quality of education offered, thus reducing the country's student or pupils – teacher ratio.

1.9 Scope of the Study

This study involves only student-teachers in Government Teacher Training Colleges of all levels in Cameroon. The study is focused on the role of e-learning on the professional development of student teachers. More specifically, the role of e-

learning on practicing teachers', communication skills, technical skills suitable for learning, interactivity/interpersonal skills, teachers' attitudes towards learning with technology, support received by ICT teachers, values and principles suitable for learning in the 21st century, performance in educational technology, and the challenges faced by teachers in the implementation of e-learning.

1.10 Clarification of Operational Concepts

1.10.1 E-learning

E-learning is multi-dimensional and all encompassing, changing according to context, circumstances and interest. As a matter of fact, it is not difficult to define the term e-learning. Naidu (2003:8) defines e-learning as “the systematic use of networked information and communications technology in teaching and learning”. According to COL (2006), e-learning is a term that has emerged to describe the application of Information and Communication Technologies (ICTs) to enhance distance education, implement open learning policies, make learning activities more flexible and enable those learning activities to be distributed among many learning venues. In the same light, Perkinson (2005:104) defines e-learning as “instructional content or learning experiences delivered or enabled by electronic technology”. Latchem (2012:12) points out that “e-learning, or online learning, involves the use, wholly or in part, of the Internet, an intranet (local area network, or LAN), or an extranet (wide area network, or WAN) for course or service delivery, interaction, support or facilitation, assessment and evaluation”. E-learning can be used to describe the delivery of content via the Internet, intranets, audio and videotapes, interactive television (TV), CD-ROM and other electronic means. Also, it may include educational animation, simulations and games, learning management software, electronic voting systems and more, with possibly a combination of different methods being used. E-learning which is online or Web-based can be used in conjunction with face-to-face teaching. In this case, the term Blended learning is used.

As far as this work is concerned, e-learning is a modern strategy or method of teaching and learning which involves Computer-Based Direct Instruction (CBDI) – direct instructions for example, lectures, demonstrations and illustrations facilitated or enhanced by ICTs; Asynchronous Experiential Learning (AEL) – experiential learning

enhanced by the internet and its facilities; Asynchronous Collaborative Learning (ACL) – cooperative or interactive strategy (discussion method) enhanced or facilitated by the internet and its facilities;. Internet Based Problem Solving (IBPS) – a problem-solving method improved by the internet and its facilities; Online Content Representation; (OCR) – the diverse representation and presentation of information on the internet (text, audio, video, audio visual, graphic, picture format) and Online Learning Environments (OLE) – the flexibility, limitless storage, user-friendly, accessibility features or characteristics of an online platform. Electronic applications and processes involved include the internet, handheld devices (personal digital assistance, simple mobile phones, smart phones, and tablets), television and digital radio.

1.10.2 Teaching model or strategy

DED 205(2008:57) and DED 206(2008:26) define a teaching model or strategy as “a framework which specifies the style or procedure of instruction in order to attain teaching and learning goals”. A teaching model or strategy can be useful in the teaching of English Language but irrelevant in the teaching of Biology. An instructional model is helpful in integrating technology in the teaching and learning process. There are several types of instructional models. This study involves direct instructional model/explicit model, indirect instructional model, interactive or cooperative model and experiential model. These models have been adapted by the researcher to conceptualize e-learning. This has resulted to the creation of current e-learning models. These are models that lay a lot of emphasis on the role of the learner in the teaching – learning process. They include Computer-Based Direct Instruction, Asynchronous Experiential Learning, Asynchronous Collaborative Learning, Internet-Based Problem Solving, Online Content Representation, and Online Learning Environment). In this work, models and strategies are used as synonyms. These models describe the various ways teachers behave as they interact with learners to ensure that specific contents are taught since each subject or concept is unique.

1.10.3 Synchronous

Synchronous refers to interactions that occur in real time when learners and instructors are communicating at the same time from different places (COL, 2000:22). McIntosh (2005:5) holds that a synchronous model is a form of group learning, where

the students interact collectively with the instructor in real time, for example through online lectures and seminars. This model uses internet-based synchronous technologies as well as hand held devices like mobile phones, ipads and PDAs. Bates (2005:143) defines internet-based synchronous technologies as those “technologies that operate in ‘real time’ over the Internet”. They include: Internet telephone service (VoIP), Web – conferencing (text and audio conferencing) and Mobile computing using wireless devices. He argues that Web – conferencing currently focuses more on audio, graphical and text communication in real time. Long (2005:17) holds that in this kind of mode, the learner and facilitator interact directly. Feedback may be provided instantaneously by both the student and the facilitator. Semenov (2005:128) points out that a new opportunity provided by computer technology today is bilateral interactivity. According to him, students can answer the questions teachers ask, and ask them questions too all in a written format from wherever they live. In this study, students can communicate with the teacher and with one another in real time via the Internet, telephone and even during face-to-face contacts.

1.10.4 Asynchronous

Asynchronous refers to interactions between students and instructors that do not occur at the same time and place (COL, 2000:22). McIntosh (2005:5) views asynchronous model as “individual learning, where the students access the course material when it is convenient for them”. He argues that this approach can often work well with the functionalist model. Long (2004:17) states that this mode of e-learning is characterized by its nature of learner-facilitator interaction where the contribution of the facilitator is temporally static. According to him, information is presented in recorded format and the learner can interact with it at any time thereafter. He further explains that asynchronous formats may also use online communication but the online learner activity usually is a response to stored data. Here, feedback may be provided by a human or via electronically programmed means.

To conclude, there is a tendency among the large providers of distance education to emphasize the asynchronous approach, since it enables vast numbers of students to be catered for at low cost. The focus on the individual gives students flexibility over when and where they study. It may be the home, the workplace, inside a car. Its convenience and flexibility improves access. Consequently, large numbers of

student enrolment will lead to economies of scale which will decrease study costs for all concerned. There is equally higher academic quality, because the scale allows the provider to make a bigger academic investment. In this study, individual students have the opportunity to access the course material when and wherever they want.

1.10.5 Computer-Based Direct Instruction

Computer-Based Direct Instruction (CBDI) refers to direct instructions for example lecture, demonstration and illustrations to a large group facilitated or enhanced by ICTs. This model is more of teacher centred. DED206 (2008:26) states that direct teaching is effective when material is structured and can be taught in a step – by – step fashion. It is used frequently in higher levels of education. Direct teaching is done deductively or inductively. This model requires the teacher to prepare and presents his or her course outline to the students. It also requires the teacher to present the rules and procedures clearly. It also requires the teacher to establish the competences expected to be developed. It is important for teachers to use direct and indirect models like discussion, role play, and assignments to complement each other.

1.10.6 Asynchronous Experiential Learning

Asynchronous Experiential Learning (AEL) refers to experiential learning enhanced by the Internet and its applications and processes. This model is based on three principles. The first principle is that students learn best when they are involved in the learning experience. The second is that when learners discover knowledge for themselves, it is more meaningful to them. The third principle is that students are more committed to learning when they are free to set their own learning goals.

According to DED 205(2008:68) experiential learning is inductive, learner-centred and activity centred. This model can be viewed as a cycle consisting of five phases. These include observation, sharing, analyzing or processing, transfer of learning and generalisation. It can be used both in and outside the classroom. In classrooms, students can engage in a simulation. Outside the classroom, they can observe for example court room procedures or conduct a survey. Students are motivated when they actively participate and teach one another by describing what they are doing. This strategy greatly increases understanding and retention

1.10.7 Asynchronous Collaborative Learning

Asynchronous Collaborative Learning (ACL) refers to cooperative or interactive strategy (discussion method) enhanced or facilitated by the Internet and its facilities. This involves cooperative planning among peers, interactive planning with students, active participation, peer tutoring and mutual understanding online. This model uses different groupings and methods and has to be well planned before hand. In order to use it well, It is important for the teacher to outline the topic and objectives, state and pay attention on time management, specify the composition and size of the groups, define reporting or sharing skills or techniques. This strategy requires that both the teacher and the student give a lot of attention to observation, listening, interpersonal and Intervention skills and abilities. The teacher must ensure that there are clear guidelines for working collaboratively. There must be procedures in place to deal with conflict resolution within groups and for dealing with students, who do not participate fully, or at all, in group assignments. Participants are expected to be proactive and not retro-active, to develop a win-win attitude, understand one another, celebrate their differences and focus on professional development.

This model uses the web, e-groups, and electronic mobile devices. Collaborative learning using the web is particularly important for courses where students are from different cultures and for continuing professional development, where participants have relevant professional experiences to share and draw from. Digital collaboration includes electronic messaging system, Social media or discussion forums. Semenov (2005:136) views that, discussion in an e-group is not limited in space and time. He explains that discussion can go on in the group as live or be delayed (synchronously or asynchronously). With hand held devices, people are able to create and disseminate information in an unprecedented manner. Bates (2005:140) holds that one great advantage of e-learning is the opportunity for students separated by time and place to work together on a common task.

1.10.8 Internet-Based Problem Solving

Internet-Based Problem Solving (IBPS) refers to problem-solving method improved by the Internet and its facilities. This involves open-ended problems, discovery learning, lifelong learning, mini group projects, large group projects and individual assignments. DED205 (2008:62) points out that problem solving model or

indirect teaching is purely student centred. It involves students in observing, investigating, drawing inferences or forming hypotheses. It takes advantage of students' interest and curiosity. It is flexible in that it encourages students to explore different possibilities. It also encourages students to participate in the learning process without the fear of making mistakes. It fosters creativity and the development of interpersonal skills. Students better understand material and there is transfer of knowledge. The role of the teacher changes from lecturer to facilitator, supporter, and resource person. The teacher arranges the learning environment, provides opportunity for student involvement and gives feedback.

1.10.9 Online Content Representation

Online Content Representation (OCR) refers to the diverse representation and presentation of information on the Internet (text, audio, video, audio visual, graphic, picture format). Text, pictures, and graphic representations constitute visual aids. These are online features that will stimulate learning through the sense of vision. They enable students to access knowledge from different viewpoints. Audio representation refers to online features which stimulates learning through the sense of hearing. Examples include u-tube, online radio, and web phone. Audio-visual representation brings together in a control situation, a combination of audio and visual experiences. Example includes Web Television or TV. These representations have the capacity to stimulate learning because they appeal to human senses. They are capable of teaching on their own or assisting a life teacher to teach effectively. Lessons delivered with the use of these aids can motivate students to learn and remember what is learnt.

1.10.10 Online Learning Environment

Online Learning Environment (OLE) refers to the flexibility, limitless storage, user friendly, accessibility features or characteristics of an online platform. Online learning environment or platform accommodates all kinds of teaching methods and learners. It fosters collaborative study which involves a student learning in partnership with another student or as part of a small group. It also enhances independent study. Independent study refers to the range of teaching methods that are planned and provided to foster the development of initiatives, self reliance and self improvement of students as individuals. Collaboration and communication needs should be considered both for subject based and cross-curricular based teaching.

1.10.11 Professional development

Professional development can be defined as investments or improvements in human capital (acquisition of knowledge, skills, and competences needed for work and life). According to World Bank (2006:32) professional development in teacher training institutions creates and enhances human capital, contributes to the production of social capital (cohesion or social ties), increase economic growth which is an important determinant of economic development and good standards of living. An effective initial professional development of student teachers that is based on e-learning can help an educational system to support the incessant growth and penetration of ICTs in education. In this study, professional development involves teacher education in new communication skills, technical skills using ICTs, interactivity using ICTs, attitude towards learning with respect to ICTs, development of values and principles suitable for learning with technology, innovative and multidimensional delivery strategies like e-learning, mobile learning and blended learning. It also involve pedagogic challenges that teachers of this generation and generations to come are faced with. World Bank former president Paul Wolfowitz stressed that capacity is at the heart of development effectiveness (World Bank, 2006:2). He further argues that capacity is the ability of individuals, institutions, and societies to solve problems, make informed choices, define their priorities and plan their futures.

1.10.12 Interpersonal skills

This refers to the ability to learn with individuals, groups, experts and interaction with content. Interpersonal skills form the basis for interactive or collaborative teaching. It involves a lot of sharing of ideas between teacher and students as well as between students and students. It is mainly through discussion. Students can learn from peers and teachers to develop social skills and abilities to organize their thoughts and to develop rational arguments.

1.10.13 Technical skills

A skill can be defined as a task or group of tasks performed to a specific level of competency or proficiency which often use motor functions and typically require the manipulation of instruments and equipments. Notwithstanding, some skills such as counselling are knowledge and attitude based. Thus, technical skills in this study refers

to the ability to use the internet and web applications such as; e-mails, search engines such as Google and Yahoo, Blogging (that is creating personal mini websites), social networking (for example use of face book or twitter), uploading and downloading of files, mastery of basic computer programs like Word, Excel and PowerPoint, Curriculum mapping/organisation: breaking curriculum into sections that can be assigned and assessed as well as some basic non technological competencies such as problem solving, critical or creative thinking. These skills are necessary for flexibility and adaptation in the field. Keith W, Hesselink F, and Corli P(2005) points out that people should be learning individuals in transforming organisations. Therefore student-teachers are expected to develop these skills in order to be prepared for effective teaching and learning in schools with ICTs.

1.10.14 Attitudes

Guglielmino and Guglielmino (2004:31) identify some attitudes that support self-directed learning. These include having confidence in you as a competent, effective learner, accepting responsibility for your own learning and viewing problems as challenges rather than obstacles, valuing your own learning, a willingness to seek help, creativity and independence in learning. Petty et al (1997) cited in Wood and Wood (2002) states that attitudes are relatively stable evaluation of persons, objects, situations or issues along a continuum ranging from positive to negative. In this work, attitude refers to students' beliefs or thinking, feelings and intentions about e-learning and pedagogic processes. Pedagogic processes include lesson preparation, time management, class management, cost management, selection and organisation of content, delivery of content, selection of strategies and methods, evaluation and publication of results, establishment of trust confidence and flexibility. Institutions of learning need to identify not only knowledge and skills but also attitudes that might be conducive to the creation of sustainable programmes.

1.10.15 Communication skills

Communication skills refer to the different competences involved in effective communication. Effective communication is simply a two way process of sending the right message, that is also being correctly received and understood via e-mails, telephone, teleconference, SMS, group discussions and face to face. It also includes non technological competences such as speaking, listening and writing. There are two

main types of communication (Verbal and Non Verbal). These modes of communication have been, and are being, radically changed by ICTs. For example the Internet, TV, radio, complemented by mobile phones or handhelds helps students as well as lecturers to express their opinions on pertinent issues concerning the school and the society. There is need for education stake holders to redefine their communication strategies and policies with respect to e-learning. Also, student-teachers need to acquire effective communication skills while in training schools in order to be able do their job effectively when they graduate. World Bank (2003:2) outlines requirements of a knowledge economy which include among others: an educated and skilled population to create, share and use knowledge; a dynamic information infrastructure to facilitate the creation, effective communication, dissemination and processing of information. Individuals should value conversation, collaboration and egalitarianism over egocentric or self-centred teaching and learning approaches.

1.10.16 Development of values and principles

Ministry of Economy, Planning and Regional Development (2009:16) view that values such as patriotism, merit, respect for authority, peace, solidarity, integrity, hard work and pride are measuring rods of individual and collective behaviors. In this study, the development of values and principles refers to improvements in peoples' character and moral principles. Moral principles include hard work, punctuality, sharing, and empathy, respect of rights, integrity, humility, confidence, and self control. The role of a teacher in helping students to develop these values cannot be overemphasized. Teachers are the main actors in schools. Schools are ideal places where students' behaviours' and future educational successes are shaped. Teachers are in a position to support the efforts of parents to build a culture of integrity, innovation and excellence in children. The development of values and principles is very important for students. As a matter of fact, students and pupils can be a tremendous resource for disseminating helpful information to parents and other adults in the community. Children can help especially misinformed parents. Most kids today will become parents and leaders tomorrow and will have to ensure or build integrity in their own children.

McIntosh (2005:5) elucidates that e-learning is suitable for the critical literacy model or the reflective learning model where there is much direct interchange with a teacher in a group setting. The reflective model is very important for e-learning where

a student is faced with a multiplicity of competing paradigms, systems of knowledge and information sources of widely varying degrees of reliability. In such a situation it becomes vital to possess the faculty of critical discrimination. Critical literacy is important for developing active citizenship in an e-learning program. Some students will always require compensatory education of one kind or another; and the humanistic approach to education will continue to have an important place. McIntosh (2005:4) links e-learning to UNESCO's 1997 Fifth International Conference on adult Education which states that "learning should be considered a "joy" as well as a tool, a right and a collective responsibility". Ministry of Economy, Planning and Regional Development (2009:16) concludes that "the functioning of society rests on consultation, dialogue, tolerance, mutual respect and recourse to mediation and justice".

1.10.17 Information and Communication Technologies (ICTs)

This consists of hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (for example, voice, data, text, images), as well as related services. Information can be defined as raw data, message, stimuli (signs, symbols) that is specific and organized for a purpose, within a context and can lead to an increase in understanding and decrease in uncertainty. The value of information lies in its ability to effect change. When raw data is processed and conceptualised, it results to knowledge and when that knowledge is used judiciously to solve a real life problem, it leads to wisdom. Communication can be defined as the transmission of information from one person or device to another. Effective communication occurs when information sent by the sender is received correctly or understood by the receiver. Thus effective communication can be described as a two way process. Technology can be defined as the application of the scientific method to solve practical or real life problems or a body of knowledge used to create tools, develop competences, and collect materials. Concerning the capacity of people to access and use Information and Communication Technologies, the Ministry of Economy, Planning and Regional Development (2009:26) states that Cameroon's target in the next 25-30 years is to move the country from a country with low access (Index of 0.16) to the category of average access with a digital access index between 0.4 and 0.5.

1.10.18 Information and Communication Infrastructure (ICI)

This refers to physical telecommunication systems and networks e.g. Internet, radio, television, PDAs, CD-ROMs, telephone. As concerns telephone, the Ministry of Economy, Planning and Regional Development (2009:26) states that Cameroon's objective is to multiply by five the number of telephone lines and increase mobile telephone network coverage in the country. The importance of these technologies in this study cannot be overemphasised.

1.10.19 Teaching

Teaching can be looked at as activities done before, during and after interaction with learners in order to enable learning to occur. The different methods of carrying out teaching include class discussion, lecture, lecture-demonstration, illustrated-lecture, laboratory method cooperative learning. Teaching goes beyond the classroom. The teacher needs to be endowed with new skills in curriculum development and technology, lesson planning, class management, innovative teaching and evaluation strategies. Current teaching and learning strategies are being driven by electronic applications and processes, for example, e-learning, blended learning and mobile learning. Tambo (2012:170) argues that motivation, interest, readiness, reinforcement, differences among learners, similarities among learners, adjustment and transfers of learning are key principles that should be considered for effective teaching. Teaching enables students to find out answers to learning problems. The process of teaching is incomplete without the use of pedagogic resources. These resources have evolved with time from traditional media to advanced media. Thus teaching can be described as the act of stimulating students to learn with the use of educational technology.

1.10.20 Learning (self-directed learning)

Knowles (1975) cited in Guglielmino and Guglielmino (2004:27) defines self-directed learning as "a process in which the learner, with or without the help of others, identifies learning needs, defines learning goals, develops and implement a learning plan and evaluates the learning gained". Latchem (2012:5) views that when learners engage on self-directed learning, they take responsibility for their learning and are able to plan and organize this learning.

1.10.21 Teaching – Learning process

UNESCO and UNICEF (2012:43) point out that the quality of education is ultimately determined by what happens in the classroom. Thus all relevant resources and processes should contribute towards building effective teacher training and development, providing quality didactic materials and improving the working conditions of teachers. Teaching – learning process refers to the reciprocal relationship between teaching and learning, involving the exchange of ideas between students and students, students and lecturers, students and content, students and experts.

1.10.22 Performance in educational technology:

This refers to the overall competences developed by student teachers during the teaching and learning process. These include general knowledge about ICTs in Cameroon, usage of ICTs and creativity (production). This also refers to scores obtained by student-teachers in the course.

1.10.23 Role of E-Learning

Means making assessment of e-learning as a strategy of teaching based on the variables under study (Interpersonal relationships, technical skills, communication skills, knowledge of modern strategies of teaching, development of values and principles and performance in educational technology).

1.10.24 Quality Education

UNESCO and UNICEF (2012:8) point out that the World Declaration on Education for All (drafted at the World Conference in Jomtien, Thailand in 1990), the Dakar Framework for Action recognized the fact that the quality of education is at the heart of education and need to be improved for the sake of relevance and equity. Like Delors et al. (1996), UNESCO and UNICEF (2012:8) conceptualised quality based on four pillars as: learning to know, learning to do, learning to live together and learning to be. They believed that the quality of learning should be assessed by the capacity of individuals to acquire knowledge, skills, understanding and values to live and participate in society from childhood throughout life (UNESCO and UNICEF, 2012:8).

Also, COL (2000:24) defines quality as “the fitness for purpose of a product or service according to a set of required standards”. Quality education is that kind of education which can result to social and economic transformation. This type of education leads to the creation of human capital. Human capital refers to people’s knowledge and skills. It is as important for production as valuable to people who have it. Most human capital is built up through training that increases a person’s economic productivity.

1.11 Synthesis

This chapter examined the problem of the study under the following sub-headings:

- ❖ Background of the study
- ❖ Statement of the problem
- ❖ Purpose of the study
- ❖ Objectives of the study
- ❖ Research questions
- ❖ Research hypotheses
- ❖ Significance of the study
- ❖ Scope of the study and
- ❖ Operational definition of terms

The next chapter will attempt to review related literature on the impact of ICTs and e-learning in particular on the learning environment. This review will be set – up within a framework of theories, models and concepts.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

A lot of research has been carried out in most countries of the world on the future potentials of ICTs in the development process. To date, however, we know very little about the role of e-learning on the professional development of student-teachers. This chapter attempts to review related literature on the role of ICTs and e-learning on the teaching/learning environment. Nevertheless, this review is set – up within a mixed framework of concepts, theories, and models.

2.2 Conceptual Framework

E-learning has become the protagonist for change in education sector. Naidu (2003:12) states that the use of the term e-learning is growing rapidly and is often used interchangeably with terms such as online learning, virtual learning, distributed learning, networked learning, web-based learning, and also open and distance learning. Naidu (2003:12) further stressed that despite their unique attributes, each of these terms fundamentally refers to educational processes that utilize information and communications technology (ICT) to mediate asynchronous as well as synchronous learning and teaching activities. On their part, Garrison and Anderson (2003:18) as well as Cornish (1996:157) contended that knowledge development in the information age is a technologically aided activity. There is an increasing need to do more research on ICTs and most especially e-learning, as the development of human capital is crucial if Cameroon and African countries are to be competitive in the global information society. Ultimately, education must prepare students to be continuous learners. In this section, the themes that form the basis for the theoretical framework for e-learning are elaborated.

2.2.1 The Concept of E-Learning

E-learning is multidimensional and dynamic, changing according to context, circumstances and interest. As a matter of fact, it is difficult to define the term e-learning. Naidu (2003:8) defines e-learning as “the systematic use of networked

information and communications technology in teaching and learning”. On their part, Ding, Gu, and Zhu (2005:64) argues that e-learning is the integration of ICT with curriculum reform and pedagogical innovation in teaching and learning for all sectors of formal education, continuing education, in-service training and lifelong learning. According to COL (2006), e-learning and online learning are terms that have emerged to describe the application of Information and Communication Technologies (ICTs) to enhance distance education, implement open learning policies, make learning activities more flexible and enable those learning activities to be distributed among many learning venues. Moore (1993:20) as well as Laurillard (2000:137) holds that e-learning has the capacity to support interaction as "the true uniqueness of e-learning lies in its multidimensional forms of communication and interaction

In addition, Perkinson (2005:104) defines e-learning as “instructional content or learning experiences delivered or enabled by electronic technology”. He further argues that the term covers a wide range of applications and processes, such as Web-Based Learning, Computer Based Learning, Virtual classrooms and digital collaboration (Perkinson, 2005:104). In the same light, Noe (2002) maintains that e-learning is instruction and delivery of training by computer online through the Internet or the Web. Rosenberg (2001:28-29); Govindasamy (2002:288); Garrison & Anderson (2003:2) stresses that e-learning is teaching and learning that is web-based. They further explain that e-learning helps learners to assume control of the learning process and directly influence outcomes (Garrison and Anderson, 2003:115). Latchem (2012:12) points out that “e-learning, or online learning, involves the use, wholly or in part, of the Internet, an intranet (local area network, or LAN), or an extranet (wide area network, or WAN) for course or service delivery, interaction, support or facilitation, assessment and evaluation”.

It can be deduced from the above definitions that the term e-learning covers a wide range of applications and processes such as Web-based learning, computer – based learning, virtual classrooms and digital collaboration. E-learning can be used to describe the delivery of content via the Internet, intranets, audio and videotapes, interactive television (TV), CD-ROM and other electronic means. Also, it may include educational animation, simulations and games, learning management software, electronic voting systems and more, with possibly a combination of different methods being used. Francoise Caillods in Bates (2001:9) contents that e-learning is more than

just online distance education. He argues that any programme which uses information and communication technology to enhance the learning process may be considered to fall into the category of e-learning. E-learning is a modern method of teaching and learning generally used to refer to the use of new technology in learning in a broader sense than Computer-Based Training (CBT) of the 1980s. It is also broader than the term online learning, which generally refers to purely Web-based learning. E-learning which is online or Web-based can be used in conjunction with face-to-face teaching. In this case, the term blended learning is used.

2.2.2 Blended Learning

Latchem (2012:13) asserts that blended learning combines the traditional “classroom” or “face-to-face” methods of teaching and learning with CD-ROM, Internet-based or mobile-learning (m-learning) to achieve the most appropriate mix of presentation, interaction and “hands-on” learning. Noe (2002:263) defines blended learning as “the use of a combination of online learning, face-to-face instruction, and other methods for distributing learning content and instruction”. Throughout the phase of blended delivery, teachers introduce changes in pedagogical strategies to support the changing requirements of online students. In fact, blended learning is the most popular form of e-learning delivery today. A survey of traditional and blended learning at the National University of Rwanda carried out by Rwagasana and Stucki (2009:67) show that many traditional lecturers much prefer the use of the blended learning approach. The choice of this mode was due to the problem of limited data transmission capacity which proves as a great obstacle to foster pure online e-learning. More still, where mobile technologies are used, the term mobile learning has become more common.

2.2.3 Mobile-Learning (M-Learning)

Latchem (2012:12) states that m-learning, or mobile learning, involves the use of handheld or wearable technologies, thus making learning accessible virtually anywhere. This means of delivery holds great promise for bridging the digital divide because mobile devices are far more common and cheaper than computers in developing and middle-income countries. Traxler and Kukulska-Hulme (2005:5) points out that, m-learning devices are lightweight and handheld, including: Personal Digital Assistants (PDAs), Palmtops or handheld computers, Mobile phones also called cell phones or hand phones. Bakari, Ishaq, Miyedu, Nykvist and Deutschmann

(2009:17) postulate that mobile devices can provide almost all the services that were provided by the stationary personal computers in the past. The cost associated with these handheld devices is also decreasing. An added advantage is that they have lower power consumption usually operate from batteries which makes them less dependent on an uninterrupted power supply. Increased access to learning materials and mobility are two main features of mobile devices that can enhance the learning process. Teachers can provide learning experiences to students irrespective of geographical constraints and the student can learn what and where they want to.

In addition, mobile technologies have the potential to support the learning experiences that are collaborative, accessible and integrated with the world beyond the classroom. Traxler and kukulska-Hulme (2005:5) points out that the University of Wolverhampton in the United Kingdom uses mobile devices to support staff and disadvantaged students in teaching, learning and administration. They mentioned that a number of pilot studies have been carried out to help a group of students with deadlines, revisions and timetabling using Short Message Service (SMS) text messaging; and another pilot study issuing a group of students with Sony key PDAs to help personal organisation, and mobile access to course material. These pilots have led to larger schemes in the university, and to a staff training and support scheme. In the same light, Traxler and Kukulska-Hulme (2005:5) points out that thanks to funding from the Department for International Development (DFID), U.K. through “Imfundo”, the Kenyan government is starting a pilot study that will use bulk SMS text messaging as in-service training to primary school teachers and local support staff across rural and urban areas, linking into other media used in their courses.

2.2.4 Internet or Web-based Learning

According to Quinn (2006:29), the Internet started as the network of networks that communicated using TCP/IP, but today has unquestionably become a new medium or new collection of media, and each medium has its own set of genres. He further explains that January 1st, 1983 could be call the birth day of the Internet, because that was the date on which all ARPANET hosts converted to TCP/IP. Singh (2004:79) holds that the Internet is the core of computer-mediated communication. As a matter of fact, it is the first medium that has technological tools to support multiple forms of intelligence. Jensen (2003:51) argues that the use of the Internet in Africa is

growing very fast. In the area of content, Jensen (2003:61) remarked that the African web-space is expanding rapidly and almost all countries have some form of local or internationally hosted web server, unofficially or officially representing the country with varying degrees of comprehension.

Worthy of note is the fact that the Internet is available in every capital city. There are many mobile phones as there are fixed lines. Hundreds of new local and community radio stations have been licensed and satellite Television is now also widely available. It is also interesting to note that the Internet system is worldwide and connects thousands of computer networks, providing an incredible array of information that students can access quickly and inexpensively. Noe (2002:255) highlights that the World Wide Web (WWW) is a user-friendly service on the Internet that links a variety of Internet materials: it includes texts, photos and graphics. Web indexes or browsers and search engines such as Google, Yahoo! GoTo, Info seek, ERIC, InfoPsych, can help students find the information they are seeking by examining and collecting a variety of sources.

Also, Semenov (2005:131) presumes that learning on the Web is one of the most promising and rapidly developing areas of ICT in education. He argues that at the same time, learning on the web is one of the most complex psychologically and socially controversial fields. Today, computer and internet can provide all the benefits of several media including Radio, Television, CDs and VCDs. Gralla (1999:2) points out that the Internet has become an information superhighway that can do almost everything people imagined could be done by using cable TV in the 90s. The computer can provide a truly interactive environment including simulation. The computer can also be effective in teaching specific subjects. Perkinson (2005:114), reports that the Policy Institute and Leadership Studies Group at the National Institute of Education (NIE) in Singapore, has designed a computer simulation to teach education managers and leaders how to structure an organization. Students go through online processes of planning, implementing, gathering, feedback and reflection and are then able to see the results of their organizational strategies.

More still, in certain settings, e-learning is also being conducted via digital games. Perkinson (2005:112) points out that the U.S military uses games to train Soldiers, Sailors, Pilots and tank drivers to master expensive, sensitive equipments. However, many action games teach essential skills like teamwork, communication as

well as concepts of command and control. Games are very important for experiential teaching and learning strategy.

2.2.5 Digital Collaboration

This refers to the use of technology to enhance and extend learners' abilities to work together regardless of their geographic proximity. Bates (2005:140) holds that one great advantage of e-learning is the opportunity for students separated by time and place to work together on a common task. Indeed, he argues that learning to work together online is an increasingly important workplace skill, and that it provides opportunities for students to share learning experiences, to learn how to work collaboratively and to test and develop their own ideas, without being physically present (Bates, 2005:140). Collaborative learning using the web is particularly important for courses where students are from different cultures and for continuing professional development, where participants have relevant professional experiences to share and draw from. However, the teacher must ensure that there are clear guidelines for working collaboratively. There must be procedures in place to deal with conflict resolution within groups and for dealing with students, who do not participate fully, or at all, in group assignments. Digital collaboration includes electronic messaging system, Social media or discussion forums.

2.2.5.1 Electronic Communication (Messaging System or Electronic Mails)

E-mail stands for "electronic mail" and is another valuable way that the Internet can be used. Quin (2006:29) states that e-mail are systems used for the electronic bulk transmission of reports and memos from one user to many others. In addition, they allow the user to receive and transmit informal note to other users on the network. Memos, reports, and notes are stored in user-specific "mailboxes" which normally are only accessible by the designated owner. Messages can be sent to and received from individuals as well as large numbers of people at once. Students, teachers and experts in the community are able to communicate with one another through the process of e-mailing.

On his part, Semenov (2005:128) view that computers have redefined the way that we communicate. According to him, e-mail has evolved from being a "transporter" of simple text messages to being a document sharing and routine facility.

Through e-mail, Internet communications have increased dramatically in many organizations. As a matter of fact, Information and Communication Technologies make possible new forms of teacher – student communication. E-mail sometimes helps introverts who find it hard to express themselves fluently during face to face. It has the capacity to facilitate the teaching and learning process as it offers every student the possibility to answer the teacher’s question unlike in a traditional classroom where only one or two students are allowed time to answer.

2.2.5.2 Social Media / Discussion Forum

Semenov (2005:136) points out that “in the new paradigm, there is much more space for class discussion with many students participating”. Social media are media for social interaction using highly accessible and scalable publishing techniques. They are relatively inexpensive and accessible to enable anyone to publish or access information. Yassine (2010:14) defines educational discussion forum as “a space open to a small group of learners on an online teaching platform where the latter are expected to communicate among themselves, provide contributions to a topic, and react to messages posted by other participants and share knowledge”. Bezuidenhout (1999:30) reports that a survey to determine whether students access discussion forums and if so whether they benefitted from using these forums show that students felt they had benefitted from the Open Discussion Forums (ODFs) as: some questions resulted in them becoming aware of their own lack of understanding; questions could be posted from the relative anonymity and safety of a computer; forums raised an awareness of areas which needed additional work; students were forced to put their queries into words; a virtual academic presence was available after hours and over weekends, or when either students or lecturer was off campus.

Additionally tutors felt students benefitted from discussions: amongst their peers in problem areas; being raised in tutorials on areas which had not been clarified on the ODFs; amongst students who were too reserved to speak during a lecture. The lecturer felt that the benefit lay in that: for a difficult exercise, an explanation needed only to be given once and all students benefitted; students often answered each other’s queries; this is a form of obtaining formative feedback through peer assessment; students often became aware of a cognitive dissonance as a result of reading the forum postings and were then able to address these problem areas. Also, the lecturer of this

course found the introduction of discussion forums to be highly beneficial in being able to reach all students when answering queries, regardless of the normal constraints lecture times and physical presence on campus; while teaching and learning activities extended beyond the physical classroom as a result of these forums.

2.2.5.3 E-group (Electronic Group)

E-group stands for electronic group which is another form of discussion forum. It is formed thanks to the World Wide Web or Internet. Members of a given e-group have access to the group through their e-mail addresses and passwords. The teacher can participate as a moderator. A moderator always coordinates an e-group. There are moderated and un-moderated e-groups. In a moderated group, the moderator looks at the messages, ensuring they are appropriate for the group. If they are appropriate, the messages are posted. All messages sent to an un-moderated e-group are automatically posted. Semenov (2005:136) views that, discussion in an e-group is not limited in space and time. He explains that discussion can go on in the group as live or be delayed (synchronously or asynchronously). Also, students can search information from the Internet and put in the link function of the group. This information can be retrieved at any time convenient to the student. They can also upload pictures, assignments and other important information in to the group. An example is the electronic group of level three students in the department of foreign languages in the Higher Teacher Training College Yaounde (Kibinkiri, 2014)

An experimental study that involved students of the National School of Engineers in Tunis revealed that online communities via a forum encourages the setting up of groups, creates social and affective links between learners and affords the opportunity of jointly building knowledge (Yassine, 2010:14). The frequency of interactions, their nature as well as their durations could be the result of a fruitful collaboration which is synonymous to quality work. The forum replaces class interactions with distance interactions which have an essentially written language dimensions and a temporal flexibility which exceeds the setting of the classical classroom. Interactions are also made through signs and coding which may be common to all groups or specific to one or several groups.

2.2.5.4 USENET News Groups

According to Gralla (1999:60), USENET is the world's biggest electronic discussion forum, which provides a way for messages to be sent among computers across the entire Internet. People from all over the world participate in discussions on thousands of topics in specific areas of interest called news groups. Students can participate in news groups by reading the messages and responding to them. Also, like e-groups, there are moderated and un-moderated news groups. News groups can increase students' abilities to carry out their research. Thus, students can be encouraged to subscribe to news groups that interest them. Gralla emphasized that the key is that e-groups and USENET news groups allows students to go beyond simple communicating and lets them work together on shared documents.

2.2.5.5 Blogs

Gillmor (2006:25) holds that blogs are a conversational medium on the Internet. According to him, they are typically composed of short essays, also called postings. The postings are shown in reverse chronological order with the most recent items at the top. They have hyperlinks pointing to other web pages. Blogs offer the possibility for students, teachers and all the average Internet users to publish their own works online. Text, audio as well as video material can be published on the Internet free of charge using blogs. Gillmor (2006:25) points out that Bloggers have won the most attention for their writings about highly topical issues in politics, technology and science. He further explains that this important feature of the Internet took off first in the United States. However Blogging is becoming a global phenomenon. Students can make good use of Blogs to learn how to create and manage websites. Students can choose the kind of template or frame, colour, font, and structure that they like for their Blog. Students can learn how to work collaboratively given that the best Blogs gives people the possibility to make comments on important topics or issues. They can equally update their knowledge or obtain the most recent innovations from Blogs.

Moreover, Blogs are similar to Wikis. Gilmore (2006:34) defines wiki as "a piece of server software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has simple text syntax for creating new pages and crosslink between internal pages. According to Aborisade (2009:10) students in the Federal University of Technology, Akure in Nigeria uses computer program Web 2.0 Wiki authoring tool to create some innovative learning

spaces for the learning of English as a second language (ESL) module with focus on academic writing. Learning activities are posted on the Wiki for students to access. In addition, students are able to correct their names, numbers, paste their email addresses, meeting times and venues on the Wiki. They also work collaboratively to write aspects of their term paper, correcting one another. Aborisade (2009:11) points out that the students were encouraged to make comments on group work and their reflection of learning. Consequently a lot of work that was impossible in traditional face – to – face classroom was accomplished at students’ group meetings or on Wiki group pages

2.2.5.6 Chat rooms

Gralla (1999) postulates that one of the most immediate ways to communicate with others via the Internet is to participate in live “chat”. Chat rooms can equally be of help to students as well as teachers just like e-mails, e-groups and USENET news groups. Students can share their experiences through chat rooms. Chat rooms provide opportunities for students to ask questions and receive feedback immediately. Example of chat rooms includes: Yahoo Messenger, hotmail messenger, “Skype messenger”, Facebook. These social networking sites are good in connecting friends, family members, organizations as well as other people. Facebook for example is one of the most popular social media used by different categories of people ranging from students, teachers, parents to politicians. Others like Skype offers possibilities for teleconferencing and videoconferencing at a cheaper rate.

In addition, electronic communications are being increasingly used in problem-based learning. According to Adeoye, Udeani and Oni (2009:15) social networking websites such as “Chat rooms”, “MySpace”, “Hi5” and “Face book” are part of the networks of virtual environments and they allow participants to exchange real live communication. The users of these forums carry on conversations as they would on the telephone, but instead of talking and responding, they type in messages to which others immediately respond.

More still, Adeoye, Udeani and Oni (2009:16) reports that a survey designed to understand how social reality is created and constructed through virtual communication forms and its application among the students in Nigeria Universities show that 37.5% of students use social networking websites regularly while 25% use it sometimes, 17% indicate that they regularly request personal information online, while

43.5% use instant messaging regularly and 30% use instant messaging sometimes. Only 12% of the respondents use the internet to discuss sexual matters while majority 57% disagree. 50% of the respondents indicate that they chat online with strangers on academic work, 25% indicate for personal information, 24% indicate sports, 27% indicate relationships, 20% indicate business and making money and 30% indicate entertainment, 26% religion. In general, participants overstated their satisfaction with the use of virtual environments. However, due to a lot of non academic activities online, the usage may hinder teaching and learning and encourage dubious activities

Perkinson (2005:115) points out that teaching teams at the Law department of Temasek polytechnic in Singapore have, for example introduced on-line inquiry and routine discussion forums into paralegal training. Students collaborate in teams to conduct a series of online inquiries and client interviews. Using online forum, students post questions and probe their clients who are online twice per week.

2.2.6 Mobile / Cell Phone

Quinn (2006:25) explains that today, there are a number of mobile devices which can provide almost all of the services that were provided by the stationary personal computers in the past. The cost associated with these handheld devices is also decreasing. An added advantage is that they have lower power consumption and usually operate from batteries which make them less dependent on uninterrupted power supply. Some mobile phones or cell phones provide direct access to the wireless Internet, also known as Wireless Application Protocol (WAP). Web pages designed use mostly text and very few images. Also, some cell phones provide a port connecting a cable to your Laptop, PDA, or handheld –computer. You can access a site you like without being limited to the small display of your cell phone. The cell phone has given way to what is now commonly called teleconferencing. Increased access to learning materials and mobility are two important features of mobile phones that can enhance the learning process. Teachers can provide learning experiences to students irrespective of geographical constraints and the student can learn what and where they want to. Moreover, mobile technologies have the potential to support learning experiences that are collaborative, accessible and integrated with the world beyond the classroom.

Bakari, Ishaq, Miyedu, Nykvist and Deutschmanm (2009:18) report that in January 2009, a survey (pilot group) of 13 students, using qualitative questionnaires and focus group discussion, were conducted in Tanzania to get a view of students' attitudes towards technology and the use of mobile phones in their studies. Results revealed that of these, twelve had more than three years experience of mobile phones. All of the students agreed or strongly agreed with the statement "learning through mobile phones is feasible and productive". Twelve (12) of the thirteen (13) thought that the use of SMS for quizzes and assignments was useful or very useful, Eleven (11) students out of thirteen (13) found the text material in the mobile phones easy or very easy to read. All the 13 agreed that the mobile phones would increase their possibilities to be successful in their studies. Some of the reasons mentioned were: "course material is now "close to me", available on time as text, voice and media files, communication is improved and updated course information can be communicated, the Internet access possibility in the mobile phones makes it easier to find material, continuous assessment is made possible and networking with fellow students is improved".

2.2.7 Personal Digital Assistance (PDA)

Gralla (1999:54) argues that PDAs also known as Palmtop devices can perform the basic functions performed by a computer connected to the Internet. They are best for storing and organizing a limited amount of information and for voice communication. Thus immediate feedback is possible. These items are relatively affordable and are extremely portable. For example 3COM's Palm series can literally put the Web in the Palm of your hands.

In addition, Cell phones and PDAs have paved the way for what is now termed mobile learning. COL (2005) report that using these technologies, people can learn when, and where it is convenient for them and that "we have reached learning on demand". In fact, using these devices to transmit information from teacher to learner or from learner to teacher concerning assignments and content can vastly speed up communications. Also, text-messaging capabilities of mobile devices allows learners to communicate with each other thus creating a learning community that extends far beyond the life and confines of traditional or even computer-based learning environments.

2.2.8 Television

Quinn (2006:27) points out that the first complete electronic television transmission was made in 1927 by Philo Farnsworth (1906-1971). He further states that Television's ability to send a message around the world was demonstrated in July 1969 when hundreds of millions of people watched on live TV astronaut Neil Armstrong stepped from the lunar module on to the surface of the Moon (Quinn, 2006:27). Gralla (1999:105) believes that television technology is developing in ways that will make it more interactive like the Internet. Every day, TV and the Internet are drawing closer to each other through cable modems and TVs that connect to the Net. For example using some TVs today, you can watch or follow a sporting event and simultaneously chat with others on the same screen. These TVs come with a remote control unit that allows you to scroll, move around the screen and "click" on objects. Semenov (2005:129) points out that TV and videotapes add something to the traditional lecture: you can see lecturers at their best time of the day, the voice is clear and the face is close. Also, TV and the Internet have given way to what is now called videoconferencing.

2.2.9 Digital Radio

According to Quinn (2006:26), the power of radio as a medium of mass communication was demonstrated in 1938 in New York. Since then, the Radio has evolved from analogue to digital. A digital radio is one, which uses a compressed digital format for transmission. It is the biggest leap in radio technology for many years, bringing improved sound quality, more stations and new features. The digital radio is very flexible and ensures the end of confusing frequencies. It has no barriers in international communication. This is because it facilitates programming with an enhanced level of interactivity and feedback. Feedback is one of the things that make communication effective. Since this is possible with digital radio, communication is effective thus enhancing the teaching and learning process.

Barnard (2000:10) argues that of all the major mass communications media, radio is perhaps the most ubiquitous and most easily available. It is also the hardest from which to escape. In fact, for most of us, life without radio is difficult to imagine. The portability and small size of radio sets enables listening in bedroom, bathroom, and kitchen and beyond the home. The radio also called universal medium is one of the

least expensive methods that can be used to reach a large audience and / or one spread over a wide geographical area, for example Chariot FM 93.5 at the University of Buea. Semenov (2005:129) reports that in some regions and communities, many people already receive general education by means of radio. The cheapness of radio sets is such that most students in developing countries can afford.

2.2.10 E-Learning Continuum towards Web-Based Learning

According to World Bank (2006) the aforementioned evolution of e-learning models depends to a great extent on access, subscription or ownership and use of information and communication infrastructure especially the Internet. Also, Perkinson (2005:113) propagated that educational institutions across the world are positioned at different points on the road map between Campus or Classroom – based learning and Web-based learning. The figure below shows the path that many higher education institutions in both developed and developing countries are traversing towards cost – efficient web-based delivery.

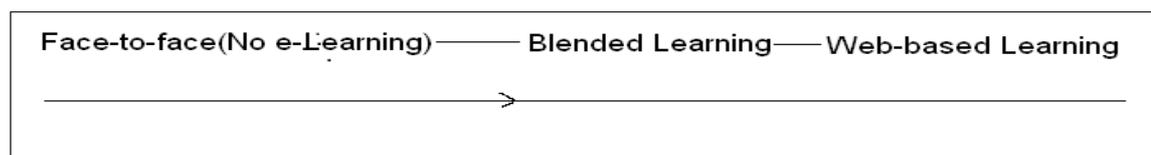


Figure 2.1: Continuum towards Web-Based Learning, kibinkiri (2013)

Furthermore, Perkinson (2005:113) stipulates that e-learning can use any of the delivery modes of the classroom, blended classroom or pure online delivery. On-campus classroom delivery can include bringing Internet sites of relevance and interest into the classroom. Students can also access topics or course materials using multimedia technologies, but do not replace traditional teaching methodologies.

Also, Blended classroom delivery (asynchronous e-learning) can partially replace face-to-face teaching with online learning. Because of the limitations of online learning related to technology (e.g. insufficient bandwidth, lack of high-speed Web connections), learners' preference for face-to-face contact with instructors and other learners, many institutions are moving to a hybrid or blended learning approach. Noe (2002:452) defines blended learning as "the use of a combination of online learning, face-to-face instruction, and other methods for distributing learning content and instruction". Throughout the phase of blended delivery, teachers introduce changes in

pedagogical strategies to support the changing requirement of online students. In fact, blended learning is the most popular form of e-learning delivery today.

Rwagasana and Stucki (2009:67) reports that the Centre of Instructional Technology (CIT) created in 2003 in the National University of Rwanda promotes blended learning combined and enriched with Open Educational Resources (OER) at NUR. The choice of this mode was due to the problem of limited data transmission capacity which proves as a great obstacle to foster pure online e-learning. Furthermore, survey has shown that many traditional lecturers much prefer the use of the blended learning approach. The e-learning unit of CIT organizes for NUR teachers, at a regular basis, workshops in ICT applications, Internet and e-learning pedagogy and techniques as well as the use of OERs in teaching and learning.

On the other hand, pure on-line delivery (synchronous e-learning) is located at the more advanced end of the continuum, where student access either intranet – based or internet – based learning objects (distributed learning systems), downloading topics or course materials and contacting tutors and each other entirely over the Web.

2.2.11 Factors Influencing the Growth and Development of E-Learning

Naidu (2003:12-13) points out that e-learning appears to be growing out: “from within educational institutions, which have offered open and distance learning programs either in a single, dual, or mixed mode. These institutions generally have a great deal of expertise and infrastructure to support learning and teaching in the distance mode. For them, the integration of information and communications technologies in their educational programs is a natural progression as access to these technologies improves; from conventional educational institutions applying information and communications technologies to support and enrich their campus-based face-to-face learning and teaching experiences. Their goal, in most cases, is to increase flexibility and efficiency in the belief that doing so will enable them to tap onto markets and student populations, which were previously out of their reach and from the corporate sector, many of which are favouring e-learning over residential workshop-based approaches to staff training and development. The corporate world is increasingly finding e-learning to be an attractive model as it searches for flexible and 'just-in-time' learning opportunities”

Moreover, Naidu (2003:13) postulates that the following factors are responsible for the growth and development of e-learning:

- The increasing accessibility as well as the decreasing costs of information and communications technologies;
- The capacity of ICT to support and enrich conventional educational practices through resource-based learning and synchronous and asynchronous communication.
- The need for flexible access to learning opportunities from distributed venues such as the home, workplace, community centre, and the conventional educational institution.
- The demand from isolated and independent learners for more equitable access to educational opportunities and services.
- The belief among many educational institutions that the application of ICT will enable them to increase their share in an increasingly competitive educational market.
- The need, among educational institutions, to be seen to be 'keeping up with the times' (with the integration of ICT) in order to attract the attention of parents, students and other funding donors.
- The belief and the expectation that online learning will reduce costs and increase productivity and institutional efficiency

Noe (2002:257) argues that there are three important characteristic of e-learning:

1. E-learning involves electronic networks that enable information and instruction to be delivered, shared, and updated instantly.
2. E-learning is delivered to the trainee or learners using computers with Internet technology. It could also include other mass media.
3. It focuses on learning solutions that go beyond traditional learning. E-learning goes beyond training to include the delivery of information and tools that improve performance. Also, some of the features of e-learning include collaboration and sharing, links to resources, learner control, delivery, and administration. The figure below shows the various features of e-learning

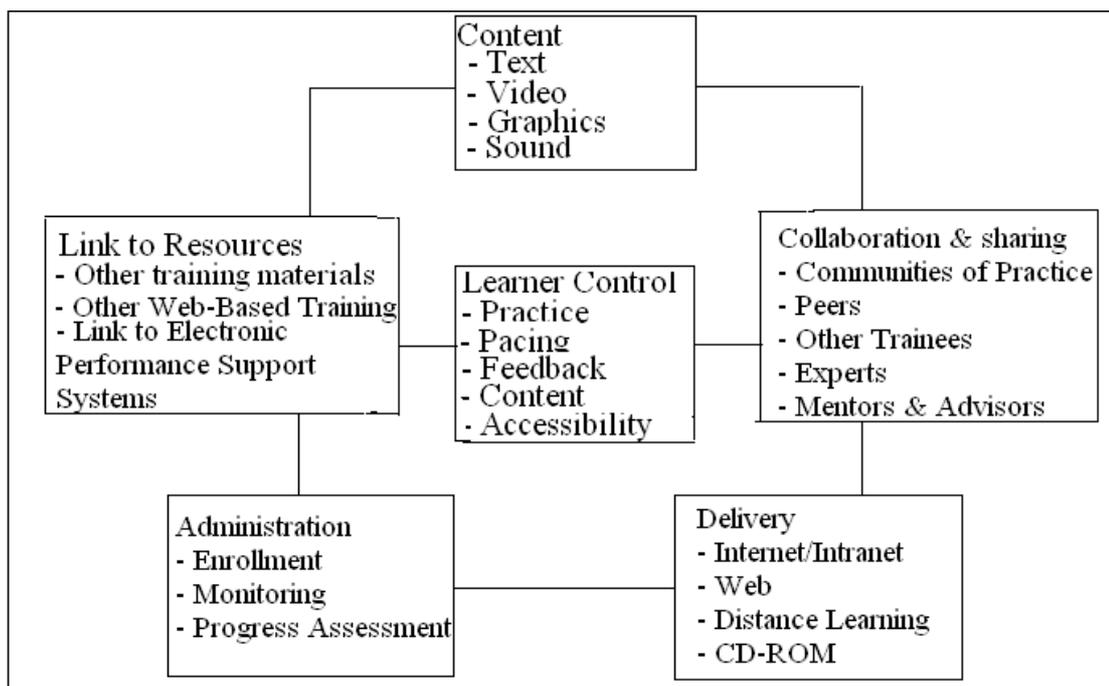


Figure 2.2: Features of E-Learning, Adapted from Noe (2002:258).

As shown in the figure above, e-learning not only involves providing the students with content, it also can give learners ability to control what they learn, the speed at which they progress through the program, how much they practice, and even when they learn. In addition, e-learning allows learners to collaborate or interact with other learners and experts, and provides links to other learning resources such as reference materials, school websites, and other learning programs.

Keegan (2000:90) stipulates that the Internet as an educational tool offers a global open platform for information storage and display in text, graphic, audio and video format as well as communication tools for synchronous and asynchronous interaction. Text, video, graphics, and sound can be used to present course content. E-learning may also include various aspects of administration such as course enrolment, testing and evaluating students, and monitoring of students' learning progress. Various delivery methods can be incorporated into e-learning including distance learning, CD-ROM and the Internet. Santrock (2004:332) concludes that computer – assisted instruction involves using computers as tutors to give students practice, to assess students' level of understanding, and to provide additional instruction if needed.

2.2.12 Learning (self-directed learning)

Knowles (1975) cited in Guglielmino and Guglielmino (2004:27) defines self-directed learning as “a process in which the learner, with or without the help of others, identifies learning needs, defines learning goals, develops and implement a learning plan and evaluates the learning gained”. Latchem (2012:5) views that when learners engage on self-directed learning, they take responsibility for their learning and are able to plan and organize this learning. The learners who are most likely to be successful in this process are those who have the highest levels of readiness for self-directed learning: a complex mixture of knowledge, skills, attitudes and habits (Guglielmino and Guglielmino, 2004:29). Sagna (2005:51) holds that people learn effectively by pursuing realistic goals, which are also intrinsically motivating and that learning is greatly enhanced when it is anchored or situated in meaningful and authentic problem solving contexts

2.2.12.1 Self-Knowledge

According to the Oxford advanced learners dictionary, knowledge is understanding or familiarity gained by experience. Brown (2002:55) states that knowledge is like an iceberg, where ten percent is explicit and visible, and ninety percent tacit and invisible. The tacit structures, the practices-the professional practices, the social practices, and the institutional practices are like the roots of a tree that underlie the visible and explicit-the trunk, branches, and leaves that you see. So the challenge we face in education is not just looking at how to add new leaves and new branches to the tree, but sometimes going back and thinking about the root structure, the tacit structures, the social practices underlying the explicit. In the same light, World Bank Institute (2007: xiii) describes knowledge as “the heart and mind of economic development”. It further explains that the role of tertiary education in the construction of knowledge economies is crucial in tackling unresolved problems such as expanding education coverage in a sustainable way, inequalities of access and outcome, educational quality and relevance, inflexible governance structures and management practices (WBI, 2007:25)

Also, Sharp et al. (2001:10) argues that ICT capability for children and teachers is built up over time from experience, reflection and review. It is not the kind of knowledge that can be quickly 'transmitted' or delivered, but is developed through

an open attitude to practical exploration, asking questions and sharing ideas with others, from technique tips to concepts and contexts for use. On his part, Waite (2004:19) stressed that the success of ICT in transforming the nature of teaching and learning and giving children skills for working life will depend on its congruence with teachers' existing constructs of what their own 'job' entails. Lucy and Guglielmino (2004:30) points out that “readiness for self-directed learning requires self-knowledge: an understanding of yourself as a learner based on an honest appraisal”.

2.2.12.2 Attitudes

Petty et al (1997) cited in Wood and Wood (2002) states that attitudes are relatively stable evaluation of persons, objects, situations or issues along a continuum ranging from positive to negative. Also, Breckler (1984) cited again in Wood and Wood (2002) points out that most attitudes have three components:

1. A cognitive component (beliefs)
2. An emotional component (feelings)
3. A behavioural component (predisposition)

In addition, Guglielmino and Guglielmino (2004:31) identify some attitudes that support self-directed learning. These include:

1. Having confidence in you as a competent, effective learner.
2. Accepting responsibility for your own learning and viewing problems as challenges rather than obstacles
3. Valuing your own learning.
4. A willingness to seek help.
5. Creativity and independence in learning.

Mezirow and Associates (2000:8) asserts that it is very important in adulthood that people develop a more critical worldview as they seek ways to better understand their world. This means learning how to negotiate and take action on their own objectives, values, feelings and meanings rather than those they have uncritically taken in or learn from others. Thus developing more reliable attitudes, exploring and validating their faithfulness, and making informed decisions are fundamental to e-learning as a new strategy or method of teaching and learning. In the same light, Tennant (1991:197) points out that the meanings that learners attach to their

experiences may be subjected to critical scrutiny or reflection. Mezirow (1995:46) argues that critical reflection “is a process by which we attempt to justify our beliefs, either by rationally examining assumptions, often in response to intuitively becoming aware that something is wrong with the result of our thought, or challenging its validity through discourse with others of differing viewpoints and arriving at the best informed judgment”.

2.2.12.3 Skills and Habits

Guglielmino and Guglielmino (2004:34), postulates that basic academic skills are an important part of readiness for eLearning, especially reading skills. Also, depending on the instructional design, writing skills can also be critical. Self-directed learners are also usually skilled at identifying and analysing their learning needs. Key skills related to meeting learning needs include the ability to set learning goals, develop a learning plan, identify resources for learning (both human and material resources), implement the learning, and evaluate the learning. Moreover, habits such as systematic planning, productive organisation of learning media and materials, and completing tasks within the time scheduled can streamline and anchor effective eLearning.

2.2.13 Lifelong Learning

Francoise Caillods in Bates (2001:9) propagates that e-learning is a chance for lifelong education to become a reality, and not a mere slogan. Dave (1976) in Thorpe (2005:24) views lifelong learning as “a process of accomplishing personal, social and professional development throughout the life-span of individuals in order to enhance the quality of life of both individuals and their collectives”. In the same light, Bates (2005:133) defines lifelong learning as “any form of deliberately chosen learning activity by a person outside the conventional campus-based school or college system”. According to him, this form of learning could be for pleasure, intrinsic interest or for career development. Also, Jung (2005:79) points out that lifelong learning is a process that people undertake to acquire knowledge, skills, and values needed for personal and occupational development throughout their lifetimes; often linked to adult learning. In the same light, Ding, Gu and Zhu (2005:63) defines lifelong learning “as an activity whereby individuals are able to choose learning resources and strategies based on their career requirements and personal needs, and to engage in learning at any time, in any

place and with any curriculum”. They argue that in the implementation of this vision of lifelong learning, ICT-based Distance Education and e-learning are playing and will continue to play a key role.

World Bank (2003:3) states that a lifelong learning framework encompasses learning throughout the life cycle, from early childhood to retirement. It includes formal, non formal and informal education and training. Formal education refers to schooling and includes structured programmes recognized by the formal education system and lead to approved certificates. Non formal education refers to education out of the formal school system and includes structured programmes not formal recognized by the national system e.g. apprenticeship, training programmes and structured on-the-job training. Informal education and training refers to education that one acquires from birth till death and includes unstructured learning, which can take place almost anywhere, time, community or workplace. World Bank (2003:3) further explains that the skills and technology gap between developing countries and industrial countries will grow or continue to grow if they do not promote lifelong learning opportunities. Thus lifelong learning is vital in enabling workers to compete in the global economy.

Furthermore, WBI (2007:127) stressed that lifelong learning is an important building block for all countries at all levels of development. It further pointed out that the challenge is to implement educational practices that develop a learner’s ability to learn, create, adapt and apply knowledge. WBI (2007:128) states that in developing countries, five main policy actions are suggested for pursuing a lifelong learning strategy:

- Improving access, quality, and equity throughout the formal education system;
- Ensuring foundation skills for all;
- Recognizing all forms of learning, not just formal courses of study;
- Mobilizing resources and rethinking resource allocation across all sectors, settings, and over the life cycle;
- Ensuring collaboration among a wide range of partners.

In addition, Halimi (2005:18) presumes that Lifelong learning presents higher education with a new challenge. Considering the advantages it offers for individuals, for businesses and for society as a whole, Sagna (2005:58) emphasized that efforts must be made to encourage its development, which will inevitably involve the

introduction of special measures. Thorpe (2005:26) points out clearly that the introduction of new media requires in effect, a complete rethink and redesign of teaching systems and staff skills. Sagna (2005:57) asserts that lifelong learning and e-learning helps combine work and training. He further explained that it has open up new horizons for the many information workers in Senegal for whom the future in terms of personal and career development prospects had previously seemed bleak. McIntosh (2005:2) presumes that lifelong learning is a crucial response to the challenges of the global knowledge economy and that countries across the world are struggling to find the resources to sustain their existing structures. They are challenged by innovative approaches and methods of teaching and research.

2.2.14 E-Learning and Women

Information and Communication Technologies have the potential to eliminate barriers and disparities between people and can improve the lives of women because access offers new economic and social opportunities. An analysis of data obtained from discussions with female students of the Higher Teacher Training College Yaounde selected for the PanAf project revealed that female students now use social media such as Facebook, Hi5, more for pedagogic reasons than for friendly relationships. The study showed that female students prefer to use the wireless connection on campus for their research since they have limited means to buy textbooks (Nkehsera, 2011:28). Nkehsera (2011:28) concludes that “the Internet is not as dangerous as people think; teachers should let students’ especially female students use social networks at school”.

Moreover, a qualitative study carried out by Yeba and Sama (2011:23) in three higher institutions of learning in Central Africa (The Higher Teacher Training College Yaounde in Cameroon, Higher Teacher Training College Bangui in Central Africa, and the Institute of Teacher Training Brazzaville in Congo) indicate that the most convenient point of access to the Internet for both male and female learners is the school. The study shows that there are no gender differences in schools as all learners have equal access to the Internet. On the other hand, gender differences exists only when it comes to Cyber Cafes which is the second most convenient because of girl’s perception of themselves and public opinions that prevent them from visiting public access points mostly frequented by men. The study also revealed that the least

convenient point of access is the home and mobile handsets. As regards mobile handsets, the only institution where it is being used is the Higher Teacher Training College Bangui. Results from group discussions also show that both males and females mostly use ICT for pedagogic reasons.

However, Nankya (2011:10) pointed out that female students of the PanAf project participating secondary schools in Uganda and Kenya indicate that cybercafés are becoming a major point of access to the Internet as a channel for knowledge sharing, acquisition and social networking, especially among students who do not have connectivity at home and are denied access to the Internet at school. She reported that in Cybercafés', Female students are able to engage in academic debates with their friends on Facebook, learn new languages, Graphic Designs, Religious Studies and history contrary to the belief that when girls access or visit Cyber Cafes their main intention is to surf pornographic materials.

2.3 Review of Related Literature

2.3.1 The influence of modern technology on the learning environment

Noe (2002:250) demonstrated that the Internet is primarily responsible for creating our revolution on learning. Internet technology has permitted the development of electronic networks that integrate voice, video, and data connections among learners, instructors and experts. Halimi (2005:16), remarks that the Internet has had a major impact on the learning environment. She argues that with the mass of information available on Web, teachers have to acquire a new skill, that of guiding students to learn how to learn. Nevertheless, Glickman (1985:5) states that research findings on the effectiveness of schools show that most schools simply do not make much difference in their students' lives. He also argues that "effective schools have faculties with a clear, collective purpose toward which they work" (Glickman, 1985:16). Beebe (2003:72) holds that traditional academic institutions are being challenged to search for innovative solutions to better create and apply knowledge. The figure below shows how the learning environment has changed.

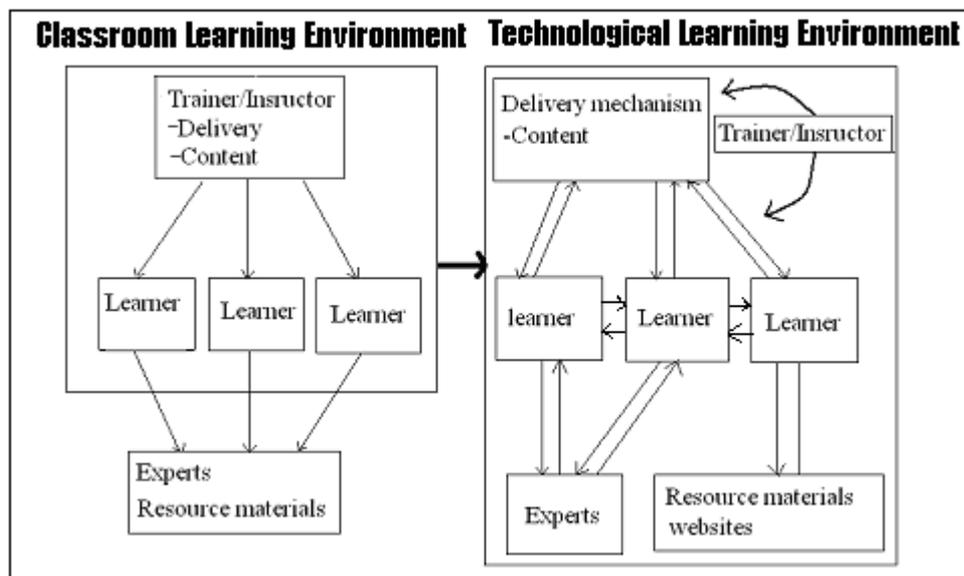


Figure 2.3: How technology has changed the learning environment. (Adapted from, Noe, 2004:250).

Learning was a very linear process as shown on the left side of the figure above. That is, instructors or teachers presented information to the learners, practice and applications then occurred after instruction was completed. Here teachers speak and learners listen. In practice, Semenov (2005:101) states that traditional schools are seen as teaching institutions. According to him, in such schools, teachers and administrators have little time to think about schools as learning institutions and do not consider it a pressing priority. The learning environment includes only the instructor or trainer and the learners. In addition, Bezuidenhout (1999:28) points out that in teaching large classes in a conventional set up, the educationally beneficial informal interaction between students and between lecturers and students is generally reduced, while effective use of both students and lecturer's time is often a challenge

In addition, Sun, Shirley and Liu (2003:1) share the view that in the traditional classroom, students learned to depend on tutors for their motivation, direction, goal setting, progress monitoring, self-assessment, and achievement. A fundamental limitation is that students have little opportunity to conduct and manage their learning activities, which are important for knowledge construction. Students played a passive role in learning. Communication on course content was one-way from the instructor to the learner. Experts and resource materials were separate from the learning environment.

However, technology has allowed learning to become a major dynamic process. As shown on the right side of the figure above, the learning environment has expanded to include greater interaction between learners and the learning content as well as between learners and the instructor. Also, learning occurs as well through interaction with experts (engineers, managers, educators). Hyperlinks take the learner to other websites. Experts and resource materials are part of the learning environment. Palloff and Pratt (1999) conclude that interaction in all its forms (between and among learners, learners and educators, learners and information on content) is an essential element in the learning process. Muyinda, Jude, and Lynch (2009:31) emphasized that teachers and textbooks are not longer the sole fountain of knowledge. What the students need is empowerment to be able to choose from the multitude of information around them. This empowerment is possible under the constructivist learning paradigm because it promotes independent learning.

Also, Semenov (2005:91) postulates that the use of ICTs potentially offer increased possibilities to positively impact teaching and learning in a world where the number of technically savvy students with a preference for using new technologies for ‘anywhere’ anytime learning will continue to grow. This newer breed of learner is better adapted to distance learning based on ICTs that promote learner – centred, self – passed learning. Without doubt, face – to – face exchange remains important in most forms of educational delivery. However, the use of new technologies increases the capacity for new and better ways of knowledge – sharing and teamwork. According to Gurtas (2009:7), students need to develop twenty first century skills (technology and media literacy: effective communication; critical thinking; problem solving; collaboration) today in order to be able to become tomorrow’s innovators. They must use those skills to work their way up the knowledge chain – to move from simply accessing and memorizing information to analyzing and utilizing that information to innovate. This also provides the ground work for lifelong learning.

In addition, Glickman (1985:19) postulates that effective or modern schools have: a particular instructional focus; student time spent on work corresponding to that instructional focus; continual monitoring and checking of students’ work by teachers; teacher time spent on instruction rather than peripheral duties; consistent classroom rules; teacher reinforcement of correct behaviour and avoidance of punishment;

teacher expectations that students will succeed; homework assigned and corrected daily by teachers.

More still, Perkinson (2005:114) reports that in a recent study of 30 universities in the United States that have introduced e-learning, preliminary results showed that all institutions had reduced their costs by about 40 percent on average (the range between 20 and 84 percent). The study projected that the estimated savings of the Universities involved would be close to US\$3.6 million each year. Also, this study, that involved more than 50,000 students nationwide, concluded that online instruction improved student attitudes toward learning, attendance, and mode of instruction and completion rates. Today, many US corporations are putting greater demands on institutions of higher education to produce graduates who can easily use new learning technologies (e-Learning) in the work place.

Also, according to Perkinson (2005:108), between 2000 and 2002, training in US Companies delivered in a classroom dropped by almost 10 percent, while training delivered via learning technologies especially e-learning increased by 12 percent. More still, most students enrol in the University and begin employment with the expectation of using the internet both in their everyday lives and to support their daily work activities by accessing specific resources or acquiring work-related knowledge.

Also, Ezendu and Rui (2005:4) carried out a study on the impact of e-learning on China education and Research Network (CERNET). This study which comprised 81 students (71%), 25 teachers (21%), 3 educationalist (2%) and 7 others (5%) in some 10 higher institutions, reported that 37 out of 120 respondents (31%) use Internet for research, 16 out of 120 (13%) use Internet for the purpose of entertainment, 41 out of 120 (34%) use it as information provider and the other 12 people (10%) say it helps them to connect with others. Also, 67% (80 out of 120) respondents use Internet for the purpose of education. More still, 79% (95 out of 120) of all respondents say they surf on the Internet daily, 8% of the previous proportion is hanging on the net every day. A further 50% use the Internet at least once a week while another 7% use it monthly. In addition, most of the respondents showed an amazing familiarity with internet: 35% of them have used it for more than 3 years and 29% have used more than 2 years but less than 3 years. Also, 33% of them have used Internet as a tool for more than 1 year but less than 2 years. Only 3% of them have used it less than 1 year.

Moreover, in an international conference on “e-learning for knowledge-based society” in Bangkok, Thailand, Guunawardana (2005:1) explains that in a survey of some 24 institutes selected from different specialization areas in Sri Lanka, the awareness of e-learning is very high but investment to develop an e-learning application is very poor. Also, most of them use Internet related e-learning sites just for the sake of it and not to do real on-line learning. Further findings reveal that these institutes have also been using e-mail and Internet in addition to developing web pages for transaction with students. They have also planned to invest funds in future in the selected areas of the e-application.

Also, in a survey of eight secondary schools in Cameroon to better understand how the nature of the conditions in the integration of African countries, favour the successful integration of information and communication technology in the school system: to ensure quality education, Tchombe in Fonkoua (2006:40) concludes that the integration of ICT has had a motivating effect on students as evident in the responses obtained from principals, students, teachers and parents. For example, the principals made reference to the influx of students during the hours of use and other hours. They also mentioned the fact that computer excited the students and generated more interest in school among them; the cyber café attendance and afternoon computer classes were evidence of this interest. Also, reduced absenteeism demonstrated the positive effect of the integration of ICT as a result of the manifested interest of the students. More still, 71% of the students: boys (38%) and girls (33%) affirmed that ICT greatly facilitates the production of schoolwork. Also, 80% of the teachers contended that the students focus more on learning task when working with the computer. Parents interviewed mentioned that their children talk about the computer and Internet and they find that they were very interested.

Notwithstanding, Mbangwana and Mambéh (2004:161) carried out a survey on “Cameroon State University students and teachers’ instructional use of ICT”. The study, which comprised 584 students and 111 teachers of the University of Buea, Douala and Yaounde, showed that:

- University teachers significantly use computer and Internet based resources to support traditional teaching approaches than new teaching approaches. T-Test results were Z-calculated (10845) and Z-critical (1.645).

- Students infrequently use computer and Internet based resources to support traditional learning approaches than new learning approaches. T-Test results were Z – calculated (0.733) and Z - critical (1.645).
- Students frequently use computer and Internet based resourced for instruction more than teachers: Z -calculated (9.78) and Z -critical (1.645).
- Students are more confident and knowledgeable about the instructional use of computer and Internet than their teachers: Z – calculated (0.775) and Z – critical (1.645).

A survey of traditional distance learning students at Makerere University using a questionnaire sectioned along the constructivist learning paradigm components and an interview through e-mail prompts sent to the respondents by the lecturer, indicate that there was good learner-learner and learner-lecturer collaboration through either electronic or non-electronic media (Muyinda, Jude, and Lynch, 2009:32). Electronic communication employed e-mail, cell phones, and the discussion board. Fifty two percent (52%) of the learners confessed having received updates on the IT II course from their course leaders during residential sessions. 88% had an e-mail address prior to the commencement of IT II online course. Sixty four percent (64%) sent at least one email to their classmates, while 62% sent to their lecturer. The mobile phone was used for learner-learner collaboration by (38%) of the learners while the discussion board was used by 42% of the learners to discuss topical issues posted in the BBLMS by the lecturer or learners. there was constructivist learning. Also, Muyinda, Jude, and Lynch (2009:33) revealed that learners (81%) concurred that the face to face tutorial and the one page step by step guideline on how to use the BBLMS (Blackboard Learning Management System) were sufficient to let them participate in online learning. Consequently 58% were able to construct their own knowledge by discovering new features of the BBLMS that were neither taught in the face to face tutorial nor specified in the one page guide. From the knowledge constructed, 84% of the learners were able to improve their ICT skills level.

In addition, Rwagasana and Stucki (2009:68) reports that a survey carried out in the National University of Rwanda in 2008 and 2009 of first year students in computer science and by students in other departments show that students taught in blended learning mode coupled with usage of Open Educational Resources (OERs)

obtained an average note of 13.5/20 while the average for those taught with traditional model was 11.2/20. Increased student's motivation, interest and better understanding of physics concepts were obtained. 65% of students taught in the blended learning mode with OERs placed physics at the first choice among all subjects while only 41% of students taught with traditional method made it their first choice. 85% of first year computer science students expressed their satisfaction and preference of the new method of teaching and learning. Results also show that students taught in a blended learning mode coupled with the use of OERs gained new ICT skills and knowledge that they can use in many other conditions.

2.3.2 Advantages and Challenges of E-Learning

2.3.2.1 Institutional Advantages

COL (2006) presumes that the growth of e-learning will have a transformative effect on open and distance learning that may be difficult at first, but more profound and positive in the longer term. It further explained that this will help overcome physical distance, solve time or scheduling problems, expand the limited number of places available, accommodate low or dispersed enrolments, make best use of limited number of teachers available and deal with individual differences. This will definitely lead to cost savings.

According to Jelmam (2009:153), e-learning courses delivered online as opposed to on-campus classes have a multiplicative factor: one e-learning course well prepared and designed can be delivered in several campuses or Universities in a flexible manner. The problem of inadequate qualified teachers can be overcome in part by computers and other forms of distance education that deliver instruction in a cost-effective manner. In addition, e-learning can facilitate contact between schools, prepare students for high-skilled employment, deliver staff development programs and provide specialized courses. Terry and Daryl (1996) comment that there is scarcely a modern University that is not significantly involved in distance education. Distance education is distance from the classroom, distance from sitting at the foot of the professor, and distance from the physical campus.

Perkinson (2005:114) postulates that e-learning facilitates access to international faculty and peers, provides flexible access to materials and other

resources, enhance face-to-face sessions, and improve communication between faculty and students and also increased peer learning. Also, Noe (2002:261) holds that e-learning is accessible at anytime and anyplace. He equally mentioned that training can be delivered faster to geographically dispersed learners and that practice, feedback, objectives, assessment, and other positive features of a learning environment can be built into the program. It can also link learners to other content, experts and peers.

Bates (2001:126) points out that the benefits of an online learning course include: Increased access for part-time students, and for full-time students with timetabling or part-time work conflicts; improved access to out-of-province and international students; improved written communication skills; much increased participation by students in discussion through the on-line discussion forums compared with print-based distance education; greater interaction with the instructors than print-based distance education; by widening the market beyond the province, the course comfortably covered its direct costs from student fees, although it is not clear whether all overhead costs would have been covered as well. Indeed, he argues (Bates, 2001:72) that it is not surprising then that governments in a number of countries are looking at e-learning as one possible means for making post-secondary education more cost-effective, more learner-centred and more economically relevant.

Adebo and Fasuyi (2009:226) asserts that Information and Communication Technologies enable new types of development solutions and thus allow countries and communities to pursue their development goals more effectively. Kangandji (2009:250) revealed that in a survey of 76 faculty members in the University of Namibia, results showed that faculty is in favour using e-learning but need management to recognize that using e-learning will change the current institutional framework. Workload implications for using e-learning, infrastructure, and access to the technology, training, user and technical support are all areas that need to be addressed before faculty will be willing to embrace e-learning. Faculty is the driving force of teaching in an academic institution. Their support in any new teaching initiative is vital to its successful implementation.

2.3.2.2 Individual Learner Advantages

Semenov (2005:161) reports that ICT provides opportunities for:

1. Facilitating learning for children who have different learning styles and abilities, including slow learners, the socially disadvantaged, the mentally and physically handicapped, the talented, and those living in remote areas;
2. Making learning more effective, involving more senses in a multimedia context and more connections in a hypermedia context and
3. Providing a broader international context for approaching problems as well as being more sensitive response to local needs.

Long (2004:10) identify seven personal learner advantages:

1. Reduced travel time and costs for learners: E-learning addresses the problem of lack of time and lack of money. For example, it may be less difficult to go to your computer desk at home or work place than to travel across town or even to another building in your work complex. As a result, you may save time and the expenses associated with travel.
2. Self-paced learning whereby learners can control their schedules.
3. Convenience of any time and any place: Learners are not obligated to meet with an instructor or trainer at a specific time.
4. Opportunity for repeated practice: This advantage depends on specific formats and content. For example computer software, training packages based on CDs provide unlimited opportunity to practice different applications.
5. Ease of review: Like opportunity for repeated practice, depends on the kind of e-learning you choose.
6. Self – responsibility: E-learning encourages and requires self-responsibility.
7. Freedom: A highly motivated learner, who is comfortable with the asynchronous mode, can use e-learning in an autodidactic manner. The learner chooses the topic; determine time, set the criteria for success and so forth.

Beckman and Rathswohl (1999) as well as Somekh and Niki (1997) affirm that information technology has become part of our society: the so-called information society of the late twentieth century. It is a statutory right for students with special educational needs where it can give them access to the curriculum of which they were previously deprived. Consequently, it is necessary that teachers and authorities consider how to use information technology effectively in teaching and learning.

Governments in Europe, US and around the world have already recognized the need to review traditional educational practices and how to incorporate new technologies.

2.3.2.3 Challenges for E-Learning

McIntosh (2005:3) argues that although the Internet and e-learning are enabling higher education to reach out, on a hitherto unprecedented scale, both to geographical areas and to sections of the population previously unreached, at the same time ICTs give rise to new problems, not least the so-called digital divide. According to him as things stand at present, a new divide, between the “info rich” and the “info poor” is added to the traditional divide between the “haves” and the “have-nots”. Semenov (2005:121) points out another divide (digital divide) between the world at large and the schools teaching children to enter it. On their part, Mahmoud and Wilks (2009:219) view that there is an abundance of educational tools and services to be found on the web. Unfortunately, many of them are not open and free. Of the ones that are, they lack usability, accessibility, mobility, and sociability. To add, there is a lack of well-structured and organized educational content and resources.

Also, Ding, Gu and Zhu (2005:70) identified the following problems of e-learning relating to learners, teachers, learning resources and education quality.

- Learner isolation: loneliness and lack of self-motivation.
- Inexperience of teachers: Among teaching personnel there is a widespread lack of understanding about e-learning and how to design and conduct ICT-based courses
- Lack of quality resources: There is also a lack of materials suitable for online learning.
- Difficulties of quality assurance: While e-learning is reaching out to increasingly large masses, it is important to pay attention to the qualitative as well as the quantitative aspect. Some institutions tend to neglect the quality of teaching and learning. How to define the quality of e-learning is, therefore, a challenge for e-learning institutions. Equally difficult problems are involved in the practical application of quality assurance, especially at a time of rapidly expanding enrolments in e-learning (Ding, Gu and Zhu, 2005:71)

Another important challenge for e-learning is teacher perception of the teaching profession. Studies carried out by Dan Lortie's School teacher (1975), based on personal interviews of public school teachers in six schools in the United States of America stated in Glickman (1985:27) show that most teachers consider teaching an honourable but menial profession, un-staged in career unlike other professions, "easy in easy out", work environment routine, isolated, characterized by multiple psychological encounters and perpetual tension. Also, over the years in Cameroon, requirements for students majoring in education have been lower than for those majoring in engineering, medicine or science. Teacher preparation has been less rigorous than training for high-status profession. Teaching has allowed relative ease of entry into its ranks. With the presence of ICTs in most of our schools, Semenov (2005:134) suggests that it is imperative to rethink the goals and values of education and also to re-examine existing practices. Based on this, we can conclude that teacher-perception of the teaching profession must be addressed for any meaningful e-learning program

Notwithstanding, Ding, Gu and Zhu (2005:71) stressed that the above-mentioned problems can best be solved within a holistic learning system by embracing all phases of life, all sectors and all levels of education. They suggested that the concept of e-learning should be presented not as a complete alternative to campus-based formal education, but rather as a good modality for adult education and as one constituent in a lifelong learning system. According to them, promoting this concept of e-learning would do much to remove the misunderstandings about lifelong learning that are common among both learners and teachers.

In addition, Zembylas and Vrasidas (2005:66), postulate that "ICTs in themselves, cannot serve as an end in education but that the demand for critical education involving ICT is pressing as the effects of globalisation are experienced". They further explained that critical education requires students and teachers to become critically literate. According to them critical literacy can be promoted by ensuring: critical emotional literacy. That is knowledge of how ICT work, how they construct meanings, how they serve as a form of cultural and emotional pedagogy or hegemony; collective witnessing. That is learning to become a 'witness' and not simply a 'spectator' and finally collective intelligence. Collective intelligence is a 'universally

distributed intelligence' in which no one knows everything or a continuum developed through collective discussion, negotiation and imagination.

Moreover, Hennessy, Ruthven and Brindley (2005:183) interviewed teachers in English schools who have begun to integrate ICT into their practice and found out that they tend to "assimilate" or accept use of ICT into existing practices rather than to "accommodate" in terms of changing their subject content, goals and pedagogy. On his part, Driew (2001) suggests that the most important task for our teachers is to utilize technology as an essential tool for developing a deep understanding of the subject matter and the pedagogy. This underscores the importance of learning with technology instead of learning from technology. Consequently, there is a need to help teachers and students develop the ability to make proper use of modern technology by effectively integrating it into the teaching - learning process.

More still, Towndrow (2005:520) believed that teachers could be helped to appreciate that IT makes it possible for them and their learners to play larger and more significant roles in planning and executing tasks that are centred on, and controlled, by them. Therefore, teachers need to monitor what they do in class and reflect on their actions and how to support learners in their work. He later proposed four interrelated stages through which teachers develop as learning task designers. These include:

1. Adoption: Teachers design and implement teacher centred tasks
2. Adaptation: Teachers start using IT to their advantage but also begin to embrace student-centred and higher-order orientations.
3. Appropriation: Teachers personal attitudes to IT change and they are well on the path towards being confident experts and willing learners in task design.
4. Invention: Teachers are able to design, implement, modify, and evaluate tasks that involve multiple solutions, strategies and perspectives either in advance or during their execution if necessary.

In the same light, Beebe (2003:83) states that "human resources are needed to lay a strong foundation for e-learning". He points out five levels of technology professional development for teachers as follows:

1. Entry: Teachers teach students to use technology;
2. Adoption: Teachers use technology to support traditional instruction;
3. Adaptation: Teachers use technology to enrich the curriculum;
4. Appropriation: Teachers integrate technology in their teaching and use technology for its unique capabilities;
5. Invention: Teachers develop new learning environments that use technology as a flexible tool. Learning becomes collaborative, interactive and customized (Beebe, 2003:83).

Coleman and LaPlace (2002:2) in Beebe (2003:84) points out that, transitioning an organization towards any platform of e-learning should consider the following:

- Make learning a continuous and measurable process, not a one-time event;
- Make up-to-date information instantly available to all users when and where they need it;
- Training should continuously assess the performance of both the information and all learners;
- Develop employees for greater responsibilities through skill-gap analysis;
- Develop course content or use pre-existing courses;
- Publish content in all the formats needed (online, CD-ROM, and print) for a complete training and development program;
- Seamlessly support 'blended' training- the powerful combination of online and instructor-led courses proven to be the most efficient and effective way to train;
- Easily update and re-use information.

Beebe (2003:84) holds that "readiness factors" for e-learning at the student level include;

- Greater responsibility on the part of the learner to be self-motivated for online participation and interactivity as well as computer literacy, reading and writing, and online research skills.
- Computer experts are needed to deal with the technical aspects of ICT, the back-end of programs, the database aspects, the networks, the computer hardware, the ones and the zeros. Software developers, network administrators,

hardware developers, computer makers, and other highly trained technical personnel are all needed in order for a student to make use of a computer and the Internet for learning.

- Finally leaders with vision and with reformed institutions are key determinants of success in the information age.

Also, on his part, Nagy (2008:32) argues that successful ICT development projects require good practices in their design and implementation practices. According to him, such projects should:

- focus on meeting a need or solving a problem-rather than delivering a technology;
- identify low-cost solutions to the problem;
- be demand-driven not supply-driven, so that the solution is adapted to the problem;
- take advantage of complementary growth in infrastructure;
- understand the target group and design the project accordingly;
- work actively to include all categories of the target group in the project;
- focus on sustainability from the beginning;
- plan for evaluation of outcome and impact from the beginning;
- include a demonstration and dissemination plan (Nagy, 2008:32)

In addition, Long (2004:12) views that learners may find it more challenging to study and practice when there is no set meeting time. However, legitimate or reputable e-learning programs especially those related to some form of certification or diploma require comparable time for study and practice as is required in traditional face – to – face instruction. Strong evidence indicates that successful e-learning requires a high commitment and drive as well as acceptance of responsibility to work alone. Furthermore, learners who do not have the requisite personality and knowledge level for e-learning are likely to experience problems. E-learning requires learners to make their own arrangements to gain hands-on experience including accessing equipment and software, and to make the effort to find support when needed. Brown (2002:59) concludes that the challenge of e-learning is to find ways to respect the fact that much

learning takes place inside the classroom as well as outside the classroom on campus or off-campus.

Finally, Mayes (2005:329) concludes that “for those who feel ‘called’ to teach, it is essential to their personal and pedagogical growth that they periodically examine, refine, and articulate anew their understanding of that calling”. In this process, teachers may probe key past events in their lives, their current psychodynamics and their ongoing existential commitments in order to understand how these influences have shaped their identity and practices as teachers. In sum, ICTs and e-learning enable teachers and students to construct rich multisensory, interactive environments with almost unlimited teaching and learning potentials.

2.4 E-Learning Models

According to Engelbrecht (2003:1), e-learning models are attempts to develop frameworks to address the concerns of the learner and the challenges presented by the technology that is required so that teaching and learning can take place effectively. Perkinson (2005:105) presumes that successful models in the developed world are likely to determine the models adopted in developing countries. In the strategic planning process, these models provide useful tools for evaluating existing e-learning initiatives or determining critical success factors. Engelbrecht (2003:4) holds that e-learning models have evolved from classroom replication toward models that integrate technology and pedagogical issues. According to her, the first e-learning models emphasized the role of the technology in providing content (information), delivery (access) and electronic services; more recent models focus on pedagogical issues such as online instructional design and the creation of online learning communities. The following e-learning models illustrate this evolution.

2.4.1 Content, Service and Technology Model

This model is also called “technology management systems Vendors’ model.” Engelbrecht (2003:4) points out that in the growth and experimentation phase of e-learning in the 1990s, Universities; public and corporate institutions based their e-learning initiatives on an e-learning model comprising three elements: Service to the customer (learner), content and technology. An example of a “technology management

system Vendors' model" is "the demand driven learning model" (MacDonald et al, 2001:19)

According to MacDonald et al (2001:19), the demand driven learning model was developed in Canada as a collaborative effort between academics and experts from private and public industries. In this model technology is seen as support or a tool to achieve the desired learning outcomes in a cost effective way. Engelbrecht (2003:5) asserts that the primary purpose of this model was to encourage academics to take a proactive role in the development and use of technology in the teaching process. It emphasized the three consumer demands: high quality content, delivery and service. For content, it should be comprehensive, authentic and researched. Concerning delivery, the interface of e-learning programs should be user – friendly with communication tools to support interactivity. Service should include the provision of resources needed for learning as well as any administrative and technical support needed.

In addition, Engelbrecht (2003:5) points out that another interesting thing about this model is the provision of a valuable framework for understanding the importance of investing in ICT infrastructure to support content, delivery and service. However, it also highlights the importance of realizing the changing needs of learners and their employers and the pedagogical changes that must be made to content and services to meet these needs.

2.4.2 Instructional design models

Engelbrecht (2003:6) postulate that Instructional design models for e-learning based on the curriculum processes of development, designing and delivering of material are usually closely aligned with traditional classroom learning models that specify some combination of planning, implementing and evaluation to organize and present curriculum content. Alexander (2001:240) concludes that successful e-learning takes place within a complex system involving the students' experience of learning, teachers' strategies, teachers' planning and thinking and the teaching/learning context. However, Engelbrecht (2003:6) emphasized the following issues for instructional design models:

- Needs analysis that investigates issues such as: Demand for instruction in the specific subject, demand and need for an online course, equivalence of an online course with face-to-face programs and costs;
- Student profiles that identify their needs and expectations: For example age, gender, culture and work experience, prior knowledge, prior experience with e-learning, goals and motivation, attitude towards e-learning, learning patterns and styles, computer literacy, access to computer and the Internet;
- Institutional support for e-learning initiatives investigates aspects such as: The vision and mission of the institution, lifelong learning as a goal of the institution, implementation costs and sustainability, experience of the lecturers and web designers, training for the lecturers, technological infrastructure, hardware, software and staff training in the systems and equipment;
- Pedagogical choices that meet the requirements of the subject and the needs of the target learner group: this include aspects such as: Learning models, learning objectives, delivery methods, assessment and Interaction.

Engelbrecht (2003:6) concludes that “Instructional design models” provide valuable frameworks for those responsible for developing e-learning materials. She further explains that these models are valuable for strategic planning, because they emphasis the issue of quality: quality of learning materials and quality of learning support.

2.4.3 Community of Inquiry Model

The community of inquiry model developed by Garrison and Anderson (2003:28) is an attempt to give educators an in-depth understanding of the characteristics of e-learning, direction and guidance to facilitate critical discourse and higher - order learning through the use of e-learning. In this light, Garrison and Anderson(2003:4) maintains that institutions of higher education have slowly begun to appreciate that the content of an educational experience will not define quality learning but that the context; how teachers design that experience, and the interactions that drive the learning transaction will ultimately distinguish each institution.

Also, the “community of inquiry model” provides the environment in which learners can take responsibility for and control of their learning through interaction and is a requisite for higher – order learning. Semenov (2005:91) defines interactions as “processes where two or more actors influence and affect each other’s actions and behaviour while striving to reach their goal, doing some common work, or performing a joint task”. According to him, any interaction generates information. Given the information access and communication facilities of the Internet, an e-learning environment has distinct advantages as a means of providing support to communities of inquiry to promote higher – order learning. Verbal communication such as in oral discussions or telephone conversation and written communication as in text supported by pictorial illustrations and graphs are being rapidly improved by Information and Communication Technologies and e-learning.

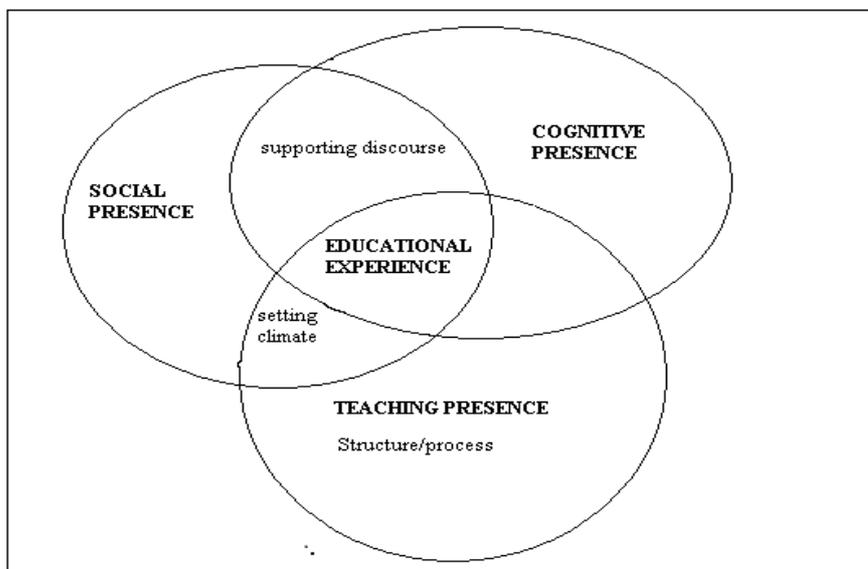


Figure 2.4: Community of Inquiry Model (Adapted from Garrison & Anderson, 2003:28)

The community of inquiry model has three key elements that must be considered when planning and delivering an e-learning experience. These include cognitive presence, social presence and teaching presence.

2.4.3.1 Cognitive Presence

Garrison and Anderson (2003:28) view cognitive presence as the extent to which learners are able to construct and confirm meaning through sustained reflection

and discourse in a critical community of inquiry. In essence, cognitive presence is a condition of higher – order thinking and learning.

2.4.3.2 Social Presence

Also, Garrison and Anderson (2003:28) points out that social presence is the ability of participants in a community of inquiry to project themselves socially and emotionally, as ‘real’ people (i.e. their full personality) through the medium of communication being used. In creating a “virtual social presence”, students can make themselves heard in virtual world. A “social presence” is defined by Picciano (2002:22) as “a student’s sense of being and belonging in a course”. In creating a “virtual social presence”, students can make themselves heard in virtual world. Bezuidenhout (1999:28) holds that having a social presence is important for students’ cognitive development, but in a large class posing questions or interrogating issues during a lecture appears difficult. It is often not easy for students to initiate discussions or establish relationships with peers or the lecturer due to feelings of vulnerability and the size and impersonal atmosphere of the lecture theatre. Bezuidenhout (1999:29) asserts that in a large class environment, where it is difficult to establish a physical social presence, a virtual social presence may assist students in achieving full cognitive development.

2.4.3.3 Teaching Presence

Also, Garrison and Anderson (2003:29) hold that teaching presence is the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes. WBI (2007:126) postulate that Tertiary-level and research institutions in low-income countries should focus on creating a pool of experts capable of adopting science and technology and adapting it to the local context. This means changing the current paradigm in the University to include in addition to teaching and research: service to the community and close cooperation with the public and private sectors to contribute to innovation and development. World Bank (2000:1) concludes that without a more and better higher education, developing countries will find it increasingly difficult to benefit from the global knowledge economy or society. This new mission of the University fits into the community of inquiry model.

The community of inquiry model builds on the demand – driven model and the instructional design models and draws attention to the complexities of communication in a virtual learning environment. Even in higher education today, the reality is that the concept of communities of inquiry that encourages learners to approach learning in a critical manner and process information in a deep and meaningful way has not been widely established. However, while this model may seem idealistic, the issue of interaction in the learning process has to be addressed.

Moreover, McIntosh (2005:4) outline some important models of distance and lifelong learning that can have practical implications for the method of educational delivery most especially eLearning. These models include:

- The functionalist model: focusing on “human capital” formation, keeping learners abreast of technical developments, and teaching essential skills for vocation.
- The critical literacy model: focusing on empowerment and consciousness-raising and the development of a challenging, questioning attitude towards assumptions and concepts that one might previously have taken for granted.
- The social justice model: sharing some elements with the critical literacy model and including issues such as gender, human rights, peace studies, neo-colonialism and programmes focusing on ethnic minorities and socially marginalised groups.
- The reflective learning model: focusing on the development of higher-level skills whereby the individual can critically assess different theories, discourses and knowledge paradigms. This model could be characterised as “learning how to think”.
- The compensatory model: in which the educational content is intended to remedy some deficiency in the learners. An example would be remedial writing courses for students who enter higher education with inadequate composition skills.
- The humanistic model: Its aim is essentially to broaden learners’ horizons and enrich their minds.

McIntosh (2005:5) argues that the predominant model used in a lifelong learning programme, or e-learning will have practical implications for the method of

educational delivery. In the same light, Long (2004:17) postulates that e-learning has been used to refer to various modes, media formats, and delivery processes, however, the broadest and most popular categories are Synchronous and Asynchronous modes.

2.4.4 Synchronous Model

McIntosh (2005:5) holds that synchronous model is a form of group learning, where the students interact collectively with the instructor in real time, for example through online lectures and seminars. This model uses internet-based synchronous technologies. Bates (2005:143) defines internet-based synchronous technologies as those “technologies that operate in ‘real time’ over the Internet”. They include: Internet telephone service (VoIP), Web – conferencing (text and audio conferencing) and Mobile computing using wireless devices. He argues that Web – conferencing currently focuses more on audio, graphical and text communication in real time. Long (2005:17) holds that in this kind of mode, the learner and facilitator interact directly. Feedback may be provided instantaneously by both the student and the facilitator. Semenov (2005:128) points out that a new opportunity provided by computer technology today is bilateral interactivity. According to him, students can answer the questions teachers ask, and ask them questions too all in a written format from wherever they live. They can speak with one another and collaborate on text-based projects using data conferencing tools such as document sharing, white boarding and typed “chat” or live audio.

According to McIntosh (2005:5) it is possible for different models to complement each other. He elucidates that this approach is suitable for the critical literacy model or the reflective learning model where there is much direct interchange with a teacher in a group setting. The reflective model is becoming very important for e-Learning when a student is faced with a multiplicity of competing paradigms, systems of knowledge and information sources of widely varying degrees of reliability. In such a situation it becomes vital to possess the faculty of critical discrimination. Critical literacy is important for developing active citizenship in an e-learning program. Some students will always require compensatory education of one kind or another; and the humanistic approach to education will continue to have an important place. McIntosh (2005:4) links e-learning to UNESCO’s 1997 Fifth International

Conference on adult Education which states that “learning should be considered a “joy” as well as a tool, a right and a collective responsibility”.

2.4.5 Asynchronous Model

McIntosh (2005:5) views asynchronous model as “individual learning, where the students access the course material when it is convenient for them”. He argues that this approach can often work well with the functionalist model. Long (2004:17) states that this mode of e-learning is characterized by its nature of learner-facilitator interaction where the contribution of the facilitator is temporally static. According to him, information is presented in recorded format and the learner can interact with it at any time thereafter. He further explains that asynchronous formats may also use online communication but the online learner activity usually is a response to stored data. Here, feedback may be provided by a human or via electronically programmed means.

To conclude, there is a tendency among the large providers of distance education to emphasize the asynchronous approach, since it enables vast numbers of students to be catered for at low cost. The focus on the individual gives students flexibility over when and where they study. It may be the home, the workplace, inside a car. Its convenience and flexibility improves access. Consequently, large numbers of student enrolment will lead to economies of scale which will decrease study costs for all concerned. There is equally higher academic quality, because the scale allows the provider to make a bigger academic investment.

2.5 Theoretical Framework

This study cuts across learning approaches and theories as already mentioned in chapter one. There are many theories that have been postulated to explain the learning process. The study is based on those that encourage students to take responsibilities for the learning process. Each theory relates to different aspects of the learning process. Also, only theories and / theorists most applicable or relevant to ICTs and e-learning in particular will be discussed in this chapter. Three of these have dominated educational explanation for over a century. This include amongst others, behaviourists, cognitivists and constructivist theories. Nevertheless, there has been a progressive move from behaviourism, cognitive theories that emphasize individual thinkers and their isolated minds to theories that emphasize the social nature of

cognition and meaning. An increasing importance is ascribed to theories that highlight the importance of studying the relations among individuals, mediating tools, and the social group (Bottino, 2004:257). Worthy to note is the fact that increasingly, technology is being studied in relation to long-term teaching and learning processes.

2.5.1 Behavioural Theory of Learning by B.F Skinner: (Operant conditioning).

According to Passer and Smith (2001:22), Harvard professor, B. F Skinner (1904–1990) believed that “the power of the environment could be harnessed for good or evil”. On his part, Diessner (2008:134) postulates that Skinner is the most influential psychologists of the behaviourist movement of the 20th century. Behaviourists see learning as a change in observable behaviour caused by external stimuli in the environment. They contend that it is the observable behaviour of the learner that shows whether he has learned something and not what is going on in his mind. However, B.F. Skinner’s theory did not only successfully combine many different ideas but also serve as the basis for a variety of applications to human behaviour. He uses the phrase “Operant conditioning” to describe a type of learning in which the emitted (operant) rather than the elicited behaviour of the learner is manipulated. An operant refers to a particular response or behaviour that an organism makes (operates) on the environment in order to obtain or avoid a particular consequence. Operant conditioning is based on the view that many of the voluntary responses of animals and humans are strengthened when they are reinforced (followed by a desirable consequence) and weakened when they are punished or ignored.

More still, Skinner (1953) believed that children could be conditioned to acquire desirable skills and behaviours (Diessner, 2008:135). Skinner is remembered for his contribution in establishing a technology of teaching (“teaching machine”), a device that used his principles of step-by-step instruction and rewarding students’ responses. This approach laid the foundation for the later development of behaviour modification, programmed instruction, mastery learning, direct strategies and other computer assisted instruction. Santrock (2004:220), comment that by breaking down learning into small, simple steps and rewarding children after the completion of each step, learning mastery is achieved. Also, by combining many of these steps, complex behaviours can be learned efficiently. Moreover, Skinner proposes that instead of aversive control or punishment, teachers should use positive reinforcement, together

with “attractive and attention compelling” approaches to teaching. Behaviourism as a theory of learning has influenced the growth of the Transmission model/Domain Centred Design to instruction.

2.5.1.1 The Transmission Model/Domain Centred Design to Instruction

The transmission model suggests that knowledge is something that is owned by a person, detached from any social context that can be transmitted from the mind of the teacher to the mind of the students (Gifford and Enyedy, 1999:189). In the same light, Brown (2002:53) points out that the behaviourists view knowledge as a kind of substance and leads to a pedagogy that encourages the optimal pouring of knowledge from a storage device into the head of a student. On his part, Bottino (2004:555) holds that the first ways in which the computer was used for educational purposes were influenced by behaviourism. The behaviourists viewed learning as an induction of a required behaviour. The focus of this kind of pedagogy was to make the transmission of knowledge more efficient. The traditional classroom with its lock-step lectures and textbooks that present the student with facts, theories and explanations is a natural extension of this theoretical assumption. Brown (2002:53) stressed that the behaviourists thinking about pedagogy in learning has a Cartesian foundation. He further explains that “three hundred years ago or so, Descartes's philosophical stance was "I think, therefore I am." Within that framework, the more abstract the knowledge is the better”. Thus a teacher could boast of being competent or intelligent when what he or she teaches becomes more abstract to the learner.

According to Gifford and Enyedy (1999:189), educational technology designed from this perspective is best exemplified by Computer Assisted Instruction (CAI). They explained that CAI aims to make knowledge transfer more efficient primarily by ordering the sequence of content and by elaborating on its presentation. For example “simple to complex”, “known to unknown”, “near- to- far. Examples of CAI include drill and practice programs and Tutorial systems. Drill and practice programs help students to develop specific competencies and abilities. They include only minimal content instruction. These programs are not used during normal classroom time but for individual training or remedial activity during 'ad hoc' hours or at home.

It is worthy to note that such programs have evolved over time. Tutorial systems, in contrast with drill and practice systems, include content instruction in a given topic. In their design, importance is ascribed to factors such as reinforcing memorisation, presenting objectives, specifying prerequisites, eliciting and assessing performance (Bottino, 2004:556). Presented questions require application of the concepts or rules covered in the instructional sequences. Feedback is often diagnostic by identifying processing errors and prompting remediation or recasting of the instruction. Their use in classroom practice is limited since they are often perceived more as substitutes for teachers than as tools to help them in their work. It can be observed that this kind of approach to the use of computers in education is also the basis of some distance learning courses on the web that are becoming progressively widespread (Bottino, 2004:556). The educational advantages of both drill and practice and tutorial programs are quite limited. Their utility has been underlined in specific cases, for example in remedial activities or in the acquisition of specific skills during initial training.

According to Gifford and Enyedy (1999:190), this kind of approach to instruction is called Domain Centred Design or Teacher Centred Design. In most cases it is assumed that the teacher whether human or a computer substitute is the sole possessor of the disciplinary knowledge that must be transmitted to the students. Consistent with this viewpoint, almost all the classroom activities revolve around the teacher or computer as the provider and evaluator of information. In a Domain Centred classroom, the teacher is placed at the centre of the class time, leaving little time for a student to initiate and complete a two-way instructional exchange. Technology can be incorporated on to each aspect of the teaching and learning process, enhancing teacher lectures with multimedia presentation tools. Worthy of note is the fact that, this does not alter the basic nature of this teaching and learning approach

In conclusion, despite some of its merits, the Domain Centred Design and the transmission model of instruction have been consistently criticized over the years for promoting imitation and memorization while limiting meaningful dialogue and interaction. It ignores the social context of learning and assumes that learning is primarily an individual activity. As a result, the DCD approach to instructional technology has provided only modest learning gains (Gifford and Enyedy, 1999:190).

2.5.2 Theory of Instruction by Jerome Bruner

According to Crook (2001:20) after behaviourism, cognitive psychology came to be the second theoretical force to shape modern accounts of learning. Jerome Bruner's theory (Cognitive theory of instruction) can be applied to ICTs and e-learning. Bruner (1956) cited in Santrock (2004:397) emphasized the concept of discovery learning by encouraging teachers to give students more opportunities to learn on their own. E-learning can facilitate this concept of discovery learning given that it is learner centred. In Bruner's view, discovery learning encourages students to think for themselves and discover how knowledge is constructed. It equally feeds their natural curiosity and inquiry. E-learning facilitates discovery learning by providing students with stimulating activities that activate their natural curiosity. In fact, its content is quite good, well structured and above all motivating to the learner.

Santrock (2004:397) asserts that discovery learning meshes with the ideas of Piaget, who once commented that every time you teach a child something, you keep the child from learning. However, working completely on their own does not benefit many students. Mosston and Ashworth (1990) postulate that guided discovery teaching style indicates a continuous and reciprocal relationship between the teacher and the learner. E-learning can equally facilitate guided discovery learning in which students are encouraged to construct their understanding with the assistance of teacher guided questions and directions. Also, students can get help from their peers and mentors elsewhere via e-learning

2.5.3 Information – Processing theory

Another cognitive theory, which is applicable or relevant to ICTs and e-learning in particular and has become for many cognitive psychologist, a popular approach to the study of learning is information – processing theory. On his part Santrock (2004:247) stresses that information processing is concerned with how individuals analyse the many sources of information in the environment and make sense of these experiences. In addition, Santrock (2004:247) as well as Hunt and Ellis (2004:24) maintain that it is an attempt to explain how the human mind works. In practice, the computer is compared with the human brain. The physical brain is compared to the computer's hardware and cognition to its software. Although computers and software are not perfect analogies for brains and cognitive activities,

nonetheless, the comparison has contributed to our thinking about the child's mind as active information – processing system.

In addition, Hunt and Ellis (2004:24) holds that central to this approach are the cognitive processes of memory and thinking. Cognitive psychologists conceive learning as an internal process that involves the use of memory, motivation, thinking and meta-cognition. They contend that the amount of learning that takes place depends on the processing capacity of the learner, the amount of effort expended during the learning process, the depth of processing and the learner's knowledge structure. Memory can be defined as the retention of information over time, which involves encoding, storage and retrieval. On the other hand, thinking can be defined as information processing. By processing, we mean activities such as perceiving, organizing, analysing, synthesizing, rehearsing, storing and retrieving. On his part, Noe (2002:117) explains that information – processing theories, compared to other learning theories, give more emphasis to internal processes that occur when training content is learned and retained. The diagram below shows a model of information processing.

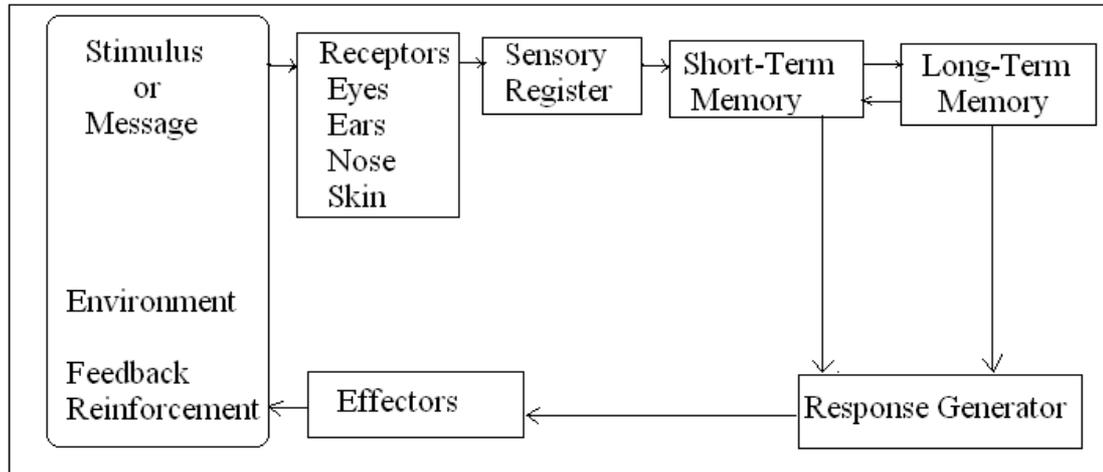


Figure 2.5: Model of human information- processing (Adapted from Noe, 2002:117)

Information - processing theories propose that information or message taken in by the learner undergo several transformations in the human brain. As can be seen in the figure above, information processing begins when a message or stimuli (which could be sound, smell, touch, or pictures) from the environment is received by receptors (ears, nose, skin, eyes). The message is then registered in the sensory register

or memory. The sensory memory holds information for about one or two seconds. What gets in depends on a person's selective attention, perception and recognition. Semenov (2005:108) emphasized that the time has come for schools to incorporate a wider array of mental processes and activities into the learning process. He argues that unlike the traditional classroom dominated by the spoken and printed word, the new classroom should practise a multisensory enhanced learning.

Nevertheless, the model of human information - processing is based on the way the computer processes information. Information in the Short Term Memory (STM) or working memory is like information in the workspace of the computer. Information that was stored in the Long Term Memory (LTM) must be retrieved for it to be used in the STM. Noe (2002:117) added that besides emphasizing the internal processes needed to capture, store, retrieve, and respond to messages, the information - processing model highlights how external events influence learning. These events include:

1. Changes in the intensity or frequency of the stimulus that affect attention.
2. Informing the learner of the objectives to establish an expectation.
3. Enhancing perceptual features of the material (stimulus), drawing the attention of the learner to certain features.
4. Verbal instructions, pictures, diagrams, and maps suggesting ways to code the training content so that it can be stored in memory.
5. Meaningful learning context (examples, problems) creating cues that facilitate coding.
6. Demonstration or verbal instructions and helping to organize the learner's response as well as facilitating the selection of the correct response.

Like Jean Piaget, Jerome Bruner's theory of learning and the Information-Processing theory have influenced the development of the Learner Centred Design to instruction.

2.5.3.1 Learner Centred Design to Instruction

The approach to instructional design mediated by ICT has greatly evolved over the years as cognitive science and the learning sciences have matured. Bottino (2004:556) postulates that one of the major forces which have driven change has been

the assumption that meanings are lost if teaching/learning are simply seen as the transmission of information. Gifford and Enyedy (1999:191) states that in the Learner Centred Design (LCD), the learner, his or her goals, misconceptions and cognitive capacities is placed at the centre of the model. The student is at the centre of the model because learner centred environments are deliberately organized to increase student control over the sequencing and pace of the materials. As the student progresses through the materials she is presented with feedback based on her actions with the software. Because of this focus on isolated individuals and the decontextualised minds of learners this approach to instructional design is called Learner Centred Design. Although the teacher is part of the system, his or her role is minimal. The role of the teacher is often described as the "guide on the side"; giving the teacher the technical ability to monitor students' investigations simultaneously in indirect cases, his direct role is as a facilitator of a classroom discussion after the students' local investigations.

Moreover, Gifford and Enyedy (1999:190) highlights that in education, the information processing model has led to many studies that focus on the cognitive capabilities, misconceptions, mental models and learning needs of individual students. With the information processing model, the Student is an active participant in his or her own learning. In this light, Gifford and Enyedy (1999:190) propose to design learning technology by focusing on the cognitive capabilities and needs of the learner. LCD has produced a number of ground-breaking computer-mediated tools, visualizations and Microworld aimed at helping students learn a specific domain. According to Bottino (2004:556), a system like Microworld should provide the user with a number of objects and functions that can be combined in order to produce a desired effect; they should embody an abstract domain described in a model and offer a variety of ways to achieve a goal; they should allow the direct manipulation of objects. Also a Microworld should be built up around a given knowledge domain which has to be explored interacting with the program. Most of these learning environments are founded on the information processing model of cognition. Bottino (2004:556) concludes that learning is progressively considered as being based on an active exploration and personal development, rather than on a transmission model.

More still, in the learner centred design ICTs are incorporated in all aspects of the teaching and learning experience. While this is certainly an improvement, it repeats the errors of the domain centred design and the transmission model of instruction. In

effect, technology is used in an individualistic and narrowly conceived view of intelligence without altering the basic activity structures or assumptions of the Learner Centred model or design. Collaboration and interaction with peers is not central, nor even necessary from this perspective. One of the major criticisms of both LCD environments and the information processing model of cognition itself is that they foster a view of learning as a highly individualistic, autonomous, non-social activity. Developing learning environments based on the LCD model is thoughtless on several accounts. First it often goes too far in reducing the role that the teacher plays, denying the student access to the accumulated wisdom, experiences and empathy of expert teachers. Second like Domain Centred Design, it ignores the social context of learning and the important role of conversation and collaboration as part of the active learning process. Third the environments are focused on individual student misconceptions which need to be changed to the normative conceptual understanding. LCD's failure to recognize the relationship between conceptual understanding and the activities in which they arise has led to compartmentalized learning activities that do not attempt to connect with students' lived experiences. These discussions are usually not supported technologically nor are they well integrated with the local activity. The result is a completely fragmented experience for the students, where the learner centred investigations are disconnected with the teacher centred discussions.

2.5.4 The social development theory by Lev Vygotsky

Crook (2001:20) argues that during the 1970s, behaviourism and cognitive psychology, defined the third theoretical alignment to be considered in learning called constructivism. According to him, this was a perspective that conceptualised knowledge in terms of an active and exploratory subject. Constructivism became influential within education through the work of Piaget as well as Vygotsky. Crook (2001:21) states that constructivism, must especially socio-constructivism confronted behaviourism and cognitivism which makes it more appealing. Diessner (2008:115) points out that Lev Vygotsky is generally considered the greatest Russian developmental Psychologist. In the same light, Santrock (2004:51) assert that, like Piaget, Vygotsky (1896–1934) “believed that children actively construct their knowledge”. What this means in practice is that teachers should actively assist children who are engaged in learning task. He was valued for his thinking now well known and widely respected, on such matters as learning as an essentially social process, the need

to engage children in whole tasks that make sense to them, and the Zone of Proximal (or potential) Development. More still, students are working within their Zone of Proximal Development (ZPD) and teachers or facilitators provide the Scaffolding to enable them move through the ZPD. The zone of proximal development is the difference between what a child can understand on its own and what it can potentially understand through interaction with others or learning support. Computer assisted learning or Information and Communication Technologies for example, can be used to provide scaffolding, both from the use of the technology itself and the social interaction stimulated by computers. In the same light, Russell, Jarvis and Gorman (2004) remarks again that there is a large body of research showing that children working with assistance, in the form of adult tutoring, cooperative group work or peer tutoring, learn more than those engaged in individual discovery learning or chalk-and-talk teaching. Vygotsky suggests that teaching and learning are “social activities that take place between social actors in socially constructed situations” (Moore, 2000:15).

Santrock (2004:51) comments that both Vygotsky’s and Piaget’s theories are constructivists, emphasizing that children actively construct knowledge and understanding rather than being passive receptacles. Although both theories are constructivist, Vygotsky’s is a social constructivist approach, that emphasizes the social context of learning, and that knowledge is mutually built and constructed. In recent times, there has been a move by education theorists towards socio-constructivism. Constructivists claim that learners interpret information and the world in the light of their personal reality and that they learn by observation, processing and interpretation, and then convert the information into personal knowledge. Constructivist theorists contend that learners learn best when they can contextualize what they learn for immediate application and to acquire personal meaning. They believe that there is more to learning than just a change in behaviour postulated by the behaviourists.

According to Tu (2000:33), Vygotsky’s theory, “full cognitive development requires social interaction”. Children construct knowledge through social interaction with others. E-learning has the capacity to help children create their own knowledge through social interaction. This implies that we should establish many opportunities for students to learn with the teacher and more skilled peers. In Vygotsky’s theory, the teacher serves as a facilitator and guide rather than director and builder of learning.

Indeed, Vygotsky's work showed that a child's cognition and thinking, to a great extent, relied upon the manipulation of material objects used as tools as well as societal surroundings. It is worthy to note that Lev Vygotsky's views of learning have influenced the growth of the cultural approach to instruction.

2.5.5 The Cultural Approach

Crook (2001:19) points out that the emergence of new educational technologies has catalyzed fresh discussion of educational theory and practice. He explains that such discussions embrace pedagogy, epistemology, or psychological development. To him, the cultural view frames intelligent action as something that is mediated. Bottino (2004:558) argued that the adoption of this perspective has implications for the support of learning and the design of resources, such as those associated with educational technology. On the one hand, technological tools influence and transform the activities performed with their mediation, but, on the other hand practice can deeply influence the technology used. This is particularly true now, when technological progress is constantly opening up new opportunities for elaboration, representation and communication whose potential for educational purposes has yet to be fully exploited. These new functions and opportunities can change the models of practice which have inspired the construction of the technology itself. However, Crook (2001:20) further explains that the cultural-psychological emphasis on social aspects of learning urges more careful protection of some educational practices from unplanned consequences of remediation with information and communication technology-particularly as they may arise within e-learning. For example some unexpected consequences may arise from lecturers' poor appropriation or conception of "social" as face-to-face approach, interpersonal processes in learning and scaffolding. Notwithstanding, the traditional interpersonal feature of teaching and learning is important, but the penetration of ICT's into educational practice promises more benefits as far as social contexts are concerned (Crook, 2001:33)

The cultural approach has challenged behaviourism, cognitivism and constructivism's concerns. This makes it more comprehensive in its scope. According to Crook (2001:22), the vision of behaviourism is evident in the design of early teaching machines which focused on Computer Assisted Instruction (simple drill and practice programmes and tutorial systems). With the coming of modern Information

and Communication Technologies, these programs have greatly evolved in design and function. A favourable environment or good conditions for learning to the cultural approach is one in which the learner is granted access to complete versions of what is to be acquired rather than starting at a distance, and incrementally moving forward as is the case with behaviourism. From the cultural perspective, the educational environment must strive to approximate something that is authentic: a recognisable version of some domain for disciplinary practice. In this approach, the learner is an active participant in the learning process. In this respect, conditions are created for learner participation. The goal in supporting a learner is to capture the integrity of the complete system-to-be-learned, rather than reducing it to components for bottom-up acquisition.

Moreover, the individualism of cognitive psychology is challenged by the socio-cultural emphasis on the distributed nature of learning and knowing. The interest in tool-mediation naturally leads to accounts of intelligent action that attend to the individual's deployment of tools and technologies, symbol systems, genres of communication (Crook, 2001:23). Therefore, cognition should be seen as something to be analysed as 'distributed' across these resources. It is worthy to note that representations may arise during the course of such intelligent activity. Jonassen (2003:362) affirm that new research is focused on the role of tools for externalizing learners' internal representations. According to him, for students to be able to transfer the skills of solving 'well-structured' and 'ill-structured problems', it is essential that they learn how to represent the problem they are solving in more than one way (Jonassen, 2003:364). On his part, Mumford(1966) in Engle(2001:87) argue that only when tool making or use is modified by linguistic symbols, aesthetic designs and specially transmitted knowledge does it become a significant contributor to human development.

Moreover, Lohner, Van Joolingen and Savelsbergh (2003:399) states that an obvious characteristic of a representation is whether it is expressed as text or as graphical diagrams. Textual representations for computer modelling require the learner to explicitly write down a sort of equation, whereas the graphical representations either additionally or exclusively use a graphical representation, such as a flow chart or icons to represent objects or variables in the model. Several modelling tools use a combination of textual and graphical representation, e.g., STELLA, where a graphical

diagram is supplemented with textual equations. Lohner, Van Joolingen and Savelsbergh (2003:398) identified four functions a representation can fulfil:

- extended working memory: it can also reduce working memory load;
- layout of the problem space: it can also make the solution of the modelling problem more or less obvious;
- determinant of cognitive behaviour: through their syntax and semantics representations can constrain and stimulate aspects of learner's cognitive behaviour;
- means for communication: representations can provide a means for communication with others;
- We expect that the choice of a representational system will affect the fulfilment of these functions.

Jonassen and Henning (1999) in Jonassen (2003:364) propagates that “well developed mental models consists of multiple representations including structural knowledge, procedural knowledge, reflective knowledge, images and metaphors of the system of strategic knowledge as well as social/relational knowledge, and artifactual knowledge”. Jonassen (2003:364) concludes that problem representation is the key to problem solving. Notwithstanding, Cognitivism has influenced the development of ICT in education. Views of communication as information processing or management have encouraged the development of intelligent tutoring systems.

To add, the cultural approach challenged constructivism for frequently reinforcing a conception of knowledge as something to be acquired from autonomous and often solitary investigation. The cultural approach situates learning and knowing in a more social context. It embraces the idea that context shapes how we think and know. On his part, Sheared (1994:36) states that essential to the cultural view is engaging “the students’ lived experience within a socio-cultural, political, and historical context”. However, in terms of educational technology, the constructivist view of knowledge has had its influence. It has encouraged the development of exploratory spaces. That is computer-based simulations and Microworlds that resource the individual's discovery and reflection. Brown (2002:53) presumes that learners often construct and augment their own understanding of the content socially through conversations. Worthy of note is the fact that the cultural approach conceptualises learning and knowledge as participatory, distributed and socially situated.

Moreover, Crook (2001:25) identifies three aspects of the socio-cultural perspective that address ideal conditions for learning. Each of them has implications for new educational technologies with respect to design. These three aspects are: tool mediation, participatory engagement, and social context. He further stressed that the social context is the most urgent for directing our planning of ICT use in education. First, cultural view of teaching and learning stresses the mediated nature of intelligent action. In this light, it emphasizes the idea of learning with computers rather than learning from computers. Educational technology is now often discussed as augmenting and extending intelligence, rather than imparting it. The cultural approach emphasise re-mediation of intelligent action by new technologies. This contrasts with the behaviourist conventional view of augmentation as being ‘amplification’ of intellectual capacity. According to the cultural approach, computers do not amplify learning and knowing rather they reorganize how it is exercised.

Second, the cultural view of teaching and learning stresses the importance of learners having a participatory relationship to those domains of practice that they are trying to study. This encourages electronic programs that are more interactive. Participatory learning can be realised through classroom collaboration built around computer-mediated communication. Wenger (1998) in Crooks (2001:26) states that such ventures illustrate a route towards greater participatory experience that is based upon creating authentic 'communities of practice'. On his part, Tisdell (2005:256) stressed the “connections between individuals and social structures and notions of intersecting personalities”. His view appreciates a culturally relevant and spiritual grounded approach to transformative pedagogy. The goal of this approach is to foster interaction, storytelling on a personal and social level through group inquiry. The teacher’s role is that of a collaborator with a relational emphasis on group inquiry and narrative reasoning, which assist the learner in sharing stories of experience and revising new stories in the process.

Third, Crook (2001:28) described ‘social’ as learning experiences and knowing even when there is no one else around (interpersonal relationship). In this light, the social dimension of learning occurs nevertheless when we are educationally engaged. Crook (2001:28) stressed that there is a great need to recognize the role of ‘social’ into teaching and learning must especially in higher education. However, some lessons of electronic remediation at this level could be usefully extrapolated to other educational

sectors and levels. He pointed out four learning contexts where electronic remediation has suggested a subtle texture to the social dimension of what happens there (Crook, 2001:29). The four contexts discussed are the informal tutor-student exchange, the peer-based discussion session, the practice of assessment feedback, and the lecture. These contexts are explained with respect to ICT below.

2.5.5.1 ICT plus Tutorial discourse as social context

According to Crook (2001:29) ICT designers have concentrated on tools for asynchronous person-to-person exchange for tutorial discourse: this means text-based communication, typically involving some ways of organising electronic mails. Also, the social nature of this context conforms to the narrow and traditional conception of 'social' as synchronous and interpersonal exchange. During focus group discussions with students, issues of social role and identity are implicated in the teaching and learning process. Dimensions of the social context surrounding tutorial exchange that can be supported by ICT include: raising issues of relative social positions, self-consciousness, and visibility (in terms of the archived nature of one's contributions).

2.5.5.2 ICT with Collaborative Peer Group as social setting

Crook (2001:30) suggests that the motivation to coordinate students working together with computers cannot be taken for granted. ICTs have the potential to support academic interaction that concerns peers more than tutors: that is, informal group discussion. Therefore, learners could be encouraged into more informal partnerships, conceived to foster collaborative study. Given the opportunity, pupils and students can engage in intelligent discussion of their own learning. Collaboration enhanced by e-learning can be very productive and lead to increased achievement. This is only possible if teachers are able to plan for and manage the process effectively. The social nature of this setting conforms to the traditional conception of 'social' as synchronous and interpersonal exchange. With the penetration of modern technology in education, an interest on the whole teaching and learning has emerged. Bottino (2004:558) considers learning not only as an individual construction developed during the interaction with the computer but also as a social construction developed within the whole learning activity.

2.5.5.3 ICT plus Assessment Feedback as social context

In this context, there is a hidden social dimension. While their organisation may not entail synchronous exchange, the nature of student engagement may well depend upon mapping what happens onto a version of such exchanges. Besides automated testing, it is also necessary to consider the forms of automated feedback that can be generated by database-managed teaching records. For example, computers make possible the construction of standard grading and commentary forms: feedback sheets that may be customised to refer to particular pieces of work, by particular students, on particular teaching units, and so forth. Because the student-tutor contract embedded in the author-reader-assessment-feedback process represents a species of social relationship, in particular, it organises for the student a setting of (interpersonal) accountability (Crook,2001:31). Bottino (2004:558) suggests that a strong need exists for exploring other contextual forms of assessment, such as those afforded by the use of portfolios, problem-based assignments, peer refereeing and evaluation, and other emerging ways of looking at the challenges of assessment.

2.5.5.4 ICT plus the lecture as social setting

This setting like the one of assessment feedback has a hidden social dimension. The lecture has significant social qualities, even though it usually demands stillness from most of the people present. Crook (2001:32) states that Multimedia can help lecturers to package their lecture notes as web pages to be consulted at anytime and anywhere by the students. However, the lecture has at least two social dimensions. First, effective engagement of learners may be associated with the communal act of attendance in a course or programme. It may matter that something has been experienced in common, as a class; that the discipline under study has been encountered in this corporate sense. As a result corporate action sustains a stronger sense of involvement and motivation. Also, attendance in the lecture creates a platform of shared peer experience. This serves as a resource for informal exploratory and evaluative discussion among the learners. Second, there is a social quality to the lecture that is about the personalization of curricular material. Thus, the existence of a voice in the curriculum facilitates learning and calls for dialogue. Transforming lecture courses into multimedia portfolios, to be sampled at the convenience of the learner,

sound attractive. The corporate nature of participation makes it a social occasion; the personalised nature of the disciplinary exploration also makes it a social occasion.

2.5.5.5 Situated multi-environment learning systems

Bottino (2004:559) states that Situated multi-environment learning systems can be considered as a new generation of open-learning systems which are more suited to mediate the new ways of looking at teaching and learning processes that are now progressively affirming themselves. These systems make available tools able to support not only the relationship of the student with the knowledge to be learnt (learning object) but also all the relationships that are established between participants during a teaching and learning activity. Bottino (2004:558) propagates that School curricular includes different types of teaching and learning methods and there is no single method or type of tool that can be used for all occasions. Moreover, within any learning domain, students' and teachers' needs evolve during the activities in which they are involved and tools have to support this evolution.

Bottino (2004:559) points out that in the design of situated multi-environments learning systems, the following issues assume a crucial importance:

- the computational objects and interactivity that a system makes available to the user and their relationship with the cognitive processes involved in the acquisition of the knowledge for the learning of which the system has been realized;
- the tools offered to validate student's actions and the support they offer to the evolution of student's knowledge;
- the tools offered to support the re-elaboration of personal experience and its sharing within the class;
- the tools offered to support the setting up of a social context able to assist students' performance and the evolution of competencies and knowledge.

In general, situated multi-environment systems are characterised by a strict integration of tools for supporting visualisation, re-elaboration of knowledge, and communication. The aim is to offer tools for problem exploration, for representing solution strategies and processes and for communicating such processes as well as tools to support learning evaluation. Of course tools and features cannot by themselves

guarantee learning. They have to be used in order to support the construction of activities in which learning could be the result of a social construction of meaning and of its justification. It should be noted also that situated multi-environment systems can integrate environments of different kinds, such as Microworlds, specific drill and practice systems, communication environments and simulation systems amongst others. Broadly speaking, the cultural approach has led to deeper reflection on the penetration of modern Information and Communication Technologies in Education. The development of activity centred design to instruction and Activity theory stemmed from such thinking.

2.5.6 Activity Centred Design

Gifford and Enyedy (1999:189) after exploring the theoretical underpinnings of many of the existing computer-mediated learning environments suggested that the learning theories that lied behind them led to designs that do not fit with nor change the basic participation structures of the classroom. They acknowledged the fact that computer mediated learning environments have increased both student learning and interest, but have not changed the nature of the teaching-learning process, the daily activities of the average classroom. For example, the whole-class, time-based, lecture method still dominates the pedagogical landscape of most schools. Computers have not yet had the profound impact on classroom practice that has been predicted. Nevertheless, they pointed out that Activity Centred Design is an effort to move toward a more appropriate framework for Computer Supported Collaborative Learning environments.

Gifford and Enyedy (1999:189) states that Activity Centred Design (ACD) is a model or design for Computer Supported Collaborative Learning environments, based on the assumptions that: activity is mediated by cultural tools, activity must be conceptualized on a number of interdependent levels, and that conceptual understanding is first established socially. In this light, Gifford and Enyedy (1999:189) view learning as a complex process in which an individual's cognition is defined by its relation to the material setting and the forms of social participation encouraged by these settings. Accordingly, ACD emphasizes the design of computer-mediated environments to support and structure the interactions and interdependencies of an

activity system, including the interrelationships between students, their instructors, the tasks they undertake, and the inscriptions they use.

2.5.6.1 Activity Theory

Cole and Engestrom (1991) in Bottino, Chiappini, Forcheri, Lemut, Molfino (1999:283) designs a model that show the complex relationships between elements in an activity. According to the model, an activity is a form of doing towards an object (objective or purpose). In education and training, the purpose of an activity is to acquire specific competences (knowledge, skills and attitudes), and the outcome is educated students. Cole and Engestrom's systemic model points out three important mutual relationships involved in every activity. This includes the relationship between subject and object, subject and community and object and community. Each of the relationships is mediated by a third unit. The relationship between subject and the object of the activity is mediated by tools. That between subject and community is mediated by rules (explicit or implicit norms, conventions, social interactions), while that between object and community is mediated by division of labour (different roles characterizing the system which is important for transforming the object into an outcome).

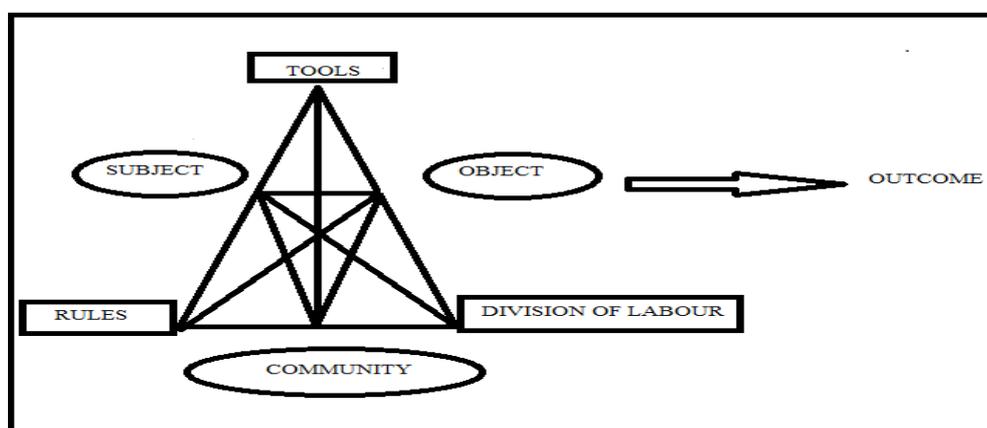


Figure 2.6: Cole and Engestrom's Model of Activity (1991) adapted from Bottino et al (1999:283)

Nevertheless, it is interesting to note that Paulo Freire's thinking is in line with Activity Theory. Freire (1984:12) championed a "critical pedagogy" which views people as subjects, not objects, who are constantly reflecting and acting on the transformation of their world so that it can become a more equitable place for all to live. In Freire's pedagogy, student dialogues, knowledge and skills are shared

cooperatively, legitimizing the experiences of the poor. Students are taught how to generate their own questions, focus on their own social problems and develop strategies to live more fruitful and satisfying lives. His view suggests that teachers should: facilitate and inspire students; advocate for the poor and agents for social change. He denounces teacher centred classrooms and illustrates how education could transform society by helping the oppressed develop a critical consciousness. In this work, following the activity model, subject refers to student-teachers, Object denote the specific competences expected to be developed; community in this respect refers to the educational community and all the stakeholders while the outcome refers to student teachers who are educated. In Activity Theory activities are influenced by other activities. External factors can change some elements of activities, causing contradictions (problems, ruptures, breakdowns). In this theory, contradictions are considered as a basis of development.

However, on the basis of Activity Theory, Bottino, Chiappini, Forcheri, Lemut, Molfino (1999:284) proposes a methodology for designing and reporting research projects involving ICT most especially computers in education and training. This methodology is specifically underpinned by Cole and Engestrom's activity model. The methodology involves analysis of the components (subject, object, community) of the activities involved in a research project, of their mutual relationships (activity-object/community, subject/activity-object, subject/community) and of the entities that mediate these relationships (division of labour, computer based tools, rules). It specify three closely connected levels of analysis that can be used for designing and reporting projects supported by ICT, taking into consideration all social interactions and structures involved. These include: epistemological, methodological and social assistance point of view.

- Epistemological level: this refers to the analysis or study of the history, culture of the learning object, characteristics of the ICT tools used and the contradictions that have characterized the evolution of the activity. The aim is to understand how the use of the tool in the activity context (learning experience) can enhance learning and reflection with respect to the overall object of the activity;
- Methodological level: understanding how the use of the tool in the learning experience can support the acquisition of a method for object construction. The

analysis includes actions, communication and goals involved in the learning experience mediated by ICTs;

- Social assistance level: this viewpoint refers to the contribution of the environment, social relationships and mediation of educational technology in the activity. The needs of the learners and the nature of the knowledge are taken into consideration. This view of learning in an organization is connected to Vygotsky's zone of proximal development. According to Vygotsky, the difference between assisted and unassisted performance is called the Zone of Proximal development which to him is the fundamental basis of development and learning Bottino and Chiappini et al. (1999:284).

In addition, it is worthy to note that the strength of both the theoretical framework and the characteristics of the methodology proposed are confirmed by its applicability to educational projects that differ as to the specific components of the activities, their mutual relationships and the entities mediating them. This applicability is shown through the description of two projects: (ARI-LAB and Qualification 2000). Bottino and Chiappini et al. (1999:287) propagates that the first project ARI-LAB was carried out in schools and involved the use of computer-based Microworlds. Bottino (2004:558) defines ARI-LAB as an open multi-environments system that supports teaching and learning activities in the domain of arithmetic at primary and lower secondary school level. It is a long term project that has undertaken major transformations from the initial prototype to the first commercially available version in 1999. The objectives of this project were to study and test new approaches to mathematics concepts and new methodologies for mathematics teaching and learning mediated by ICT environments and tools. Based on the theories of mediation and their basis in social interaction derived from Vygotsky's work and Activity Theory key ideas, the principles which have inspired the design of such tools are the following:

- mathematics rich activities: children should have access to, and be involved in mathematics rich activities to which they can attribute a concrete meaning and should be using age-appropriate tools and representations based on computational artifacts so that they can refer to their own experience thus contributing towards concrete abstract concepts;

- construction: children should be allowed to construct, manipulate, and validate artifacts and to share them with their community;
- collaboration: educational environments should involve collaboration between teachers and students and between the individual learner and fellow learners. They should make available tools for developing pedagogical activities based on the comparison and the negotiation of the mathematical meanings involved;
- context: an educational technology tool or environment should be designed to support all the activities that are developed through its mediation in the context of use. For example, a technology must be designed to support not only students' learning activities but also teachers' activities, because it is only by understanding and designing for the whole educational situation that effective and valuable changes can be brought about in the classroom Bottino (2004:561).

To add, it is worthy to note that the description and analysis of the project were made in terms of activity cycles with each expanding on the previous one. The expansion is observed when contradictions occur in the activity system, and new motivations arise as the result of the new objectification of needs. An example of activity cycle in the project that can be described in epistemological terms, corresponds to the shift from an empirical and objective conception of numbers (where the number 80 refers to eighty counted objects) to a conception in which this number is viewed in terms of relationships with other numbers (ten more than seventy; ten less than ninety; four times twenty; thirty more than fifty) each of these relationships in turn underpins the solution to a problem or class of problems. The activity cycle is eminent by another transformation; the shift from an additive conception of numbers in which children construct spontaneously in extra school experience to a positional conception. E.g. the child writes the number seven-thousand, one hundred as 7000100 instead of 7100. This is an example of a contradiction which is very common with children in elementary schools in the passage from an additive structure of numbers to a positional one. The expression 7000100 is the creative act of the pupil who has gained experience with the additive numerical system of coins and tries to apply the same structure to the new notation system she is learning.

Also, according to Bottino (2004:289), the object of the teaching and learning activity begins to transform when the student is able to recognise the new structure. It should be noted that the evolution in the activity was brought about by the emergence of a contradiction related to the use of two different sets of rules in the two situations. This contradiction resolved itself in the teacher mediated relationship between user and system. Positional number writing was therefore explained and justified on the basis of common rules and conventions. Bottino and Chiappini et al. (2004:289) states that a complete cycle mediated by the system can be studied from the epistemological, methodological and social assistance standpoints. Each of these expresses the role of the mediation in relation to each of the components (object, subject, community) in the model. In epistemological terms, the research showed that the system particularly the coins and abacus micro worlds made it possible to:

- work well with numbers in a defined context;
- solve problems in an environment which offers a visual feedback to performed actions;
- conduct meaningful activities with objects, helping students to grasp the additive conception of numbers;
- foster reflection about numbers as relations between other numbers in a context that facilitate attribution of meaning to that relation, in respect to problem-solving;
- develop automation of various counting strategies to be adopted as required when solving different problems (Bottino and Chiappini et al., 2004:289).

Also, in methodological terms, the ARI-LAB Microworlds made it possible to:

- manipulate objects that correspond to numbers in a context where students can attribute a meaning to manipulation actions when solving problems;
- transform objects corresponding to numbers with the help of feedback that contributes to the construction of meaning for the transformation carried out (i.e. coin exchange);
- associate a numeric value to specific object manipulation actions (i.e. selecting coins for counting them);

- establish suitable and useful communication actions in order to resolve the contradiction that emerged in the learning situations set (Bottino and Chiappini et al., 2004:289).

More still, in terms of social assistance, the ARI-LAB Microworlds together with the system's database and communication environments made it possible for the teacher to exploit the available action opportunities to:

- restructure the learning situation in line with the students' specific cognitive requirements;
- pose questions leading to the acquisition of abilities for planning the solution strategy;
- offer direct examples of appropriate and effective modes of action for solving problems;
- make generalizations about the knowledge involved in the activity (Bottino and Chiappini et al., 2004:290).

In conclusion, the above analysis can be very important for e-learning because it leads to a comprehensive explanation of what happens in technology mediated educational practice. The three levels described makes it possible to make inferences and generalizations about the systematic observations that may be made when the Engestrom model is applied to specific learning situations.

Nevertheless, the second project 'Qualification-2000' involved continuous training that integrates face to face lessons, self training and distance learning based on multimedia and distance learning support (Bottino and Chiappini et al., 1999:290). For the self training aspects, five multimedia packages on the following topics: graphic user interfaces, word processing, spreadsheets, databases and electronic mail were designed and implemented. As to distance learning, a communication environment that can be accessed from within the packages was created. Considering the project as an activity system, the subjects were employees (the trainees), and researchers (trainers). The object was office automation tools and methods. The community was made up of the class, the researchers, and the small and medium enterprises, that represented the context where the learning was applied. The rules included the time that was dedicated to training, the needs of the participants, and the relationships among the subjects - both social and those generated by the computer mediation. With regard to the division of labour, the roles of the different subjects involved varied during the activity.

However, as concerns the nature of the knowledge embedded in the use of the system with respect to the knowledge adopted as reference by the community (epistemological level) it was assumed that the outcome of the office automation training for company personnel should be twofold: first, becoming aware of technological evolution and its impact on their working activities; second, being capable of integrating new skills with those already mastered, in order to be able to manage transformation in the workplace brought about by the introduction of advanced information technology. The project adopted a problem solving approach to tackle the various topics and focused on the conceptual aspects involved rather than introducing them as independent of their application or presenting them as practical examples of general concepts as its common in most training courses.

More still, as to the methodological level: self learning, discussion with classmates and experts especially when studying a new topic. The integration of tools gives an orientation towards self learning with a communication system that seems an appropriate response to students needs, as students are offered the opportunity to discuss their autonomously acquired knowledge with friends and with the trainer. As to the social assistance level, the facilities embedded in the system allowed the participants to organise a series of activities aimed at simultaneously fostering the learning of computing contents, the development of group work skills and use of the network for sharing information and knowledge.

The following lessons were learned by the researchers about the role of ICT in continuous training:

- at the epistemological level, the researchers learned that ICT tools have to balance the theoretical approach typical of University and research context with the practical needs of the industrial world. The project suggests that ICT tools should help people to acquire autonomous learning capability;
- at the methodological level the researchers found out that materials and approaches proposed should take into consideration the practical context where they have to be employed. The project proposed that different approaches to training should be integrated in a single context: in face to face, autonomous, and distance under the guide of the teacher or in collaboration;

- at the social assistance level the researchers found out that Infrastructure have to be realized for technology based training to effectively take place (Bottino and Chiappini et al., 2004:293).

Bottino and Chiappini et al. (2004:293) concludes that the combination of theoretical aspects with practical experience and application to real problems helps users to acquire self confidence, understand problems and tackle tasks successfully. Also users learned that practicing with and without the guide of someone else are a valuable help for learning. They also learned that autonomous learning capabilities are the basis for personal growth while working in a group is difficult but presents advantages for learning. Lifelong learning requires autonomous learning activity. Different approaches to learning must be adopted. Motivation and the capability of cooperating with colleagues is central. The project showed that the web and multimedia technology effectively give the possibility of realizing continuous training experiences. It suggests that practical conditions like management, technology, maintenance must be guaranteed to make the use of ICT for training effective. The cultural approach has also led to the concept of systems thinking in instructional design, for educational technology.

2.5.7 Systems Thinking and Instructional Design

C.O.L (2000:8) highlights that a systems approach sets the conditions for proceeding in an orderly way when designing instructions or programmes for example open and distance learning.

It further states that Open and distance learning programmes, units and institutions use a phased model for problem solving:

“Analyze → design → develop → implement → evaluate → revise” (C.O.L, 2000:8)

The systems approach recognizes that all the parts of the system are interrelated. Consequently a change in one component will bring about a change in the others. It views that the whole as well as the different components that make up the system are all important. Considering not only the system but also its subsystems, its companion systems and the supra systems which they comprise. It is worthy to note that the activity of instructional design is approached from a holistic perspective. This

enables teachers and designers to see the bigger picture and thus resolve in advance several problems that would otherwise be created by their designs.

2.5.8 Theory of Multiple Intelligences

According to Passer and Smith (2001:347) Gardner's multiple intelligences is reshaping many current assessment practices and instruction. Teachers are now re-examining their methods of instruction and evaluation. For example, in evaluation, schools are now using descriptions to report student competence. According to Gardner, there are many specific types of intelligence or frames of mind and every student has the potential to develop strengths in one or more areas (Diessner, 2008:39). He further defines intelligence as "the capacity to solve problems or to fashion products that are valued in one or more cultural settings." Gardner maintains that if teachers give students the opportunities to use their bodies, imaginations and different senses, almost every student will find out that he or she is good at something. In the same light, Gardner believes that his theory of "multiple intelligences" accurately captures the diverse nature of human capability. He further identified eight kinds of intelligence, not all of which are commonly recognized in school settings. His eight intelligences are:

1. Logical mathematical intelligence (as in a scientist, mathematician).
2. Linguistic intelligence (as in a poet, journalist)
3. Bodily – Kinaesthetic intelligence (as in an athlete or dancer)
4. Musical intelligence (as in a composer, musician)
5. Spatial intelligence (as in a sculptor, painter, engineer)
6. Interpersonal intelligence (as in a salesman, teacher psychologist)
7. Intrapersonal intelligence (exhibited by individuals with accurate views of themselves).
8. Naturalist intelligence (as in an environmentalist, botanist).

The theory of multiple intelligences goes a long way in explaining why the quality of an individual's performance may vary greatly in different activities, rather than reflect a single standard of performance as indicated by an IQ score. Semenov (2005:107) comments that what is important is Gardner's stress on the fact that a particular intelligence cannot be conceptualised independently of the particular context in which an individual happens to live, work and play, and the opportunities and values

provided by that milieu. Diessner (2008:42) supports that as human beings, we all have a repertoire of skills for solving different kinds of problems. He argues that to better solve a problem; we should first take in to consideration the problem itself, the context and the cultural set up.

To add, Diessner (2008:39) holds that Gardner's theory has led to a lot of research by educators, some of whom are redesigning their curricular; to respond to differing student intelligences. In fact, Gardner's multiple intelligences is reshaping many current assessment practices and instruction

2.5.9 Levy's Collective Intelligence

Levy (1997:10) contends that "collective intelligence is the inevitable result of intelligent systems which are structurally coupled through electronic mediation". Levy's (1997) description of collective intelligence has much to offer educators and students, especially in the articulation of e-learning and online learners. As a matter of fact it is very important for effective comprehension of e-learning models. Levy (1997:8) states that "collective intelligence" is a "universally distributed intelligence" in which "no one knows everything, everyone knows something, all knowledge resides in humanity". The Cartesian, "I know, therefore I am", becomes "We know, therefore we are". Collective intelligence is a continuum developed through collective discussion, negotiation and imagination. Levy (1997:9) points out that ICT have the potential to "promote the construction of intelligent communities in which our social and cognitive potential can be mutually developed and enhanced and enable us to think collectively rather than simply haul masses of information around us".

Moreover, Zembylas and Vrasidas (2005:79) postulate that "educators have the opportunity to produce systematically the tools that will enable learners to construct intelligent communities and to think as a group, capable of dealing with the continuous transformation". They argue that the potential of collective intelligence can be described in terms of the development of new or enhanced individual and collective competence, research contributions to the evolution of knowledge to promote issues of peace and social justice, and the creation of new designs for global education". Zembylas and Vrasidas (2005:80) stress that "as collective intellects, educators and students may empower themselves in using ICT to be critical, and to take action for justice, peace, and equity". They conclude that "developing critical education means

exploring new ways of incorporating strategies of criticality such as: critical emotional literacy, collective witnessing, and collective intelligence into online activities” (Zembylas and Vrasidas (2005:80).

2.5.10 Adult learning theory

The limitations of formal education or learning theories and the quest for students to become independent lifelong learners have led to the development of adult learning theory (Andragogy). In fact, this theory is relevant to ICTs and e-learning. In the same light, Glickman (1985:4) views that “Knowledge of how teachers can grow as competent adults is the guiding principle for researchers in finding ways to improve teaching and learning”. Indeed, he (Glickman, 1985:4) argues that “when teachers accept common goals for students and therefore complement each other’s teaching, and when supervisors work with teachers in a manner consistent with the way teachers are expected to work with students, then and only then does the school reach its goals”. Two theorists/theories related to adults will be discussed below.

2.5.10.1 Jack Mezirow’s Transformative Learning Theory

Mezirow (1996:162) in Taylor (2008:1) postulates that this theory of transformative learning is considered uniquely adult, that is, grounded in human communication, where "learning is understood as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action." Notwithstanding, the transformative process depends on the frame of reference. Taylor (2008:1) describes frames of reference as "structures of assumptions and expectations that frame an individual's tacit points of view and actions." On his part, Kegan (1994:232) notes that learning that reflects on itself can only be accomplished through transformational education, “a ‘leading out’ from an established habit of mind,” an order of mental complexity that enables self-direction, a qualitative change in how one knows.

Moreover, Mezirow (2000:26) describes adult education “as an organized effort to assist learners who are old enough to be responsible for their acts to acquire or enhance their understanding, skills, and dispositions”. He argues that central to this process is helping learners to critically reflect on, appropriately validate, and effectively act on their beliefs, others’ beliefs, interpretations, values, feelings, and

ways of thinking. Taylor (2008:1) asserts that Jack Mezirow was the first to introduce the theory of adult learning in 1978. He argues that it helped explain how adults changed the way they interpreted their world. Mezirow (2000:8) holds that this theory has two kinds of learning: Instrumental and communicative. He argues that instrumental learning focuses on learning through task-oriented problem solving and determination of cause and effect relationship while communicative learning involves learning what others mean when they communicate with you (their feelings, intentions, needs and desires).

Also, McIntosh (2005:5) points out that the Seminal Faure report, issued under UNESCO auspices in 1972, saw education not only as a means of promoting vocational competence and economic progress but as a way of expanding individual freedom and enabling people to live fulfilled lives in a variety of roles. In the same light, Siegal (1990:58) in Mezirow (2000:26) describes a liberated person as one “free from unwarranted and undesirable control of unjustified beliefs, unsupportable attitudes and paucity of ability which can prevent one from taking charge of her own life.” Fostering these liberating conditions for making more autonomous and informed choices and developing a sense of self-empowerment is the cardinal goal of adult education. Mezirow (2000:54) postulates that an autonomous choice is one in which the individual is “free to act and judge independently of external constraints on the basis of her own reasoned appraisal.” He explains that acquiring the ability to make more autonomous choices is a process never fully realized. And that this process has to do with assessing reasons supporting beliefs.

In addition, Mezirow (2000:27) points out that "the process of self-empowerment, acquiring greater control of one's life as a liberated learner, is, of course, always limited by social, historical, and cultural conditions." And that "Sociologists, feminists, and ecologists have helped us become aware that human beings are essentially relational." He further explains that “our identity is formed in webs of affiliation within a shared life world.” It is within the context of these relationships, governed by existing and changing cultural paradigms, that we become the persons we are. Beebe (2003:86) points out that US President Franklin D. Roosevelt (1945) holds that “today we are faced with the pre-eminent fact that, if civilization is to survive, we must cultivate the science of human relationships—the ability of all peoples, and of all kinds, to live together and work together in the same

world at peace". Transformative learning involves liberating ourselves from forms of thought that are no longer dependable (Mezirow, 2000:27).

More still, Janik (2005:144) championed a "neurobiological" view of transformative learning which sees learning as "volitional, curiosity-based, discovery-driven, and mentor-assisted" and most effective at higher cognitive levels. Furthermore, this neurobiological approach suggests that transformative learning: requires discomfort prior to discovery; is rooted in students' experiences, needs, and interests; is strengthened by emotive, sensory and kinaesthetic experiences; appreciates differences in learning between males and females, and demands that educators acquire an understanding of a unique discourse and knowledge base of neurobiological systems. Janik (2007:12) points out that the brain structure actually changes during the learning process. His findings bring into question traditional models of learning like behaviourism, cognitivism, constructivism and instead offer a distinctive neurobiological, physically based pathway to transformative learning.

To add, Taylor (2006:92) argues that a transformative educator should not be taken without considerable personal reflection given that although the rewards may be great for both the teacher and the learner, it demands a great deal of work, skill and courage. This means that the teacher must be willing to be transformed in the process of helping students to transform. Thus, the teacher needs to take a position that will help him or her to develop a deeper awareness of his or her own mindset and how it shape practice in order to foster change in students (Johnson-Bailey and Alfred, 2006 : 55). In the same light, Basseches (1984) in Mezirow (2000:30) concludes that the main goal of adult education is to help adults realize their potential for becoming more liberated, socially responsible, and autonomous learners- that is , to make more informed choices by becoming more critically reflective in their engagements in a given social context. Nevertheless, Mezirow (2000:29) stressed that, it is important to recognize the difference between the goals of educators and the objectives of their learners that they want to help them achieve. He emphasized that the curricula, instructional methods, materials, assessment, faculty and staff development should address both learner objectives and this goal of adult education. According to Mezirow (2000:30) adult educators and learners possess the following characteristics:

- Transformative learners, with social or organizational change as objectives, become active agents of cultural change.
- Adult educators are never neutral: They are cultural activists committed to support and extend those canon, social practices, institutions, and systems that foster fuller freer participation in reflective discourse, transformative learning, reflective action, and a greater realization of agency for all learners;
- Adult educators do not indoctrinate: They create opportunities and foster norms supporting freer, fuller participation in discourse and in democratic social and political life;
- Adult educators may choose to work with learners with whom they have a feeling of solidarity;
- In fostering transformative learning efforts, what counts is what the individual learner wants to learn. This constitutes a starting point for a discourse leading to a critical reflection of assumptions and expectations underpinning the learner's/educators' tacit point of view which influence their thinking, beliefs and actions;
- Adult educators create protected learning environments in which the conditions of social democracy necessary for transformative learning are fostered. Central to the goal of adult education in democratic societies is the process of helping learners become more aware of the context of their problematic understandings and beliefs, more critically reflective on their assumptions and those of others, more fully and freely engaged in discourse, and more effective in taking action on their reflective judgments.

On the one hand, “Transformative learning” theory has significant implications for the implementation of e-learning. On the other hand, e-learning has the capacity to develop this theory of learning. Nagy (2007:2) highlights that although ICT applications in development are both new and increasingly central to all sectors of the economy especially education, they are driving productivity and empowering social and institutional transformations. It can help learners to acquire their autonomy by furthering their education while working. It also has the potential to give everybody equal access to the necessary education and training to become qualified thereby ensuring social justice in the community. It gives learners the opportunity to develop autonomous thinking. Mezirow (2000:28) views autonomous thinking as a competence

acquired through transformative learning. According to him, “fostering greater autonomy in thinking is both a goal and a method for adult educators.”(Mezirow, 2000:29). Worthy of note is the fact that the unit of analysis in this theory like the traditional theories (behaviourism, cognitivism and constructivism) is the individual, with little consideration given to the role of context and social change in the transformative experience. This ‘overemphasis’ on the individual has been challenged by the socio-cultural approach already discussed

2.5.10.2 Malcolm Knowles’ Theory of Adult Learning

Knowles (1990) in Noe (2002:116) identified some characteristics of adult learners that can be used to facilitate learning. These include.

1. Adults have the need to know why they are learning something;
2. Adults have a need to be self-directed;
3. Adults bring more work-related experiences into the learning situation;
4. Adults are likely to choose to learn when they are ready to learn;
5. Adults, in their learning are problem – centred;
6. Adults tend to be motivated by personal factors.

Malcolm Knowles’s theory of adult learning (theory of Andragogy) can be used as the basis for developing or sustaining any e-learning program in higher education. This theory was developed out of a need for a specific theory of how adults learn. Noe (2002:115) pointed out clearly that most educational theories or learning theories as well as formal educational institutions were developed exclusively to educate children and youths. He further adds that pedagogy, the art and science of teaching children, dominated educational theory. Notwithstanding, Pedagogy gives the instructor major responsibility for making decisions about learning content, method, and evaluation. Here, students are generally seen as being passive recipients of directions and content and bringing few experiences that may serve as resources to the learning environment. This has paved the way for what is now known as adult learning theory.

According to Latchem (2012:9), “Adult education is specifically designed and provided for those over school-leaving age who, for whatever reason, have missed out on, or have dropped out of, formal education, but are still keen to learn more about matters relevant to their needs and interests”. He further explains that these kinds of

people need basic education. Latchem (2012:9) defines basic education as “the term used to describe the formal, non-formal and informal learning that meets basic learning needs and lays the foundation for all subsequent learning”. Latchem propagates that many studies have shown that basic education develop knowledge and skills that translate into employment, empowerment and higher earnings. He further stressed that it can also result in reduced spread of HIV/AIDS, prevention and medication of disease, lower maternal, infant and child mortality, improved nutrition, longer life expectancy, increased productivity in traditional sectors, and greater understanding of democracy, human rights, governance and non-violent ways of solving problems. WBI (2007:117) concludes that Basic education provides the foundation for lifelong learning and increases people’s capacity to assimilate and use knowledge.

On his part, Glickman (1985:44) points out that adult development studies have build on some of the findings of research on children. For example studies carried out by great psychologist like Jean Piaget. Glickman (1985:44) defines adult development as “the study of adults’ capabilities to improve over time”. Glickman holds that, adults change in predictable ways according to age, individual characteristics, and the demands of the environment. He further states that one major finding of adult research is that cognitive, social, and language development does not solidify at adolescence or early adulthood but continue throughout life. The only difference is that in childhood the changes are so remarkable. Changes in adults in terms of thinking, attitudes toward work, social relationships are subtle and become clear only after a long time. WBI (2007:128) highlights that improving adult education, as well as upgrading the skills of workers constitute an important issue for low-income countries. The use of ICT’s and e-learning can be useful in this respect.

However, Glickman (1985:44) states that the principles of development revealed for children can equally apply to adults:

1. Common stages of growth through which all humans are capable of passing.
2. The stages are in order. That is one stage precedes the next.
3. The rate of passage from one stage to the next varies from person to person.

Another area of research in Adult development which can be applied to e-learning is cognition, conceptual attainment and personality. Havighurst (1980:6) in

Glickman (1985:45) found that there are two types of intelligence; one which decreases during adulthood (fluid) whereas the other increases (crystallized). According to Havighurst, fluid learning depends on physiological and neurological capacities which decline over time. This slows down the abilities of adults over 30 years to handle instant and visual information (inductive reasoning). However, crystallized learning which is based on experiences, older people naturally have more experience and knowledge to draw on in processing new information and solving familiar tasks (deductive reasoning). According to Glickman, intelligence or the ability to solve new problems becomes a slower but more thorough process with age. An older person will not respond as quickly but can relate more experience to understanding new problems.

Moreover, Glickman (1985:46) defines conceptual formation or development as “the acquisition of symbols or abstractions that accommodate particular events into an integrated, larger category”. For example the concept of e-learning which is multidimensional and based on the context. Kohlberg and Turiel (1971) in Glickman (1985:46) demonstrate a hierarchy of concepts related to morality. According to Kohlberg and Turiel, in stage three unlike in stage one and two, people learn to empathize with others. Stage four is characterized by learning to see oneself both apart from and in relation to others. Kohlberg and Turiel (1971) in Glickman (1985:46) assert that, concept development, as moral and crystallized learning, “is the natural tendency to acquire more information about oneself, one’s situation, and one’s relationship with others before making judgments”. Persons in the highest stage (stage 6), decide what is right or wrong according to universal criteria. Unfortunately, according to Kohlberg, a majority of persons do not move beyond stage 4, “conventional reasoning, according to rules of authority”. Research on adult education and development focuses on improvement and how educators can apply such knowledge to help teachers improve. Cognitive, moral, and conceptual development research and theory can be used in the design and implementation of e-learning programs for students and teachers.

To conclude, it should be noted that none of these theories can be used exclusively to explain all learning processes. Each one of them makes a contribution to the understanding of the learning processes. Learning strategies should therefore be selected that motivate learners, facilitate deep processing, build the whole person, cater

for individual differences, promote meaningful learning, encourage interaction, provide feedback, facilitate contextual learning and provide support during the learning process. Thus learner support services characterized by these qualities can facilitate learning in ways that are envisaged by the theories of learning.

2.6 Synthesis

The chapter just ending reviewed related literature on the possible role of ICTs and e-learning on the learning environment. Also, it has discussed the conceptual framework, models and the theoretical frameworks for the study.

The next chapter will be providing a blue – print plan on how to carry out the investigation in the field.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes procedures applied in carrying out the study. This includes the research design, geographical location, population, sampling technique, instrumentation and data analysis plan. It is necessary for generating information that will determine the success of this research in reaching its projected conclusion.

3.2 Research Design: Research Approach and Research Methods

A research design can be defined as a plan, format or layout which is used to acquire data relating to a given problem. Data is necessary to verify hypotheses or answer research questions in a particular study. This study will involve a mixed methodological approach. It involves the mixing of qualitative and quantitative approaches at many phases in the research process, from the initial philosophical assumptions to the drawing up of conclusions. It focuses on collecting, analyzing, and mixing quantitative and qualitative data in a single study or series of studies. Some researchers called this approach to research “triangulation of method”. Neuman (2006:149) asserts that triangulation is the idea of looking at something from multiple points of view. On his part, Gay (1996:217) defines triangulation as “the term for the use of multiple methods, data collection strategies and or data sources”. Elliot (1992:82) says, “the basic principle underlying the idea of triangulation is that of collecting observations or accounts of a situation from a variety of angles or perspectives and then comparing them.

Amin (2005:64) points out that the aim of triangulation is to map out or explain fully the richness and complexity of a study from different points of view and involves the use of both quantitative and qualitative approach in a particular study under investigation. According to him, “the presentation or use of only qualitative or quantitative approach often presents only a myopic view of things”(Amin, 2005:63). Jonassen (2003:364) confirm that relying exclusively on a quantitative or any single form of research restricts researchers’ understanding of the problem. Fraenkel and

Wallen (2000:508) postulate that the two approaches should be combined frequently in research. The basis of using quantitative and qualitative approaches in combination is to provide a better understanding of the research problem than either approach alone. This better understanding results because mixed methods offers strengths that offset the weaknesses of separately applied quantitative and qualitative research methods. It also encourages the collection of more comprehensive evidence for study problems, helps answers questions that quantitative or qualitative methods alone cannot answer, and reduces adversarial relationships among researchers and promotes collaboration. Mixed methods encourage the use of multiple worldview. It is a practical and natural approach to research. This research method is important today because of the complexity of problems that need to be addressed. In the same light, Neuman (2006:149) supports that the idea of looking at something from different angles or viewpoints improves accuracy. Qualitative and quantitative representations are complementary (Jonassen, 2003:364).

On the one hand, Qualitative research can be defined as a research study that explores the quality of relationships, activities, situations or materials. According to Fraenkel and Wallen (2000:12), a qualitative research approach provides a holistic picture of what goes on in a particular situation or setting rather than just comparing the effects of a particular treatment. Amin (2005:43) states that qualitative research approach is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives (that is the multiple meanings of individual experiences, meanings socially and historically constructed with an intent of developing theory or pattern) or participatory perspective (collaborative). This approach has the capacity to provide a complete picture of the role of e-learning on the professional development of student-teachers in Cameroon. Worthy of note is the fact that qualitative research sometimes provides preconditions on which quantitative research can be applied. Also, qualitative research supports construction of quantitative knowledge not available initially. It supports the findings of quantitative research.

On the other hand, Quantitative research, can be defined as a research approach that investigate how well, how much, to what extent or how accurately different learning, attitudes, or ideas are being developed. Amin (2005:55) points out that quantitative research involves the collection of numerical data in order to test hypotheses or answer questions concerning the current status of the subject of the

study. Fraenkel and Wallen (2000:212) assert that quantitative data are obtained when the variable being studied is measured along a scale that indicates how much of the variable is present. They are reported in terms of scores. Higher scores indicates that more of the variable is present than do lower scores. Neuman (2006:151) postulates that “quantitative researchers emphasize precisely measuring variables and testing hypotheses that are linked to general causal explanations”. Quantitative approach also supports the construction of qualitative knowledge. Its findings support qualitative research. The use of this approach in this study is to investigate the extent to which the use or incorporation of e-Learning method influences the professional development of student teachers in Cameroon. That is, the extent to which the use of e-learning influences practicing teachers’ communication skills; technical skills; interpersonal skills; teachers’ attitudes towards ICT; support received by ICT teachers; values and principles suitable for learning; and challenges faced by teachers in the field.

This study will employ survey as well as experimental research (Quasi experimental design). The use of a survey research design necessitates the study of a representation sample, which will allow the researcher to make inferences or generalization to the population under study. The use of survey will permit the collection of quantitative data. Fraenkel and Wallen (2000:283), points out clearly that experimental research is one of the most powerful research methodologies researchers can use. According to them, it is the best way to establish cause-and-effect relationship between variables. In this case, I am going to use the quasi experimental design. Neuman (2006:256), Amin (2006:220), Fraenkel and Wallen (2000:294), holds that quasi experimental designs do not include the use of random assignment. Using this design, the researcher relies on other techniques to reduce threats to internal validity. Amin (2006:220) points out that there are two main types of quasi-experimental designs: non equivalent group post-test designs and non equivalent group pre-test-post-test. This research is going to employ the non equivalent group pre –test – post – test design. There will be an experimental or treatment group and a control or comparison group. The experimental group will be taught using the method of e-Learning while the control or comparison group will not be taught using e-learning. This therefore means that in the experimental group, there will be the presence of e-learning while in the control group there will be the absence of e-learning. In the control group, only the traditional or conventional methods such as the lecture method

will be used in the teaching-learning process. This group (control group) will help me to determine whether the integration or use of e-learning has had an effect or influence on the professional development of student teachers.

3.3 Area of the Study

The area of study refers to the location where this study was carried out. This study was carried out in Cameroon. The country covers a surface area of 475,440 square kilometres and has an ethnically and linguistically diverse population of about 20 million with about 200 linguistic and ethnic groups (Africa Atlases: Cameroon, 2007:7, Cameroon/World bank Report,2012:32). It is bordered to the south by Equatorial Guinea, Gabon and Congo; on its south-west side, it overlooks the vast Atlantic Ocean; to the west by Nigeria; on its eastern side by the Central African Republic and Chad; and to the north by Lake Chad. Cameroon has two official languages, English and French. The country is sub divided into ten regions (North West Region, South West Region, West Region, Littoral Region, Centre Region, South Region, East Region, Adamawa Region, North Region and Far North Region). Each region is further sub-divided into Divisions and Sub-Divisions. These regions are each administered by appointed Governors in addition to Divisional and Sub-divisional officers while executive powers are conferred to the President of the Republic. The economy is basically Agricultural and commonly described as Africa in miniature or the basket of West Africa.

The choice of the study area was first of all because the researcher is a Cameroonian, born and lives in Cameroon. Secondly, the multiplicity of schools in Cameroon and the interest by so many graduates of becoming teachers especially at the secondary, primary and nursery schools. Thirdly, the great need for these young Cameroonians aspiring to becoming teachers to acquire the necessary academic and professional skills, attitudes and values suitable for learning in the 21st century. Fourthly, the incessant love of electronic gadgets like computers, Internet, digital radios, digital Televisions and hand held devices like telephones by Cameroonians motivated the researcher to carry out this study. Fifthly, the growing interest in the telecommunication sector by the Cameroon government: the project on the creation of 20,000 community tele-centres in Cameroon, the project on the National Optic Fiber

Network planned to be implemented with the government of China. Above all the researcher masters the area of the study and is a University lecturer in Cameroon

Moreover, the study was carried out in Government Teacher Training Colleges. Cameroon has 59 Government Teacher Training Colleges that trains teachers of basic education located in each Sub-Division. Basic education is two years for Nursery and Six years for primary school in Cameroon. The country has eight state Universities. Of this eight, two are Anglo-Saxon Universities (University of Buea and the newly created University of Bamenda), four Bilingual Universities (University of Yaounde I, University of Yaounde II, University of Maroua and University of Dschang) and two Francophone Universities (University of Douala and University of Ngaoundere). Five of these universities have Higher Teacher Training institutions that train teachers of secondary education in both technical and general education. This include the Higher Teacher Training College Yaounde of the University of Yaounde I, The Higher Teacher Training College and the Higher Technical Teacher Training College Bamenda of the University of Bamenda, The Higher Teacher Training College Maroua of the University of Maroua, the Higher Technical Teacher Training college Douala of the University of Douala and the Faculty of Education of the University of Buea that trains both campus and distance education students. It is worthy to note that the study involves only general education institutions.

3.4 Population of the study

Amin (2005:6) defines a population as “the complete collection (or universe) of all the elements (units) that are of interest in a particular investigation. The population of the study defines the limits within which the researcher’s findings are applicable or are generalised. Thus the population of the study was made up of student-teachers in institutions of teacher education in Cameroon.

3.4.1 Target Population

According to Amin (2004:6), a target population is the population to which the researcher ultimately wants to generalize the results. He further explains that this target population may not be accessible to the researcher. The target population was made up of all the final year student-teachers and lecturers in the different Government Teacher Training institutions in Cameroon. That is third year (3rd year) Student-teachers in

teacher education schools in Cameroon. The choice of final year students is first of all because of their experience in school as prospective teachers. These are students that have already learnt basic competencies in teaching and technology given that educational technology is already one of the disciplines taught in all schools from nursery to tertiary education. Secondly, the researcher thought that was the level that could generate data necessary for the study.

Table 3.1 *Summary Table of Target Population According to Regions of Cameroon*

Region	Adamaoua	Centre	East	Far North	Littoral	North	North West	West	South	South West	National Total
G.T.T.C (Student-teachers)	901	3598	748	1577	1309	1074	2744	2386	964	1738	17040
H.T.T.C (Student-teachers)	-	807	-	3822	-	-	850	-	-	860	6339

Source: Ministry of Secondary Education (2013), Ministry of Higher Education (2013)

Sampled or Accessible Population

This is the population from which the sample will actually be drawn (Amin, 2004:6). The accessible population was comprised of student-teachers and lecturers of 20 teacher training institutions and three higher teacher training colleges in three regions. This include the Centre Region, South west Region and North West Region.

Table 3.2 *Summary Table of Accessible Population (Centre Region)*

School	G.T.T.C Akonolinga	G.T.T.C Bafia	G.T.T.C Esseka	G.T.T.C Mbalmayo	G.T.T.C Mfou	G.T.T.C Monatele	G.T.T.C Nanga Eboko	G.T.T.C Ngomou	G.T.T.C Ntui	G.T.T.C Yaounde	H.T.T.C Yaounde
Student - teachers	217	210	205	253	268	230	168	259	220	266	807

Table 3.3 *Summary Table of Accessible Population (South West Region)*

School	G.T.T.C Bangem	G.T.T.C Buea	G.T.T.C Fontem	G.T.T.C Kumba	G.T.T.C Limbe	G.T.T.C Mamfe	G.T.T.C Mundemba	F.ED Buea
Student - teachers	255	386	262	412	306	245	228	860

Table 3.4 *Summary Table of Accessible Population (North West Region)*

School	G.T.T.C Bamenda	G.T.T.C Kumbo	G.T.T.C Mbengwi	G.T.T.C Nkambe	G.T.T.C Fundong	H.T.T.C Bamenda
Student - teachers	320	240	260	245	250	850

3.5 Sample and Sampling Technique

To obtain a representative sample for this study, a number of sampling techniques were employed. Firstly, purposive sampling was used to select the target population. The researcher sought the opinion of his colleagues and used his own

personal judgment to select the level and classes that he believed would provide data needed for the study based on their prior experiences and knowledge of ICTs. The researcher being a lecturer in one of the target institution (the Higher Teacher Training College Yaounde) conducted an experiment on e-learning and initial professional development of student-teachers with his students as part of the study. These were third year students from four departments studying the course Educational technology (EDI 309). Of the four (4) departments, two (2) were chosen for the experimental group and two (2) chosen for the control or comparison group.

Secondly, cluster sampling was applied for the survey. The various regions/teacher education institutions of the country were considered as clusters. The researcher wrote the names of the different regions and institutions respectively on a slip of paper. The slips were then folded and put in a basket. The folded slips in the basket were thoroughly shuffled. After shuffling, each slip was blindly drawn. A drawn slip was unfolded and the selected region/institution recorded. After that, the slip was folded and put back in to the basket for another reshuffling, drawing and recording.

However, a recorded slip drawn the second time was not taken in to account. Instead of being recorded, it was again folded and put back in to the basket for another reshuffling, drawing and recording. This procedure was repeated until the desired number of regions and institutions was selected. The procedure gave each region and school an equal chance of being selected. This operation led to the selection of eight (8) primary Government Teacher Training Colleges from three (3) regions of the country for the study. It is also worthy to note that all the Higher Teacher Training Colleges in the three regions were selected for the study since each region had only one. After selecting the schools with their respective levels, the number of student-teachers to be selected from each institution to make up the desired sample size was calculated. The sample size was determined using Krejcie and Morgan's table on "determining sample size for research activities" (Krejcie and Morgan, 1970). This number was proportional to the total number of student-teachers in each school selected.

Finally, the researcher employed the procedure described above in smaller classes (using simple random sampling) and systematic random sampling in larger

classes visited to obtain the desired sample size of 796 respondents initially desired for this study as seen in the table below.

Table 3.5 *Summary Table of Sample Population according to Region*

Region	School	Population(N)	Sample
CENTRE	HTTC Yaounde	807	133
	GTTC Yaounde	266	44
	GTTC Mbalmayo	253	42
	GTTC Mfou	268	44
SOUTH WEST	FoED	860	142
	GTTC Buea	386	64
	GTTC Limbe	306	51
NORTH WEST	HTTC Bambili-Bamenda	850	140
	GTTC Bamenda	320	53
	GTTC Kumbo	240	43
	GTTC Mbengwi	260	40
Total			796

3.6 Instruments for Data Collection

The main research instrument for this study was a questionnaire that was carefully designed with respect to the variables under study and administered to student-teachers in the selected schools. The instrument consisted of nine (9) sections (section A, B, C, D, E, F, G, H and I) designed to assess the role of e-learning on the professional development of student-teachers in Cameroon. In section A, biographical and demographic information (school type, name of school, region, gender, age, ICT resources, qualifications, experience, frequency of ICT use, type of user, and reasons for using ICTs) was requested from the respondents. In this section, the students were asked to indicate whether they think students taught with ICTs perform better. Section B of the instrument sought to measure the respondent's knowledge of e-learning and current models of teaching/learning. This section was further partitioned into six (6) sub-sections (B1, B2, B3, B4, B5, and B6) with each sub-section relating to one indicator or model of e-learning which constitutes the independent variable of the study. A four point – Likert scale questions was provided with 4 representing strongly agree and 1 representing strongly disagree.

Also, section C of the instrument was well designed to assess respondent's communication skills. In this section, a four – point scale was provided for each statement, with 4 representing very good and 1 representing very poor.

Also, section D sought to measure the respondent's ability or technical skills gained by using ICTs (Internet, computers, mobile phones). A four – point scale was provided for each statement with 4 representing very good and 1 representing very poor.

To add, section E was designed to assess the respondent's interpersonal skills (interactivity) with respect to the teaching/learning process using ICTs. A four – point scale was provided for each statement just as in the sections above with 4 representing very good and 1 representing very poor.

Also, section F sought to measure respondent's attitude towards ICTs with respect to learning. A four – point scale was provided for each statement with 4 representing very positive and 1 representing very negative.

In addition, section G was designed to assess the support received by ICT teachers thanks to the penetration of ICTs in the curriculum. A four point – scale was provided with 4 representing strongly agree and 1 representing strongly disagree.

More still, section H was designed to assess respondents with respect to the development of values and principles of meaningful learning using electronic applications. A four – point scale was provided for each statement just as in the sections above with 4 representing very good and 1 representing very poor.

Also, with the introduction of ICTs in the curriculum, section I sought to measure the challenges faced by respondents in the field. A four point – scale was provided with 4 representing strongly agree and 1 representing strongly disagree.

Moreover, the questions and items were carefully stated in clear, simple and unambiguous language so as to facilitate the respondents' understanding and responses. The purpose of the study was taken in to consideration before constructing the instrument. The various competences expected to be developed by teachers most especially in this era of Information and Communication Technologies were considered to be very important for this research. In this light, the cognitive, affective and psychomotor domains of learning were equally taken care of in the instrument.

Finally, the questionnaire had a short letter addressed to the respondent. The letter had the name of the researcher, his level, University, research domain, appeal for honest responses and an assurance of confidentiality. The instrument ends with a statement of appreciation to the respondent for participation and the researcher's e-mail address and telephone number for any concerns.

3.7 Validity of the Instrument

The researcher collected content – related evidence to check the validity of the instrument. The first draft of the instrument (questionnaire) was prepared by the researcher and sent to the supervisor. The questionnaire was given along with the objectives and research questions. A concept mapping, which clearly defines the variables to be measured and a description of the sample, was attached to the instrument. This was to ensure that the content of the instrument was appropriate, comprehensive and capable of measuring the variables.

After reviewing the instrument, the supervisor made some corrections and suggestions. The researcher effected the corrections and incorporated suggestions for improvement in to the final instrument. In order to check whether the questions and items were to be understood by the participants, a pilot study was conducted. This was done by administering the questionnaires to 30 student-teachers who were not part of the sample but constituted part of the population. After analysing the responses for the pilot study, the researcher identified no difficulties with the participants in understanding the questions and items. This gave him confidence and courage to administer the instrument to the actual sample of the study.

3.8 Administration of the Instrument

The researcher began the exercise by paying a visit to all the regional delegates and institutions selected for the study. At each regional delegation, the researcher presented himself to the regional delegate who later issued an authorization letter for research which facilitated access to the various schools involved in the project. In each institution visited, the researcher reported to the head of the institution who guided him on how to meet the respondents. The instrument was administered only in those classes that were involved in the study.

Also, given the importance attached to the study by the different stakeholders, some of the lecturers made the administration of the instrument easier by offering part of their lecture time for the exercise. For larger classes, the researcher administered the questionnaires to the students systematically. The arrangement of the lecture halls in to rows and columns facilitated the administration of the questionnaires. The sampling interval was based on the total number of students in each class. In some classes where the student-teachers were not many, the researcher simply applied simple random sampling in administering the questionnaires.

Finally, in all the schools visited, the questionnaires were completed immediately and handed to the researcher.

3.8.1 Questionnaire Return Rate

Table 3.6 Return Rate of Questionnaire for Student-teachers

Region	Number Distributed	Number Returned	Return Rate (%)
Centre	263	263	100
North West	276	276	100
South West	257	257	100
Total	796	796	100

Table 3.5 above shows that a total of 796 questionnaires were administered to student-teachers and 796 were returned giving a 100% return rate.

3.9 EXPERIMENTATION

Purpose: The purpose of the experiment was to find out whether student-teachers taught using the method of e-learning (Blended Learning) perform better than student-teachers taught without e-learning.

Goal or Competencies expected to be developed: Knowledge of general culture of ICTs in Cameroon, Usage and Creativity/Production.

Assignment Question One (Test One): Individual Assignment Question:

In not more than one page, explain three reasons why a prospective professional teacher should study educational technology.

Assignment Question Two (Test Two): Group Assignment Question:

1. Construct one instructional media (material) or platform from one of the following domains:
 - Visual Media
 - Audio Media
 - Audio-Visual Media
 - Multimedia
2. Describe how it can be used in teaching a specific concept or topic in your field of study

Resources or Materials: The following requirements were very essential for the success of the study:

- the right study environment;
- Internet access;
- Online Learning Platform (Kibinkiri, 2014)
- Individual and group Email addresses (compulsory for all the students in the experimental group);
- Digital Camera;
- Video Projector;
- Telephone;
- Classroom for tutorials (face-to-face lessons); and
- Programme guide.
- Participants/learning community: Student-teachers, the researcher and the platform.
- Moderator/Web Manager: Researcher (e-mail: kibinkirieric@yahoo.com)

Design: The study was conducted using the quasi-experimental design. It employed the non equivalent group pre – test – post – test design. In this design, the subjects for the study were not randomly selected. Also, subjects were assigned to two groups (experimental and control groups) without any random selection. To establish if the two groups were initially different on the outcome measure, the two groups were pre-tested. After that, the treatment was given to one of the groups (experimental group). At the end of the treatment, a post-test was given to the two groups. This designed was

applied because the study focused more on the development of competences which could be evaluated at the beginning and at the completion stage of the experiment. It is worthy to note that some observation (participant observation) was involved in this study given that the researcher worked closely with the different groups as facilitator. As a matter of fact, this involvement in the study helped the researcher to collect some data of qualitative nature. The type of e-learning experimented was **Blended learning** (combination of 'face-to-face' lessons and online learning). Also, the study was underpinned by the Competence-Based Approach strongly recommended by the Ministries of education in Cameroon.

3.9.1 Area of the Study

This experiment was carried out in the Higher Teacher Training College (H.T.T.C), University of Yaounde I in Cameroon. H.T.T.C Yaounde is a bilingual institution with English and French as the main official Languages used for instruction. It is commonly called E.N.S (Ecole Normale Supérieure de Yaounde). The institution has about 4745 students partitioned in fourteen (14) departments and seventeen (17) series (University of Yaounde I, 2012:78). The choice of this study area was sanctioned first of all by the fact that the institution has the basic infrastructure necessary for the research.

3.9.2 Description of Programme/Guide: The course EDI 309

The programme on Educational Technology (EDI309) was based on three main competences expected to be developed. This include: Knowledge of general culture of ICTs in Cameroon, Usage and Creativity/Production. The aforementioned competences expected to be developed were grouped under modules. Each module was accompanied with Feedback (formative and summative evaluation), remediation and reinforcement. The modules were carefully designed by the researcher to suite the objectives of the course and the research. Each unit or module ended with sample questions which gave students the opportunity to assess themselves and their work (peer evaluation). Student-teachers were expected to develop competences according to their abilities. In this respect, the programme took in to consideration the aspect of individual differences given that not every student could achieve the same competences at the same time. The programme was designed on the premise that the initial professional development of teachers was very important for teaching and

learning with ICTs in the later years. Worthy of note is the fact that the design of the programme took into account the needs and expectations that the institution has in respect to training. The course was designed in a way that students could acquire the knowledge and skills needed for effective teaching and learning in the field.

However, the course was subdivided into fourteen (14) units covering all the fourteen (14) weeks of the first semester. Each unit had duration of two hours of tutoring each week in school (face-to-face meeting). The course sought to introduce to student-teachers modern methods of teaching and learning with ICTs which include: Direct teaching, indirect teaching, discovering learning, Asynchronous collaborative learning, problem-based learning, Asynchronous experiential learning, self-directed learning, blended learning, synchronous, and asynchronous learning. Also, the course was designed to identify some technical skills expected to be developed by student-teachers. For example emailing, blogging, social networking, Uploading and Downloading, mastery of basic computer programs like word, excel and power point, Curriculum mapping (the breaking up of the curriculum into sections that can be assigned and assessed), reading skills, typing, research, Problem solving, critical or creative thinking

Moreover, the course was planned to develop effective communication skills such as emailing (sending and reception of e-mails), use of telephone, teleconferencing, group communication or discussions, face-to-face communications, web publishing, speaking, listening and writing skills.

In the same light, the course was designed to develop interpersonal skills/interactivity between student-teachers, students and lecturers, students and the learning content, students and community resources. It was expected to involve students in ICT based curriculum design, system thinking, curriculum planning, curriculum implementation and curriculum evaluation. It also sought to develop values and principles suitable for learning in the 21st century, for example, personal values, group values and principles. Group values included: Punctuality, general good (goal beyond oneself), sharing/collaboration, empathy, and respect of rights.

Personal values included: hard work, integrity, humility, and confidence, being responsible and having self-control.

In addition, the course was designed to find out the kind of attitudes developed by student-teachers with ICT that can be suitable for learning in the 21st century. For example, continuous learning with ICTs, interest in learning, self-directed learning, believing in the potentials of ICTs in learning and research, capacity building, direct assistance, and group development. Also, with the introduction of ICTs in the curriculum, the course sought to find out the challenges faced by student-teachers with respect to ICTs and learning. Finally, the course sought to find out the support received by ICT teachers thanks to the penetration of ICTs in the curriculum.

3.9.3 Description of Experiment

The experiment was carried out with two different groups of students studying the course EDI 309 (Educational Technology). Educational Technology (EDI 309) is a course offered from the department of Science of Education to all level three students in all the departments of Higher Teacher Training College Yaounde. The first group was a combined class that was made up of level three students studying German and Spanish as foreign languages respectively in the department of foreign languages registered for the aforementioned course. This group constituted the experimental group. The second group was also a combined class that was made up of level three students studying Chemistry and Physics as teaching subjects and registered for the course EDI 309. This group constituted the control group. In the experimental group, student-teachers were given access to an electronic platform (Yahoo group). The Blended learning mode or approach (combination of face-to-face and Internet-based learning) was adopted in teaching and learning. In this group, student-teachers had the opportunity to meet 'face-to-face' with the lecturer during normal class time once a week and to continue learning in the Yahoo group. However, students in the control group had no access to an electronic platform or e-group. The only opportunity they had was to be taught in the classroom following the 'face-to-face' approach. Therefore, in the experimental group, there was the presence of e-learning while in the control group there was no e-learning. In the control group, only the traditional or conventional methods such as the lecture method, demonstration and discussion were used in the teaching-learning process. This group (control group) helped the researcher to determine whether the integration or use of e-learning had an effect or influence on the initial professional development of student teachers.

Moreover, in the experiment, the independent variable was e-learning which created conditions for learning while the dependent variable was student-teachers professional development. The independent variable creates learning conditions such as: asynchronous collaborative learning; computer-based direct instruction; internet-based problem solving; asynchronous experiential learning; and online content representation. The dependent variable includes: communication skills; technical skills gained by using ICTs; interpersonal skills; teachers' attitudes towards ICT; support received by ICT teachers; values and principles suitable for learning; and challenges faced by teachers in the field.

3.9.4 Experimental Group

First of all, the researcher created a Communication environment or platform called *espalledi309* thanks to *yahoogroup*. '*espalledi309*' refers to Spanish and German Student-teachers taking the course EDI 309. Secondly, students were asked to create e-mail addresses and send to the researcher through which they can receive invitations to join the learning platform. The class agreed that this activity will carry two points on continuous assessment. Thirdly, the students were instructed on how to join the group by accepting invitations that were sent into their electronic mail boxes (Inbox). A time limit was fixed for that activity. Eventually all the students received invitations and joined the platform. The learning platform or community included the *yahoogroup*, the students and the researcher. The goals and rules to be respected were agreed by all the members. For example members agreed not to send private mails or discuss private issues in the platform, to respect one another in the group and focus on building an atmosphere of trust. Also the roles of members were clearly defined as the class was subdivided into 10 groups. The groups were formed according to the class size and the order of names in the class list. Each group was expected to appoint a coordinator, a secretary and a disciplinarian. The duty of the coordinator was to ensure that the group work was accomplished and that all the members were active. The secretary ensured that all the assignments were typed and sent to the platform. The secretary was also the one to present the work to the class after production. The disciplinarian ensured that there was total discipline in the group. All the members were expected to be proactive especially in the conception, design and production of their didactic material.

The presence of a study guide gave an orientation to the student-teacher, encouraging discovery learning and decreasing psychological difficulties. The presence of the online platform gave an orientation towards self learning, discussion with classmates and the researcher (collaborative learning) when studying a module. The system offered students the opportunity to discuss their autonomously acquired knowledge with friends and with the teacher.

The Online learning platform gave students a number of possibilities:

- to interact with the researcher (one-to-one message exchange, individual question and answer exchange)
- to discuss problems arising in individual and group activities with friends and the teacher;
- to communicate with friends in order to carry out collaborative activities (discussions).

These possibilities were designed to increase flexibility in learning strategies, promote innovative learning methods, and encourage creativity and the development of professional skills and values, the development of group work skills and use of the network for sharing information and knowledge. After assessment of individual and group work, the students and the teacher organised group discussion in class about the work done. The discussions were done ‘face-to face’ in the classroom and asynchronously online. After the discussion, students continued working in their respective groups. Specific corrections and comments were posted to the platform. The researcher also posted comments and questions asked by students to the platform for students to propose solutions. At each level, the researcher intervened to solicit participation and to moderate the discussion and also to conclude it. The teacher acted as moderator on-and-offline. The units were completed at home or in school. Students who did not have Internet at home in the experimental group, had the opportunity to carry out their studies and assignments in school since the school had wireless Internet connection.

3.9.5 Control Group

Unlike in the Experimental group, student-teachers in the control group had no access to an electronic platform. They received their lessons in the mode all the student-teachers are used to (face-to-face). In this group, the lecture, demonstration

and illustration methods dominated in most of the lessons. That is conventional methods of teaching and learning. However both groups followed the same programme with similar activities taking into account the needs and expectations of the student-teachers, the expectations of the course and the institution. The course was taught in a way that students could acquire basic knowledge and skills needed for effective teaching and learning in the field (Basic education). Latchem (2012:9) defines basic education as “the term used to describe the formal, non-formal and informal learning that meets basic learning needs and lays the foundation for all subsequent learning. WBI (2007:117) argues that “basic education provides the foundation for lifelong learning and increases people’s capacity to assimilate and use knowledge.” As a matter of fact, basic education develops knowledge and skills that translate into employment, empowerment and higher earnings.

3.9.6 Evaluation

Both formative and summative evaluations were used. Formative evaluation was considered to be the First Test. The elements that constituted the first test included:

- creation of emails;
- Online/offline registration and feedback;
- participation;
- attendance;
- respect of instructions and deadlines; (10 marks)

Assignment: For the assignment question, students were asked to explain three reasons why a prospective professional teacher should study educational technology. (10 Marks) The total score for the first test was 20 marks (10 marks X 2).

Summative evaluation was based on the final group production (design, presentation and description). Like formative evaluation, it was marked on a total of 20 marks.

Finally the group assignments, production and results were uploaded in the platform for students to consult at their convenient or for further learning.

3.10 Method of Data Analysis

In this study, data analysis involved a combined statistical tool used to analyze data obtained from the experiment and the survey. Both descriptive and inferential statistics were used to analyze the responses of the student-teachers. Concerning descriptive statistics, tables, percentages, charts, Mean, Standard Deviation were used. For inferential statistics, the student t-test, ANOVA, Pearson Product Moment Correlation Coefficient and Stepwise Multiple Regression Analysis were applied. The technique adopted for data analysis was in relation to the specific phases and methodologies used in this study. The analysis of quantitative data involved two major steps:

1. Preparation stage: Here, data was logged into the computer and analyzed using the Statistical Package for Social Sciences (SPSS) version 20. This statistical package is designed to analyze, display and transform data collected from the field.
2. Organization Stage: At this stage data organization was developed and documented into a database structure that integrated the various measures presented in the data.

It is worthy to note that the experimental phase of this study, generated data in terms of scores (student-teachers' results). Descriptive univariate and bivariate statistics, graphical analysis which described the basic features of the analyzed data, were used to examine the quantitative aspects of the data. The use of descriptive statistics to analyze the responses of the respondents was to answer questions about how participants viewed issues within a given context and helps readers to have an idea of the typical values in the data and how these varied. It was also used to help readers of this work construct a mental picture of the relationship between the data and the phenomena under study.

The survey as already seen used a questionnaire that was carefully designed for student-teachers as the main instrument for data collection. This instrument was administered in the various schools that constituted the sample of the study. It is also important to note that this phase of the study generated quantitative data. The data obtained from the 4-point Likert scale questions of the survey were analyzed using

SPSS software. Frequency distribution tables, histograms, charts and graphs were used to describe socio-demographic data and multiple variables such as standardized test scores. Measures of central tendencies of distributions were used to determine and describe the median of sets of values of the data that required this approach. Trochim & Donnelly (2007: 266) defines the central tendency of a distribution as “an estimate of the centre of a distribution of value”. Also, Ranges, which are measures of dispersion in a frequency distribution, were also used to describe the variability of data values. Generally, this was to help readers of this work to construct a mental picture of the relationship between the data and the phenomena under study.

3.10.1 Data Representation

Trochim and Donnelly (2007:183) points out that the use of graphic displays is “particularly valuable in making the logic of mixed-method design explicit”. In this perspective, Tufte (2006:83) affirm that most of the techniques used for displaying evidence are inherently multimodal; bringing verbal, visual, and quantitative elements together. In so doing, a variety of charts, graphs and figures were used to represent quantitative data analysis. The researcher also used tables to report results related to the research questions. According to Creswell and Plato Clark (2007:135), these visual forms depict the trends and distributions of the data and allow readers to better understand the quantitative results of the study in a summarized form.

3.10.2 Bivariate Descriptive Statistics

A frequent goal in data analysis is to efficiently describe and measure the strength of relationships between variables (Amin, 2005:368). In this regard, bivariate descriptive statistics describes such relationships.

3.10.3 The Student t-test and One way ANOVA

The experiment was conducted with two independent groups that necessitated the use of the student t-test to compare the experimental effect between the two groups. Equally, the t-test and the one way-ANOVA were used to determine the variability of the marks of student-teachers by personal or socio-demographic characteristics (gender, age, fields of study). We also conducted the t-test and the one way-ANOVA to determine the variability of professional development of student teachers by

personal characteristics (gender, age, school type attended, region of origin amongst others).

3.10.4 Correlation

The Correlation Coefficient was used to test our research hypotheses. The purpose was to measure the degree of association between the independent variables in our research hypotheses and professional development of student-teachers, symbolize by the correlation coefficient. The correlation coefficient is a simple descriptive statistic that measures the strength of the linear relationship between two variables (Amin, 2005:378). The value of the correlation coefficient r ranges from -1 for a perfect negative correlation, to +1 for a perfect positive correlation. The degree of association between two variables is described by the coefficient of correlation, which indicates the strength of this association. In order to determine existing relationships between two variables, we used the Pearson's r Correlation Coefficient because the purpose of this study was to predict the dependent variable from the independent variable (Amin, 2005:379). In so doing, the Pearson Product Moment Correlation coefficient was used because the data in this study were parametric. That is, its interpretation depends on the population fitting a parameterized distribution. Also, parametric statistics was used because it enables researchers to make generalization of their results to a larger population.

Formula:

$$r_{xy} = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

Where:

- n = number of paired observations;
- $\sum XY$ = sum of cross products of X and Y;
- $\sum X$ and $\sum Y$ are sums of the X and Y scores respectively;
- $\sum X^2$ = sum of all the squared values of the X scores;
- $\sum Y^2$ = sum of all the squared Y scores;
- $(\sum X)^2$ = sum of all X scores, this sum squared;

- $(\Sigma Y)^2$ = sum of all Y scores, this sum squared.

3.10.5 Interpreting the Pearson's Product Moment Correlation Coefficient

The usefulness of the correlation depends on its size and significance (Amin, 2005:381). If r reliably differs from 0.00, then r -value is statistically significant. It does not result or occur by chance. Therefore, if the same variables were measured on another set of similar subjects, a similar r -value would result. If r achieves significance, it is possible to conclude that the relationship between the two variables was not due to chance. According to Muijs (2004), the size or magnitude of any correlation is described as follows:

Table 3.7 Description of Correlation Values

Correlation value	Interpretation
0.00 to 0.10	Weak
0.11 to 0.29	Low
0.30 to 0.59	Modest
0.60 to 0.79	Moderate
0.80 to 0.89	Strong
0.90 to 1.00	Very strong

On the other hand, it is important to note that correlation does not imply causation. In this regard, just because one variable relates to another variable does not mean that changes in one cause changes in the other. Cause-and-effect may be present, but correlation does not prove cause (Fraenkel and Wallen, 2000:10). In this study, the researcher was not interested in verifying if the occurrence of one variable caused or increased the occurrence of the other variable. The researcher was only interested in determining the strength of the correlation between the variables.

3.10.6 Coefficient of Determination (r^2)

The relationship between two variables can be represented by the overlap of two circles representing each variable as in the Figure below. If the circles do not overlap, no relationship exists. The area of overlap represents the amount of variance

in the dependent (y-variable) than can be explained by the independent (x-variable). The area of overlap is called the proportion of common variance, calculated as $r^2 \times 100$

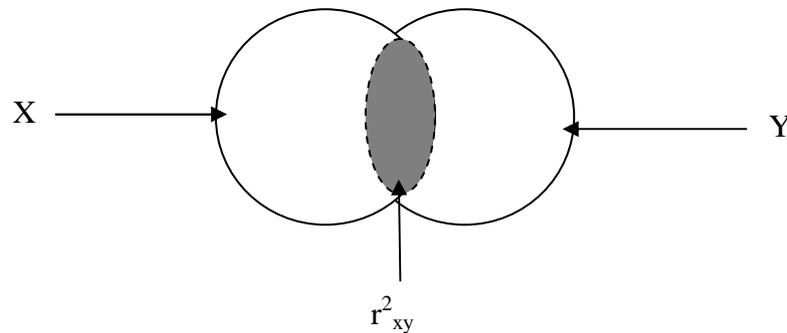


Figure 3.1 Relationship between two variables X and Y

3.10.7 Multiple regression analysis

In order to gain a full understanding of the nature of professional development of student- teachers in Cameroon, it was necessary to proceed with a more refine statistical tool (Stepwise multiple regression analysis) to see which of our variables emerge as the best predictor for the professional development of student teachers. Multiple regression deals with the use of many predictor variables to predict a criterion variable (Amin, 2005:405). Correlation and regression analysis are related in the sense that both deal with relationships among variables. Neither regression nor correlation analyses can be interpreted as establishing cause-and-effect relationships. They can indicate only how or to what extent variables are associated with each other. The correlation coefficient measures only the degree of linear association between two variables. Conclusions about cause-and-effect relationship are based on the judgment of the analyst.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon$$

Where:

- Y is the estimated value of y;
- β_0 = the regression constant;
- β_1 = the unstandardised regression coefficients;
- ε = the error term.

Table 3.8 Summary Table of Variables

Hypotheses/ Research Question	Variables of the Study			Test Statistics	Measurement scale	Questionnaire item
	Independent Variable	Dependent Variable	Indicators of Dependent Variable			
1	Computer-Based Direct Instruction (B1) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree	Professional development of student-teachers	Communication skills <u>Modalities</u> - Very Good - Good - Poor - Very Poor Technical Skills	r^2	<i>Nominal</i>	Section C (8items)
2	Asynchronous Experiential Learning (B2) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree	Professional development of student-teachers	Gained - Very Good - Good - Poor - Very Poor Interpersonal Skills/Interactivity	r^2	Nominal	Section D (10items)
3	Asynchronous collaborative learning (B3) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly	Professional development of student-teachers	Gained - Very Good - Good - Poor - Very Poor Teachers' attitudes	r^2	Nominal	Section E (4items)

	Disagree		towards learning with ICTs			
4	Internet-based problem solving(B4) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree	Professional development of student-teachers	<u>Modalities</u> - Very Positive - Positive - Negative - Very Negative	χ^2	Nominal	Section F (9items)
5	Online content representation(B5) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree	Professional development of student-teachers	Support received by ICT teachers <u>Modalities</u> - Very Positive - Positive - Negative - Very Negative	r^2	Nominal	Section G (10items)
6	Asynchronous collaborative learning(B3) <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree	Professional development of student-teachers	Development of values and principles <u>Modalities</u> - Very Positive - Positive - Negative - Very Negative	r^2	Nominal	Section H (10items)
7	e-learning <u>Modalities</u> -Positive views -Negative views	Professional development of student-teachers	Performance:	Student t-test		

			- Results (scores)			
8	e-learning	Professional development of student-teachers	Challenges faced by teachers <u>Modalities</u> - Strongly Agree - Agree - Disagree - Strongly Disagree			Section I (11 items)

3.11 Synthesis

This chapter has examined the research design, area of the study, population, sampling and sampling technique, instrumentation and method of data analysis.

The next chapter will present and analyse the data collected from the field.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the findings of the study. Data collected from the field was analyzed using both descriptive and inferential statistics as already mentioned in the previous chapter. A combined statistical tool was used to analyze data obtained from the experiment and the survey. For descriptive statistics, percentages, tables, charts and graphs amongst others were used while for inferential statistics; the student t-test, ANOVA, Pearson Product Moment Correlation Coefficient and Stepwise Multiple Regression Analysis were applied. However, the first part of this chapter, presents findings of the experiment conducted while the second part presents results of the survey.

4.2 Findings of the Experiment

4.2.1 Description of Demographic Information

Table 4.1 Description of Sample in Relation to Gender

Gender	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Female	71	37.2	37.2	37.2
Valid Male	120	62.8	62.8	100.0
Total	191	100.0	100.0	

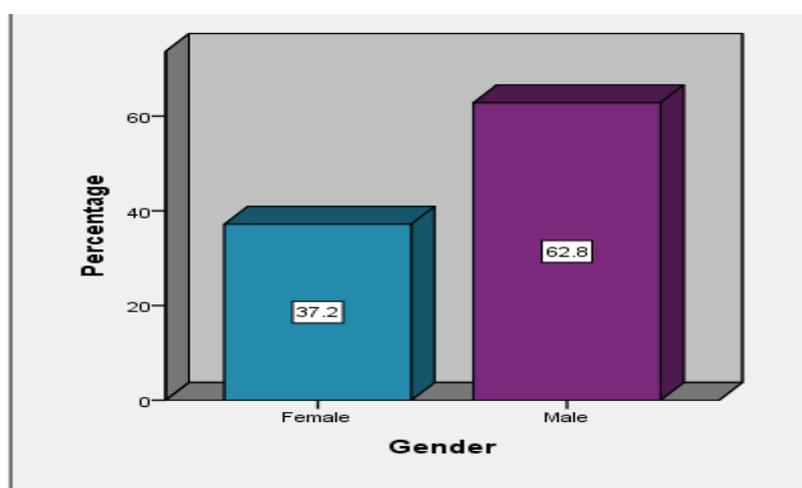


Figure 4.1 Bar chart representation of Student-teachers in terms of Gender

The Bar chart above shows that of the 191 student-teachers that participated in the experiment, 71 were made up of females scoring a percentage of (37.2 %) while 120 were males scoring a percentage of (62.8 %). This means that the male student-teachers dominated in the experiment.

Table 4.2 *Description of Sample in relation to Field or Area of Study*

Area of Study	Frequency	Percentage (%)	Cumulative Percentage (%)
PHYSICS (PHYS)	68	35.6	35.6
CHEMISTRY (CHEM)	67	35.1	70.7
Valid GERMAN (GEM)	25	13.1	83.8
SPANISH (SPAN)	31	16.2	100.0
Total	191	100.0	

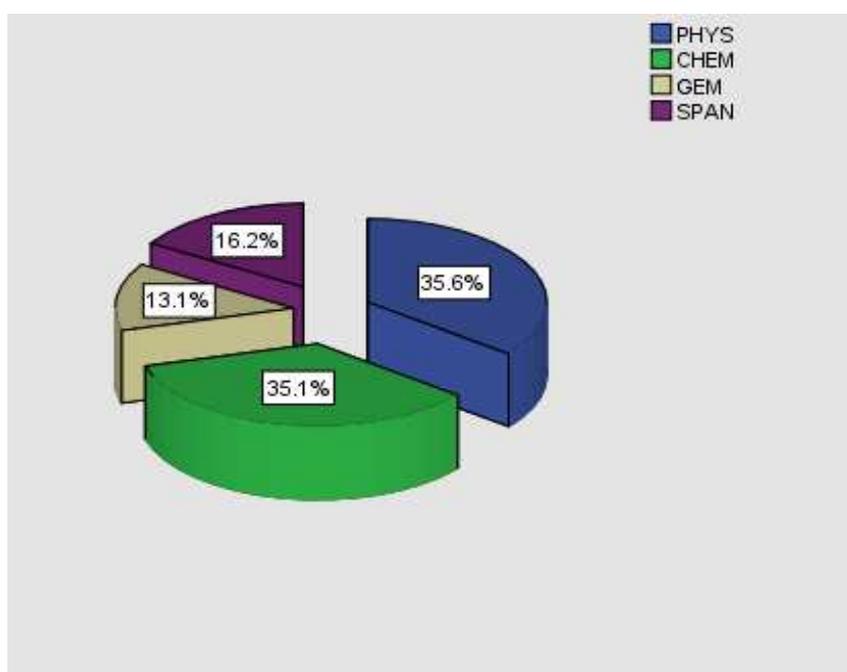
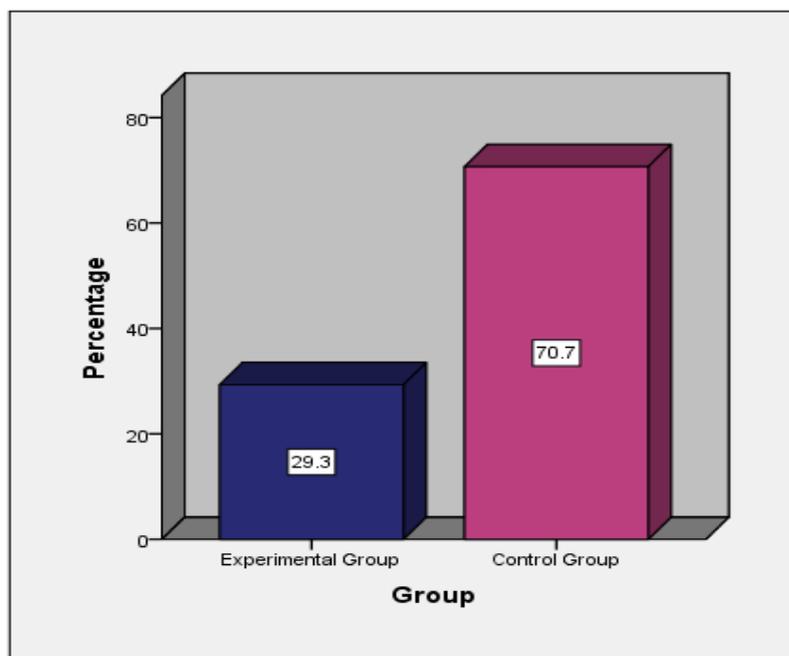


Figure 4.2 Pie chart representation of Field of Study of Student-teachers

The Pie chart indicates that a total of 68 student-teachers from the department of Physics took part in the experiment scoring a percentage of 35.6% while a total of 67 student-teachers from the department of Chemistry participated scoring a percentage of 35.1%. The Pie chart also show that a total of 25 student-teachers studying German took part in the experiment (13.1%) while a total of 31 student-teachers studying Spanish (16.2%) participated in the study.

Table 4.3 *Description of Sample in relation to Group*

Group	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percent (%)
Experimental Group	56	29.3	29.3	29.3
Valid Control Group	135	70.7	70.7	100.0
Total	191	100.0	100.0	

*Figure 4.3* Bar chart representation of Group of Student-Teachers

The Bar chart above shows that there were 56 student-teachers in the experimental group (GE) scoring a percentage of 29.3% while 135 student-teachers constituted the control group (GC) scoring a percentage of 70.7%. The figures clearly show that there were many student-teachers in the control group as compared to the experimental group.

4.3 Description of sample with respect to Performance

Table 4.4 *Description of the sample using Means and Standard Deviations*

	First Test Marks	Second Test Marks	First and Second test
N Observations	191	191	191
Missing	0	0	0
Mean	14.4607	14.7801	14.6204
Std. Deviation	1.92416	1.57741	1.57067

The table shows that 191 student-teachers sat in for the first and second test without any absences recorded respectively. The first test recorded the lowest Mean of 14.46 with a Standard Deviation of 1.92 while the second test recorded the highest Mean of 14.78 with a Standard Deviation of 1.58. Both the first and the second test gave a Mean of 14.62 and a Standard Deviation of 1.57

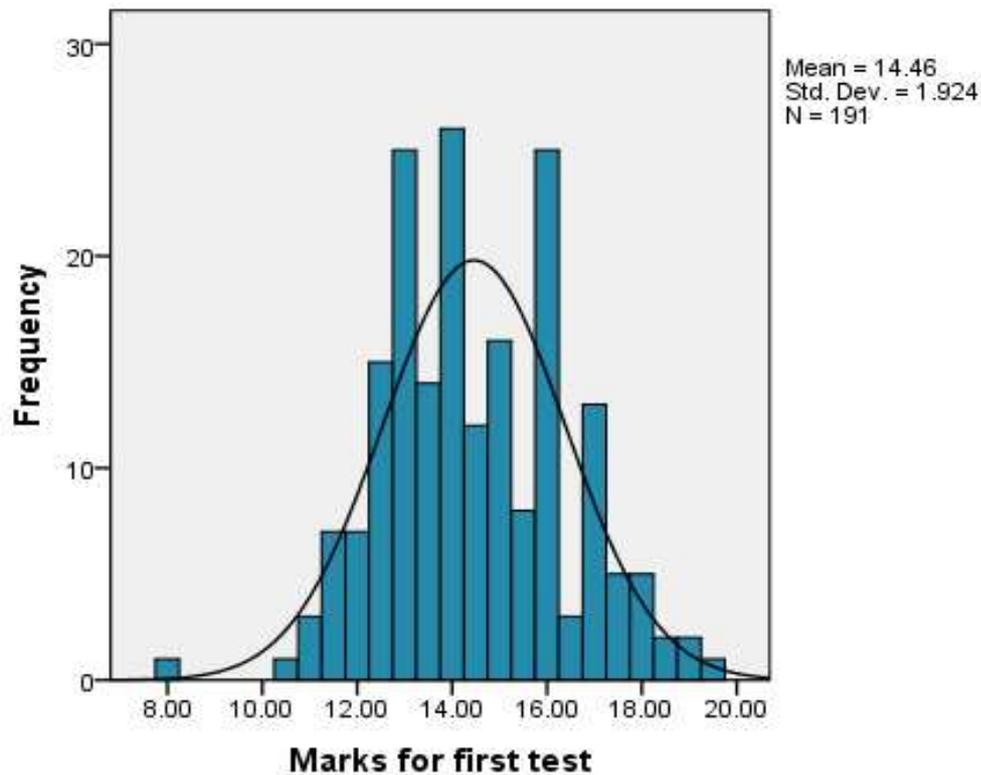


Figure 4.4 Histogram showing the distribution of marks (results) for the First Test

From the Histogram, we notice that in the first test, the results or marks of the student-teachers were close to the Mean (14.46) as most of the student-teachers scored between 12 points and 16 points on an overall score of 20 points.

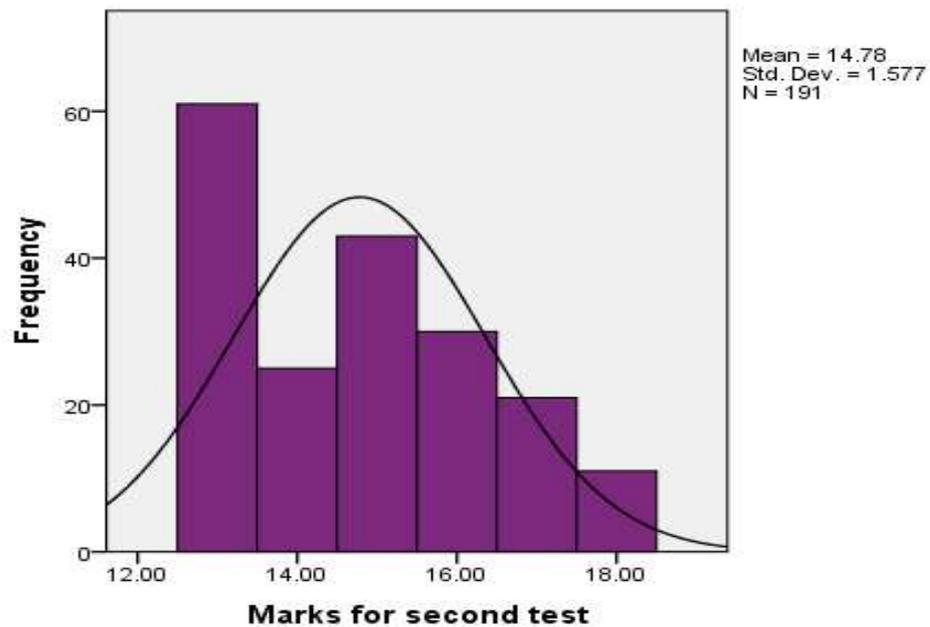


Figure 4.5 Histogram showing the distribution of marks (results) for the Second Test

The Histogram indicates that in the second test, the marks of the student-teachers were closer to the Mean (14.78) as compared to the first test. Also, the Histogram shows a marked increased in results during the second test as most of the student-teachers scored above the Mean.

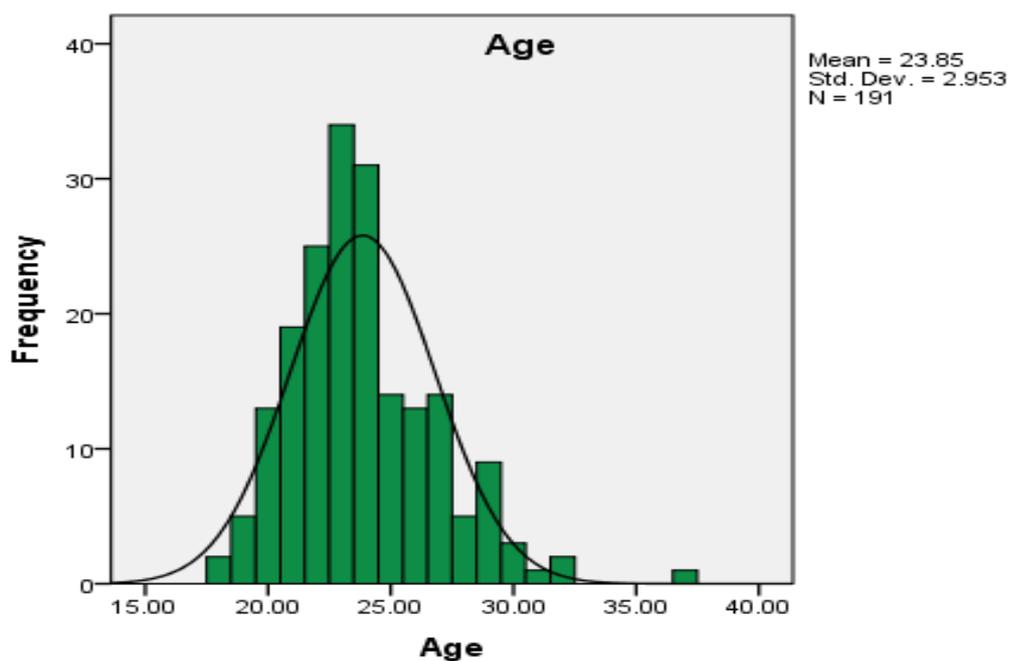


Figure 4.6 Histogram showing the distribution of marks according to Age for the First Test

From the Histogram above, we see that most of the student-teachers who participated in the experiment during the first test were between the ages of 20 and 25 years. The Mean (M) with respect to the ages of the student-teachers in the first test was 23.85 and a standard deviation (SD) of 2.95. The Mean of 23.85 with a standard deviation of 2.95 is indicative of the fact that the ages of the student-teachers did not have a significant effect on the outcome of the results in the first test.

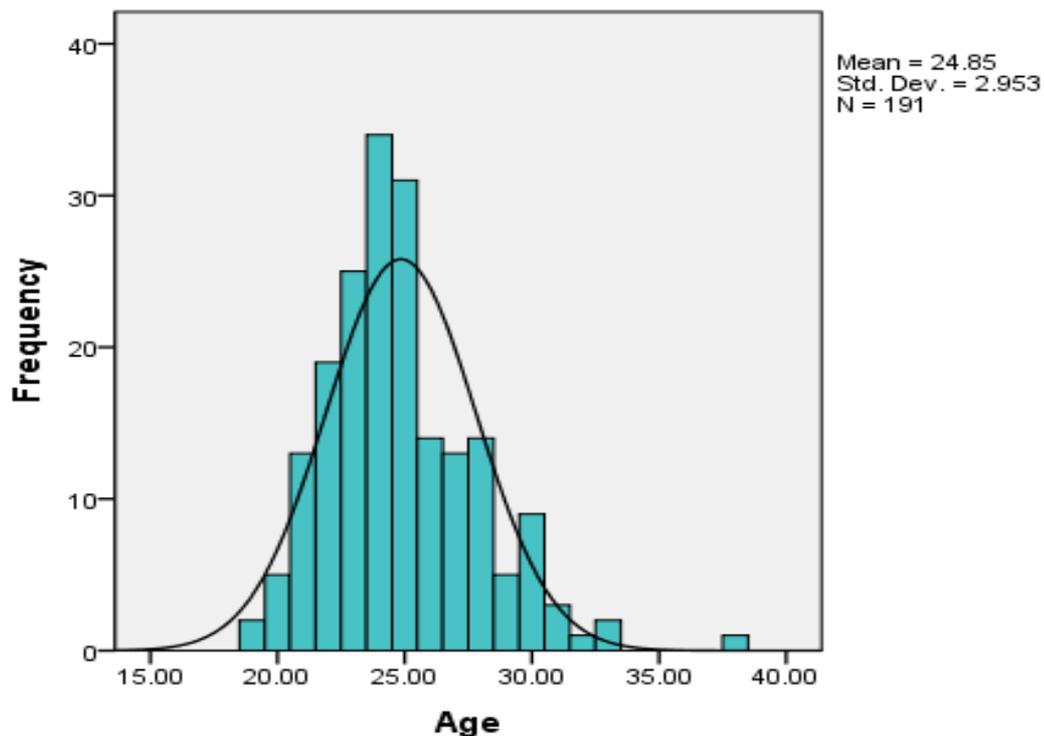
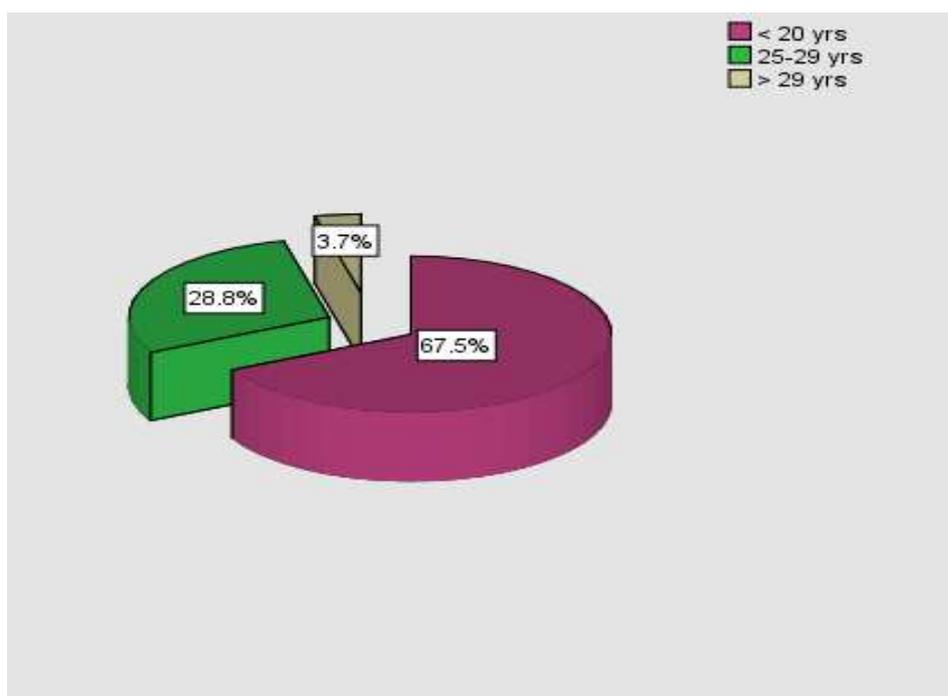


Figure 4.7 Histogram showing the distribution of marks according to Age for the Second Test

The Histogram shows that most of the student-teachers who took part in the experiment during the second test were between the ages of 20 and 25 as in the first test. However, the Mean in the second test slightly increased to 24.85 with a Standard Deviation of 2.95. The slight difference between the Mean of 23.85 in the first test with a standard deviation of 2.95 and the Mean of 24.85 with a standard deviation of 2.95 in the second test is indicative of the fact that the ages of the student-teachers did not have a significant influence on the outcome of the results in both the first and second tests respectively.

Table 4.5 *Description of Sample in relation to Age*

	Age	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Valid	< 25 yrs	129	67.5	67.5	67.5
	25-29 yrs	55	28.8	28.8	96.3
	> 29 yrs	7	3.7	3.7	100.0
	Total	191	100.0	100.0	

**Figure 4.8** *Pie chart representation of Age of Student-teachers*

The Pie chart points out that 67% of the student-teachers who participated in the experiment were below 25 years. It also shows that 28.8% of them were between the ages of 25 and 30 years. Of the 191 student-teachers that were involved in the experiment, only 3.7% were above 29 years.

4.4 First Test

T-Test

Table 4.6 *Description of Marks (Results) in relation to Gender for the First Test*

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Marks for first test	Female	71	14.8310	1.72987	.20530
	Male	120	14.2417	2.00523	.18305

Table 4.6.1 Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference
Marks for first test	Equal variances assumed	0.520	0.472	2.063	189	0.040	0.58932	0.28566
	Equal variances not assumed			2.143	164.417	0.034	0.58932	0.27505

From the independent sample test, we notice that on the average, the reported variability of the marks in the first test was significantly higher for female student-teachers ($M = 14.8310$, $SD = 1.729$) than for male student-teachers ($M = 14.241$, $SD = 2.005$), $t(191) = 2.063$, $p < 0.05$, $r = 0.14$. The size of the estimated effect reveals that the difference in performance in the first test created by gender was small and thus representing an important consideration.

One-way

Table 4.7 Description of Marks in relation to Age for the First Test

Age	N	Mean	Std. Deviation	Std. Error
< 25 yrs	129	14.7016	1.93298	0.17019
25-29 yrs	55	14.0545	1.88972	0.25481
> 29 yrs	7	13.2143	0.90633	0.34256
Total	191	14.4607	1.92416	0.13923

From the above table, we deduce that there was a clear difference in the Means of the various age groups. That is, below 25 years scored a Mean of 14.70; between 25 and 29 years scored a Mean of 14.05 and above 29 years scored a Mean of 13.21. However, the main issue at this level was to find out or test whether this difference in age group was significant.

Table 4.7.1 Test of Homogeneity of Variances for first test Marks

Levene Statistic	df1	df2	Sig.
2.659	2	188	0.073

Table 4.7.2 ANOVA for First Test Marks

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.431	2	13.715	3.814	0.024
Within Groups	676.025	188	3.596		
Total	703.455	190			

The analysis of variance as shown in the tables above reveals that the age group or category had a significant influence on the performance of the student-teachers in the first test, $F(2, 188) = 3.814$, $p < 0.05$, $\omega = 0.17$. This means that about 17% of the results can be explained by the age category of the student-teachers.

One-way

Table 4.8 Description of Marks in relation to Field of Study for the First Test

Field of study	N	Mean	Std. Deviation	Std. Error
PHYS	68	14.1838	2.15778	0.26167
CHEM	67	14.0672	1.58806	0.19401
GEM	25	16.0000	1.68325	0.33665
SPAN	31	14.6774	1.64088	0.29471
Total	191	14.4607	1.92416	0.13923

As evident in the table above, there were differences in the Means and Standard Deviations of the various study fields and consequently the different groups. For example Physics (PHYS) with a sample of 68 student-teachers scored a Mean of 14.18 with a Standard Deviation of 2.16. On the other hand, German (GEM) with a sample of 25 student-teachers scored a Mean of 16.00 with a Standard Deviation of 1.68. Nevertheless, the main issue at this level was to test whether the difference was significant between the different areas of study

Table 4.8.1 Test of Homogeneity of Variances for First Marks

Levene Statistic	f1	df2	Sig.
1.956	3	187	0.122

Table 4.8.2 ANOVA for First Test Marks

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	76.281	3	25.427	7.581	0.000
Within Groups	627.174	187	3.354		
Total	703.455	190			

The analysis above shows that the field of study had a significant influence on the performance of the student-teachers in the first test, $F(2, 188) = 7.581, p < 0.001, \omega^2 = 0.30$. Thus, about 30% of the results can be explained by the field of study of the student-teachers.

T-Test

Table 4.9 Description of Marks in relation to Group for the First Test

	Group	N	Mean	Std. Deviation	Std. Error Mean
Marks for first test	Experimental Group	56	15.2679	1.77345	0.23699
	Control Group	135	14.1259	1.89039	0.16270

Table 4.9.1 Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Marks for first test	0.006	0.940	3.869	189	0.000	1.14193	0.29519
			3.972	109.115	0.000	1.14193	0.28746

From the independent samples test, we noticed that on the average, the reported variability of the marks was significantly higher for the Experimental Group ($M = 15.267, SD = 1.773$) than for the Control Group ($M = 14.125, SD = 1.890$), $t(191) = 3.869, p < 0.001, r = 0.27$. The estimated size of the effect indicates that the difference

in performance in the first test created by group was small and thus representing a substantial effect.

4.5 Second Test

T-Test

Table 4.10 Description of Marks in relation to Gender for the Second Test

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Marks for second test	Female	71	15.2817	1.61407	0.19156
	Male	120	14.4833	1.48371	0.13544

Table 4.11 Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Marks for second test	0.121	0.728	3.478	189	0.001	0.79836	0.22957
			3.403	137.302	0.001	0.79836	0.23460

The results of the second test indicate that on the average, the reported variability of the marks was significantly higher for female student-teachers ($M = 15.281$, $SD = 1.614$) than for male student-teachers ($M = 14.125$, $SD = 1.483$), $t(191) = 3.478$, $p < 0.001$, $r = 0.2453$. The estimated size of the effect indicates that the difference in performance in the second test created by gender was small and thus represents a substantial effect.

One-way

Table 4.12 Description of Marks in relation to Age for the Second Test

Age	N	Mean	Std. Deviation	Std. Error
< 25 yrs	129	14.8527	1.58164	0.13926
25-29 yrs	55	14.6364	1.55592	0.20980
> 29 yrs	7	14.5714	1.81265	0.68512
Total	191	14.7801	1.57741	0.11414

The table shows that there were differences in the Means and Standard Deviations in the various age groups. For example the age group below 25 with a frequency of 129 student-teachers scored a Mean of 14.85 and a Standard Deviation of 1.58. Also, the age group between 25 and 29 scored a Mean of 14.64 and a Standard Deviation of 1.81. However, the main issue at this level was to test whether the difference was significant between the different age groups.

Table 4.12.1 Test of Homogeneity of Variances for Second Test Marks

Levene Statistic	df1	df2	Sig.
0.198	2	188	0.820

Table 4.12.2 ANOVA for Second Test Marks

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.121	2	1.061	0.424	0.655
Within Groups	470.643	188	2.503		
Total	472.764	190			

The analysis of variance as shown in the tables above reveals that age did not have a significant influence on the performance of the student-teachers in the second test, $F(2, 188) = 0.424$, $p > 0.05$.

One-way

Table 4.13 Description of Marks in relation to Field of Study for the Second Test

Field of Study	N	Mean	Std. Deviation	Std. Error
PHYS	68	14.2500	1.41817	0.17198
CHEM	67	14.2537	1.29502	0.15821
GEM	25	16.1600	1.24766	0.24953
SPAN	31	15.9677	1.42557	0.25604
Total	191	14.7801	1.57741	0.11414

The table above shows that there were differences in the Means and Standard Deviations of the various study fields and consequently the different groups. For example Physics (PHYS) with a sample of 68 student-teachers scored a Mean of 14.25

and a Standard Deviation of 1.42. On the other hand, German (GEM) with a sample of 25 student-teachers scored a Mean of 16.16 and a Standard Deviation of 1.24. Nevertheless, the question at this level was to test whether the difference was significant between the Fields of Study

Table 4.13.1 Test of Homogeneity of Variances for the second Test Marks

Levene Statistic	df1	df2	Sig.
0.289	3	187	0.833

Table 4.13.2 ANOVA for Second Test Marks

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	129.000	3	43.000	23.391	0.000
Within Groups	343.764	187	1.838		
Total	472.764	190			

The analysis above shows that the field of study had a significant influence on the performance of the student-teachers in the second test, $F(3, 187) = 23.391$, $p < 0.001$, $\omega = 0.5100$. This means that about 51% of the results can be explained by the field of study of the student-teachers.

T-Test

Table 4.14 Description of Marks in relation to Group for the Second Test

Group		N	Mean	Std. Deviation	Std. Error Mean
Marks for second test	Experimental Group	56	16.0536	1.34055	0.17914
	Control Group	135	14.2519	1.35337	0.11648

Table 4.14.1 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Marks for second test	Equal variances assumed	0.368	0.545	8.399	189	0.000	1.80172	0.21453
	Equal variances not assumed			8.432	103.728	0.000	1.80172	0.21368

On the average, the reported variability of the marks in the second test was significantly higher for the Experimental Group ($M = 16.054$, $SD = 1.341$) than for the Control Group ($M = 14.252$, $SD = 1.353$), $t(191) = 3.869$, $p < 0.001$, $r = 0.5214$. The estimated size of the effect indicates that the difference in performance in the second test created by group was significant and thus represents a substantial effect.

T-Test

Table 4.15 Description of Mean Marks for the Two Tests

Gender		N	Mean	Std. Deviation	Std. Error Mean
Mean Marks for the two tests	Female	71	15.0563	1.46702	0.17410
	Male	120	14.3625	1.57876	0.14412

Table 4.15.1 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mean Marks for the two tests	Equal variances assumed	0.461	0.498	3.012	189	0.003	0.69384	0.23033
	Equal variances not assumed			3.070	155.775	0.003	0.69384	0.22601

The results show that on the average, the reported variability of the Mean marks for the first and second test was significantly higher for female student-teachers ($M = 15.056$, $SD = 1.467$) than for male student-teachers ($M = 14.362$, $SD = 1.578$), $t(191) = 3.012$, $p < 0.001$, $r = 0.2140$. The estimated size of the effect indicates that the difference in performance in the first and second test created by gender was significant, and therefore represents a substantial effect.

One-way

Table 4.16 Description of Mean Marks in relation to Age

Age	N	Mean	Std. Deviation	Std. Error
< 25 yrs	129	14.7771	1.61965	0.14260
25-29 yrs	55	14.3455	1.44937	0.19543
> 29 yrs	7	13.8929	1.18899	0.44939
Total	191	14.6204	1.57067	0.11365

The table above shows that there were differences in the Means and Standard Deviations in the various age groups. For example the age group below 25 with a frequency of 129 student-teachers scored a Mean of 14.78 and a Standard Deviation of 1.62. Also, the age group between 25 and 29 scored a Mean of 14.35 and a Standard Deviation of 1.45. However, the main question was to test whether the difference was significant between the different age groups.

Table 4.16.1 Test of Homogeneity of Variances for Mean Marks for the Two Tests

Levene Statistic	df1	df2	Sig.
1.100	2	188	0.335

Table 4.16.2 ANOVA for Mean Marks for the Two Tests

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11.032	2	5.516	2.266	0.107
Within Groups	457.699	188	2.435		
Total	468.730	190			

The analysis of variance as shown in the tables above reveals that age did not have a significant effect on the marks of the student-teachers in the second test, $F(2, 188) = 2.266, p > 0.05$.

T-TEST

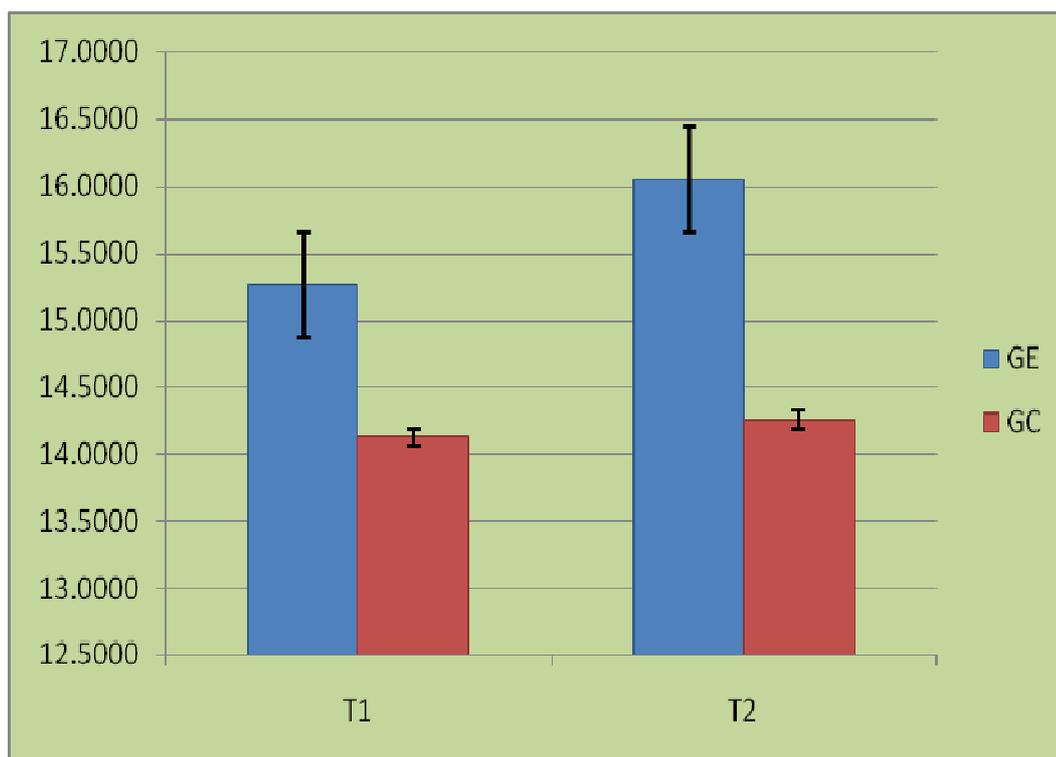
Table 4.17 Description of Mean Marks in relation to Group

Group	N	Mean	Std. Deviation	Std. Error Mean
Mean Marks for the Experimental Group	56	15.6607	1.20268	0.16071
two tests Control Group	135	14.1889	1.50480	0.12951

Table 4.17.1 Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Means Marks for the two tests	3.412	0.066	6.505	189	0.000	1.47183	0.22626
Equal variances assumed			7.131	127.551	0.000	1.47183	0.20640
Equal variances not assumed							

From the above results, it is clear that the reported variability of the Mean marks between the first test and the second test was significantly higher for the Experimental Group ($M = 15.660, SD = 1.202$) than for the Control Group ($M = 14.188, SD = 1.504$), $t(191) = 6.505, p < 0.001, r = 0.4280$. The estimated size of the effect indicates that the difference in performance between the two groups was significant, and therefore represents a substantial effect.

Figure 4.9 Representation of Student-teachers' Results in Test One and Test Two

The above chart clearly shows a significant difference between the results in the first test and the second test for both the Experimental group and the Control group. These results revealed that on the average, students in the Experimental group perform better than students in the control group in both the first and the second test respectively.

T-Test

Table 4.18 Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Marks for first test	14.4607	191	1.92416	0.13923
	Marks for second test	14.7801	191	1.57741	0.11414

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Marks for first test & Marks for second test	191	0.606	0.000

Paired Samples Test

	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Marks for first test - Marks for second test	-0.31937	1.58532	0.11471	-0.54564	-0.09310	-2.784	190	0.006

T is significant meaning there was an improvement

According to the results, it is obvious that the reported variability of the marks in the second test was significantly higher for the Paired Samples ($M = 14.7801$, $SD = 1.57741$) than for the first test, ($M = 14.4607$, $SD = 1.92416$) $t(191) = -2.784$, $p < 0.001$, $r = 0.198$. The estimated size of the effect indicates that the difference in performance in the second and first test was large and thus representing a substantial effect.

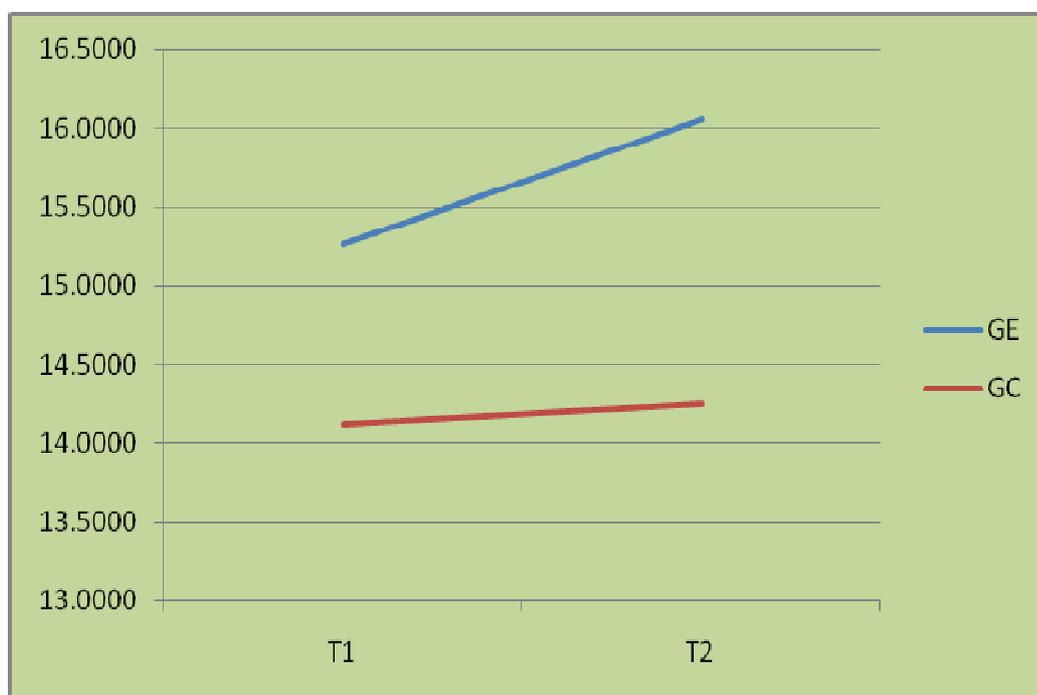


Figure 4.10 Representation of Student-teachers' Results in Test One and Test Two using Time Series Chart

The graph shows that student-teachers in the Experimental Group (GE) performed better than student-teachers in the Control Group (GC) in the first test. Also, the graph for the Experimental Group shows a steady increase in results from the first test to the second test while the graph for the Control Group indicates a slight increase in results from the first test to the second test. In all, both graphs show an improvement in results in both groups. However, results of student-teachers in the Experimental Group remained consistently higher than the results of student-teachers in the Control Group.

4.6 Findings of the Survey

4.6.1 Description of Socio-Demographic Information

Table 4.19 Description of sample in relation to type of school

Type of School	Frequency	Percentage (%)	Cumulative Percentage
GTTC	381	47.9	47.9
HTTC/FoEdu	415	52.1	100.0
Total	796	100.0	

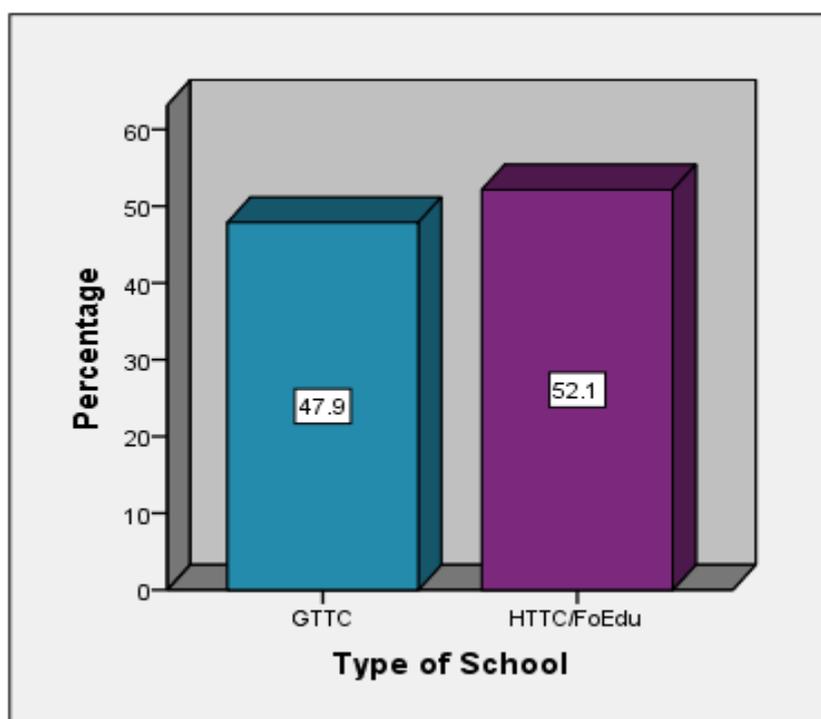


Figure 4.11 Bar chart representation of sample in relation to type of school

The table as well as the chart show that there were 381 student-teachers of primary Government Teacher Training Colleges scoring 47.9% of the sample and 415 student-teachers of Higher Teacher Training Colleges and One faculty of education scoring a percentage of 52.1%. This statistics shows that student-teachers of Higher Teacher Training Colleges dominated in the sample.

Table 4.20 *Description of sample in relation to Name of school*

Name of School	Frequency	Percentage (%)	Cumulative Percentage
HTTC Ydé	133	16.7	16.7
GTTC Ydé	44	5.5	22.2
GTTC Mbyo	42	5.3	27.5
GTTC Mfou	44	5.5	33.0
FoED Buea	142	17.8	50.9
GTTC Buea	64	8.0	58.9
GTTC Limbe	51	6.4	65.3
HTTC Bbli	140	17.6	82.9
GTTC Bda	53	6.7	89.6
GTTC Kumbo	43	5.4	95.0
GTTC Mbengwi	40	5.0	100.0
Total	796	100.0	

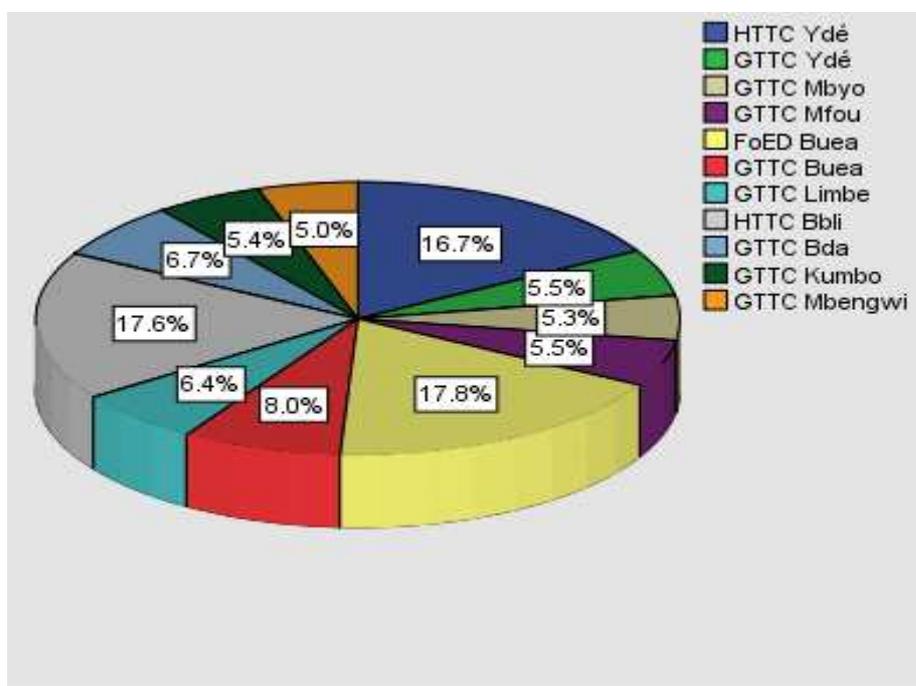


Figure 4.12 *Pie chart representation of Sample in relation to Name of School*

The chart clearly points out the three (3) Higher Teacher Training Colleges and eight (8) primary Government Teacher Training Colleges that were represented in the sample. The table as well as the chart also show that the highest number of student-teachers that participated in the research came from the Faculty of Education (FoED) in the University of Buea (South West Region of Cameroon) representing a percentage of 17.8% of the sample. This was followed by the Higher Teacher Training College Bambili (HTTC Bbli) in the North West Region with a total of 140 student-teachers representing a percentage of 17.6% of the sample. Then, the Higher Teacher Training College Yaounde (HTTC Yde) with 133 student-teachers representing a percentage of 16.7% of the sample. The lowest number of respondents came from the Government Teacher Training College Mbalmayo (GTTC Mbyo) in the Centre Region. It is also worthy to note that the highest number of respondents came from the Higher Teacher Training Colleges.

Table 4.21 *Description of sample in relation to Region of Origin*

Region	Frequency	Percentage (%)	Cumulative Percentage
Centre	116	14.6	14.6
East	23	2.9	17.5
West	171	21.5	38.9
Littoral	35	4.4	43.3
South	48	6.0	49.4
South-West	177	22.2	71.6
North-West	208	26.1	97.7
Adamawa	8	1.0	98.7
North	6	0.8	99.5
Far-North	4	0.5	100.0
Total	796	100.0	

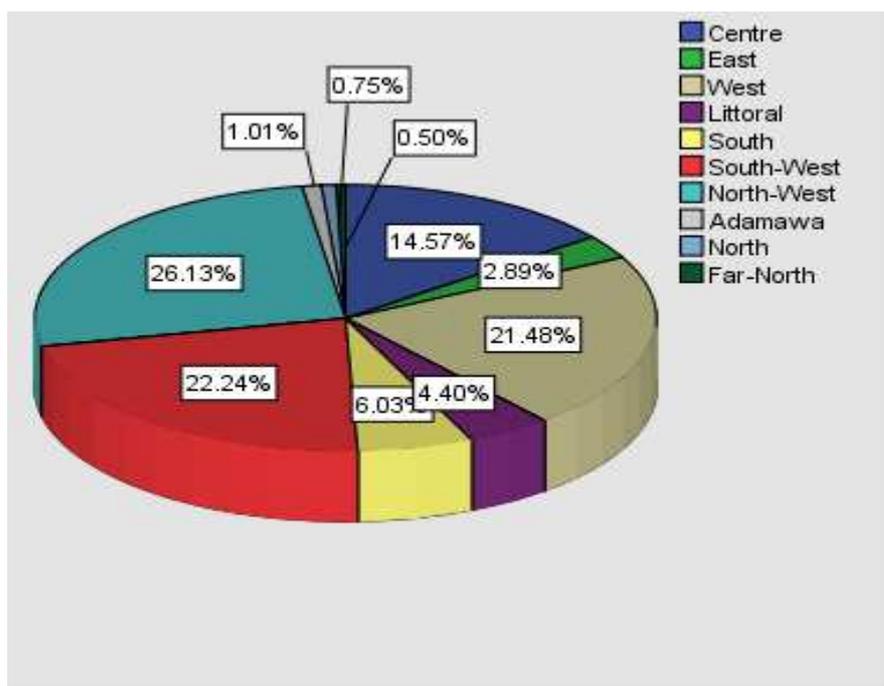


Figure 4.13 Pie chart representation of Sample in relation to Region of Origin

The table and the chart above reveal that all the ten (10) regions of the country were represented in the survey. The North West scored the highest percentage in terms of representation in the sample scoring 26.1%. This was followed by the South West with 22.2%, the West with 21.5%, the Centre with 14.6% while the Far North scored the least in terms of representation in the sample scoring 0.5%.

Table 4.22 Description of Sample in Relation to Gender

Gender	Frequency	Percentage (%)	Cumulative Percentage
Female	470	59.0	59.0
Male	326	41.0	100.0
Total	796	100.0	

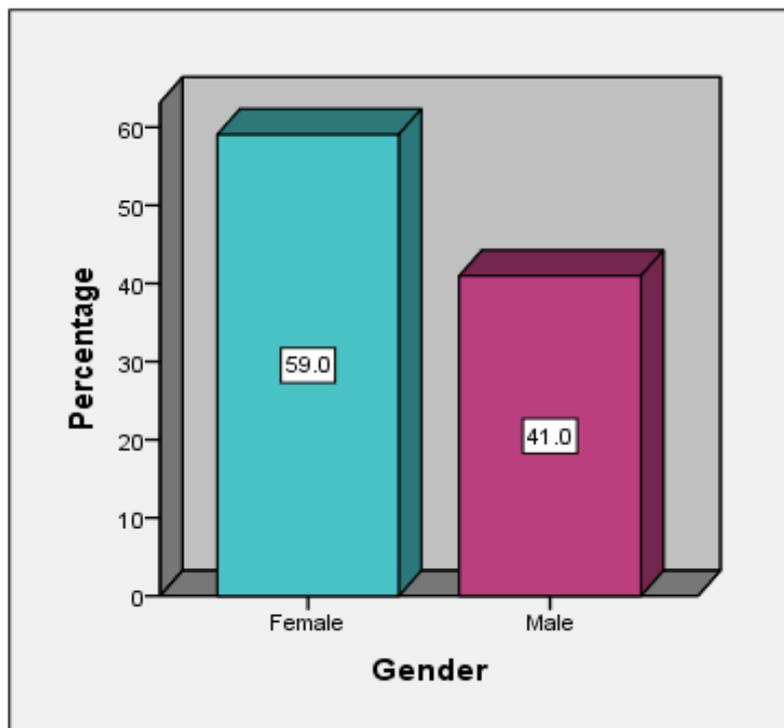


Figure 4.14 Bar chart representation of respondents in relation to Gender

The table as well as the chart shows that the sample was made up of 59.0% females and 41.0% males. This means that females dominated the sample.

Table 4.23 Description of Sample in Relation to Age

Age	Frequency	Percentage (%)	Cumulative Percentage
16-20 yrs	81	10.2	10.2
21-25 yrs	380	47.7	57.9
26-30 yrs	206	25.9	83.8
31-35 yrs	108	13.6	97.4
36-40 yrs	21	2.6	100.0
Total	796	100.0	

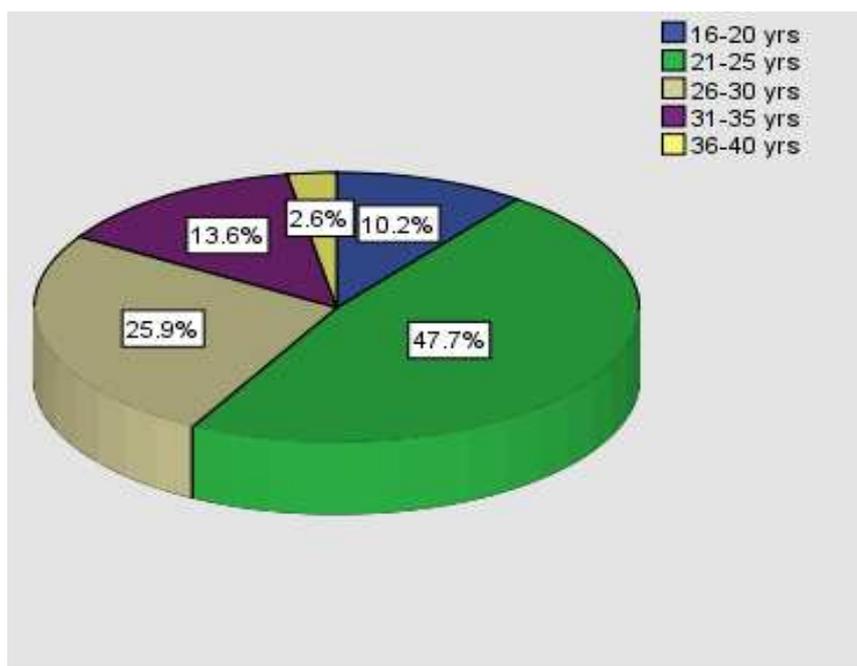


Figure 4.15 Pie chart representation of Sample in relation to Age

The table and the chart above show the age distribution in the sample. 10.2% of the student-teachers were found to be within the age range of 16 - 20 years while 47.7% of the student-teachers were within the age range of 21 – 25 years. Also, 25.9% of the student-teachers were found to be within the age range of 26 – 30 years while 13.6% of the student-teachers were within the age range of 31 – 35 years. 2.6% of the student-teachers were within the age range of 36 – 40 years.

Table 4.24 Description of Sample According to ICT Resources owned

ICT Resources owned	N	Mean	Std. Deviation
Computer	796	0.7374	0.44030
Mobile phone	796	0.9095	0.28701
E-mail address	796	0.9209	0.27014
E-group address	796	0.6256	0.48426
Internet connection on mobile phone/computer	796	0.4410	0.49681
Valid N	796		

As seen from the table, the highest mean is 0.9209 while the lowest is 0.4410. This finding implies that the majority of the respondents owned e-mail addresses. It also means that a smaller number of respondents (minority) have Internet connection on mobile phone or computer. It is also interesting to note that a good number of

respondents owned mobile phones scoring a mean of 0.9095. These results are substantial because online platforms and e-learning in particular is being supported and depends solely on these gadgets. In all, results reveal that a respondent has at least one electronic gadget considering the differences in the Means and Standard Deviations as shown on the table below.

Table 4.25 Description of Multiple Responses with respect to ICT Resources owned

ICT Resources owned	Responses		Percentage of Cases
	N	Percentage	
Computer	587	20.3%	74.6%
Mobile phone	724	25.0%	92.0%
E-mail address	733	25.3%	93.1%
E-group address	498	17.2%	63.3%
Internet connection on mobile phone/computer	351	12.1%	44.6%
Total	2893	100.0%	367.6%

a. Dichotomy group tabulated at value 1.

The question on ICT resources yielded 2893 responses. Among these responses, 25.3% refer to e-mail address, showing that 93.1% of the students' teachers report that they have e-mail addresses. Also, 25% of the responses correspond to mobile phones, meaning that 92% of the students' teachers reported that they have mobile phones. More still, 20.3% of the responses refer to computer, showing that 74.6% of the student-teachers reported that they have a computer. Also, 12.1% of the responses refer to Internet connection on mobile phone or computer showing that 44.6% of the student-teachers reported that they have Internet connection on mobile phone or computer.

Table 4.26 Description of Sample in Relation to Qualification

Qualification	Frequency	Percentage (%)	Cumulative Percentage
Grade 1 Certificate	257	32.3	32.3
Diploma/HND in Education	251	31.5	63.8
BA/BTech	223	28.0	91.8
MA/MED	65	8.2	100.0
Total	796	100.0	

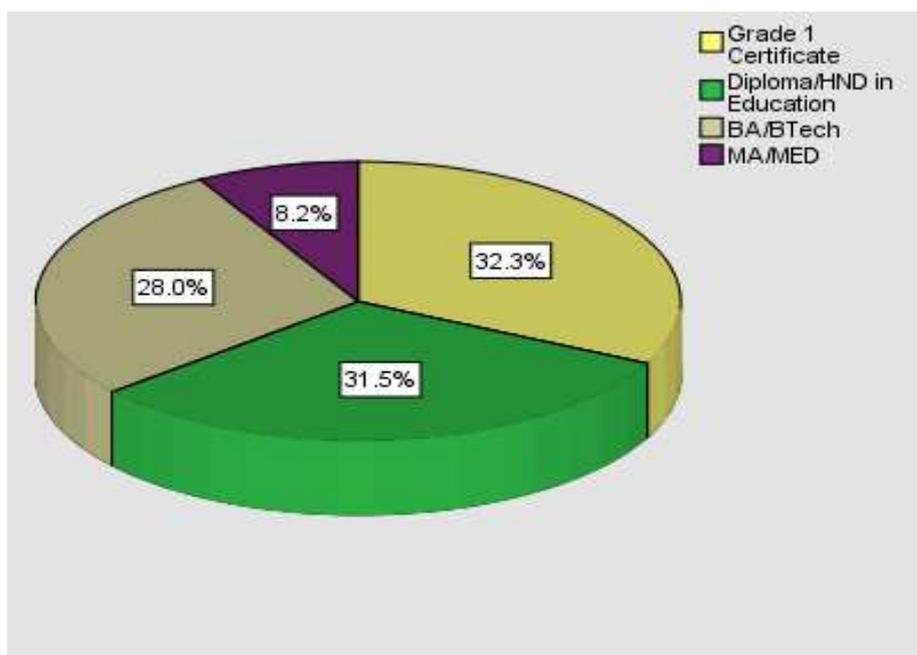


Figure 4.16 Pie chart representation of Sample in relation to Qualification

The table and the chart above reveal that 32.3% of the student-teachers had Grade 1 Certificates, 31.5% of the respondents had diplomas/HNDs in Education. Furthermore, the chart shows that 28.0% of the student-teachers owned Bachelor's Degrees (BA/BTech) while 8.2% of the student teachers had Masters' Degrees.

Table 4.27 Description of Sample According to Years of Experience in Using ICTs

Years of Experience	Frequency	Percentage (%)	Cumulative Percentage
< 5 yrs	319	40.1	40.1
5-10 yrs	297	37.3	77.4
11-15 yrs	144	18.1	95.5
> 15 yrs	36	4.5	100.0
Total	796	100.0	

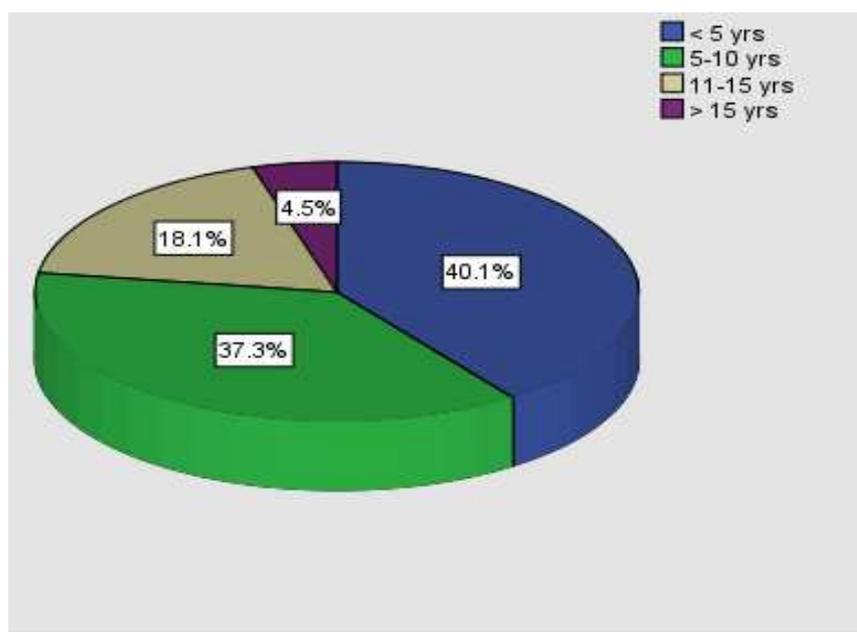


Figure 4.17 Pie chart representation of Sample in relation to Experience

The responses represented in the pie chart above show that, 40.1 % of the respondents have used ICT resources and its facilities for less than 5 years, 37.3 % have used it for more than 5 years, and 18.1 % have used it for more than 11 years, while 4.5 % have used it for more than 15 years. The table shows that more than 50% of the respondents have used ICT resources for more than 5 years. Thus student-teachers in Cameroon are familiar with ICT resources and its facilities.

Table 4.28 Description of Sample According to Frequency of ICT use

Frequency of ICT Use	Frequency	Percentage (%)	Cumulative Percentage
Daily	353	44.3	44.3
Once a week	380	47.7	92.1
Monthly	63	7.9	100.0
Total	796	100.0	

From the table above, 44.3% responded that they use the Internet daily, 47.7 % indicated that they use it at least once a week while 7.9 % indicated that they use it monthly. Thus, a bulk of the respondents (72 %) uses Internet services at least once a week.

Table 4.29 Description of Sample According to Type or Category of User

Type of User	Frequency	Percentage (%)	Cumulative Percentage
Expert	254	31.9	31.9
Casual user	398	50.0	81.9
Ordinary user	144	18.1	100.0
Total	796	100.0	

The responses above show that 31.9% of the student-teachers were expert users. This means that they had the capacity to design, develop, implement and evaluate programmes with ICTs. Furthermore, 50.0% of the respondents indicated that they are casual users. This refers to those who use the Internet and its facilities occasionally. Also, 18.1% of the student-teachers indicated that they are ordinary users. Thus they use the Internet and its facilities regularly. It can be deduced from the statistics that 50% of the respondents belonged to the category of ordinary and expert users while 50% uses the Internet and its facilities occasionally (casual users)

Table 4.30 Description of Sample according to Reasons for using ICTs

Reasons for using ICTs	N	Mean	Std. Deviation
To increase my effectiveness in teaching	796	0.7048	0.45643
To improve relations with students	796	0.2827	0.45058
To get instructional content	796	0.6822	0.46593
To improve relations with colleagues	796	0.2387	0.42655
To do research	796	0.9435	0.23109
To get information concerning the school	796	0.5452	0.49826
To chat with friends in Face book/Twitter	796	0.6256	0.48426
To listen to music	796	0.3166	0.46544
To watch movies	796	0.2487	0.43256
To make cheap calls	796	0.1709	0.37662
Valid N	796		

The table above reveals that the highest mean is 0.9435. This implies that the majority of the respondents indicated that they use ICTs mainly for research purposes. This finding reveals that in Cameroon, a majority of student-teachers use Internet frequently when they are given assignments to do or when they are carrying out their academic research. The responses also show that Cameroonian student-teachers use ICTs more often to improve their effectiveness in teaching (0.7048). Instructional

content also scored a high mean of 0.6822 indicating that student-teachers use Internet and its facilities to search for content in their areas of study. Findings also show that social media scores a high mean of 0.6256 meaning that they use Internet and its facilities frequently to chat with friends on Facebook or Twitter. The lowest mean on the table is 0.1709 indicating that student-teachers in Cameroon use the Internet and its facilities occasionally to make cheap calls. Results also indicate that student teachers use ICTs occasionally to improve relations with colleagues and to watch movies, scoring a mean of 0.2387 and 0.2487 respectively.

Table 4.31 *Description of Sample According to their view on whether Student-teachers' taught with ICTs perform better*

View	Frequency	Percentage (%)	Cumulative Percent
YES	216	27.1	27.1
NO	580	72.9	100.0
Total	796	100.0	

The responses in the table above portray that 72.9% of the respondents are of the opinion that student-teachers taught with ICTs perform better than student-teachers taught without ICTs. However, 27.1% of the respondents as could be seen on the table were of the opinion that student-teachers taught with ICTs do not perform better than student-teachers taught without ICTs. It therefore means that the majority of the respondents viewed that ICTs improves the outcome of student-teachers.

4.6.2 Description of Sample Using Means and Standard Deviations Under the main Variables

Table 4.32 *Items Relating to Computer-Based Direct Instruction*

Items	N	Mean	Std. Deviation
Course outline or programme can be presented to a large group in an online (Internet) learning platform.	796	3.2563	0.76538
Rules and procedures can be clearly presented in an online platform	796	3.0653	0.79511
ICTs enhances face-to-face tutoring	796	2.9196	0.93085
Demonstration to a large group is possible in an online platform	796	2.8869	0.87151
Illustration to a large group can be carried out in an online platform	796	2.9535	0.78129
ICTs promotes competence based teaching	796	3.2387	0.89207
Valid N	796		

The table shows that the highest mean is 3.2563 while the lowest is 2.8869. This finding implies that the majority of the respondents were in support of the view

that Course outline or programme can be presented to a large group in an online (Internet) learning platform. It also implies that fewer respondents (minority) were in favour of the view that demonstration to a large group is possible in an online platform. Furthermore, presentation of course outline online to a large group is followed by the view that ICTs promotes Competence Based Teaching with a score of 3.2387. This finding is obvious as Competence Based Teaching is the main approach that is used in all the primary and secondary schools in Cameroon.

Table 4.33 *Items Relating to Asynchronous Experiential Learning*

Items	N	Mean	Std. Deviation
Online learning environment enhances observation	796	2.6822	0.95994
There is integration of theory and practice in an online platform	796	2.7387	0.99410
An online learning platform strengthens investigations	796	2.7852	0.88472
ICTs promotes self-directed learning	796	3.4899	0.65677
There is transfer of learning and generalisation in an online platform	796	2.8744	0.82373
Valid N	796		

The table shows that the highest means are 3.4899 and 2.8744 while the lowest mean is 2.6822. This implies that the majority of the respondents were in favour of the view that ‘ICTs promotes self-directed learning’ and the view that ‘there is transfer of learning and generalisation in an online platform’ respectively. This finding also reveals that a smaller number of respondents were in support of the view that online learning environment enhances observation. These results are very important as most institutions across the world are struggling to adopt self-directed learning. That is, learning in which the learner with or without the assistance of a teacher or colleague is able to identify a learning need, design and develop strategies, implement and evaluate the learning gained. The table also shows that the view that ‘online learning environments strengthen investigation’ scored a high mean of 2.7852. This finding is substantial given the fact that the Internet offers access to a wide variety of resources and information.

Table 4.34 Items Relating to Asynchronous Collaborative Learning

Items	N	Mean	Std. Deviation
There is Cooperative planning among peers in an online environment	796	3.1608	0.78140
There is Interactive planning with students in an online platform	796	3.1256	0.77981
There is active participation in an online platform	796	3.0892	0.77757
ICTs promotes peer tutoring	796	3.0075	0.83474
There is common understanding among learners in online platform.	796	2.5804	0.85256
Valid N	796		

Judging from the data in the table, the highest mean is 3.1608 while the lowest is 2.5804. This finding implies that the majority of the respondents were in support of the view that there is cooperative planning among peers in an online environment. It also means that a smaller number of respondents (minority) were in favour of the view that there is common understanding among learners in an online platform. These results are substantial because online platforms support interactions of all dimensions between learners. In all, results reveal that all the items were very important to the respondents considering the slight differences in the Means and Standard Deviations.

Table 4.35 Items Relating to Internet-Based Problem-Solving

Items	N	Mean	Std. Deviation
Open-ended problems can be carried out in an online platform	796	3.3204	0.69978
ICTs fulfils the need for discovery learning	796	3.3417	0.70493
ICTs promotes lifelong learning	796	3.5226	0.60250
Mini group projects can be created in an online learning environment	796	3.2701	0.81103
Large group assignments can be carried out in an online platform	796	3.2023	0.71148
Individual assignments can be accomplished in an online platform	796	2.9987	0.85341
Valid N	796		

The table shows that the highest mean is 3.5226 while the lowest is 2.9987. This finding means that the majority of the respondents were in support of the view that ICTs promotes lifelong learning. It also means that a smaller number of respondents (minority) were in favour of the view that individual assignments can be accomplished in an online platform. These results are substantial because online platforms support lifelong learning. Generally, our findings reveal that all the items

were very important to the respondents considering the slight differences in the Means and Standard Deviations.

Table 4.36 Items Relating to Online Content Representation

Items	N	Mean	Std. Deviation
Text presentation online (on the internet) is user-friendly	796	2.7952	0.84200
Graphical representation on a computer facilitates learning	796	3.2161	0.76136
Video representations enhances learning	796	3.5352	0.56303
Pictorial representations enhances learning	796	3.4108	0.63312
Audio presentation sustains learning	796	3.2827	0.67237
Valid N	796		

The table shows that the highest mean is 3.5352 while the lowest is 2.7952. Therefore, the majority of the respondents were in support of the view that video representations enhance learning while a smaller number of respondents (minority) were in support of the view that Text presentation online (on the internet) is user-friendly. However, results reveal that all the items were very important to the respondents considering the slight differences in the Means and Standard Deviations.

Table 4.37 Items Relating to Online Learning Environment

Items	N	Mean	Std. Deviation
There is accessibility to unlimited information in an online environment	796	3.2814	0.79856
There is flexibility in an online learning environment	796	2.8505	0.76167
Internet-based learning environment completely eliminates distance	796	3.4284	0.78261
Internet-based learning environment offers maximum storage facilities	796	3.3417	0.75156
Valid N	796		

The table shows that the highest mean is 3.4284 while the lowest is 2.8505. This finding implies that the majority of the respondents supported the view that Internet-based learning environment completely eliminates distance. It also means that a smaller number of respondents were in support of the view that there is flexibility in an online learning environment. These results are substantial because online learning environments support distance education. Generally, findings show that all the items

under online learning environment were very important to the respondents given the slight differences in the Means and Standard Deviations.

Table 4.38 *Items Relating to Communication Skills*

Items	N	Mean	Std. Deviation
Emailing/SMS (that is sending emails)	796	3.3304	0.79313
Teleconferencing (interactive communication with telephone)	796	2.7839	1.03816
Group discussions	796	3.0817	0.88146
Face to face discussions.	796	2.6470	0.96466
Web publishing	796	2.7060	0.97852
Speaking	796	3.0013	0.73801
Listening	796	3.1131	0.87151
Writing	796	3.1457	0.79233
Valid N	796		

The table shows that the highest mean is 3.3304 while the lowest is 2.7060. This finding implies that the majority of the respondents indicated that they have very good skills in E-mailing and Short Messaging Service (SMS). It also means that a small number of respondents indicated that they have good skills in Web Publishing. These results are substantial because ICTs have the potential to improve communication skills. Also, findings reveal that all the items were important to the respondents considering the slight differences in the Means and Standard Deviations.

Table 4.39 Items Relating to Technical Skills Using ICTs

Items	N	Mean	Std. Deviation
Surfing (searching for information that interest you on the Internet)	796	3.3518	0.67433
Blogging (that is creating personal mini websites)	796	2.1106	1.01577
Social networking (for example use of face book or twitter)	796	2.8756	0.99602
Content organisation (Presentation of information)	796	3.0075	3.29588
Uploading and Downloading(posting content and copying to a computer)	796	3.2839	0.83766
Mastery of basic computer programs like Word, Excel and PowerPoint	796	2.9058	0.88874
Curriculum mapping/organisation: breaking curriculum into sections that can be assigned and assessed	796	2.1344	0.88212
Problem – solving	796	2.6332	0.84443
Deep thinking	796	2.5201	0.83980
Reading and typing	796	3.1470	0.81788
Valid N	796		

The table shows that the highest mean is 3.3518 while the lowest is 2.1106. These results reveal that most of the respondents indicated that they have very good skills in searching for information that interest them on the Internet (surfing). It also means that a small number of respondents indicated that they have good skills in Web Publishing. These results are important because most student-teachers use internet mainly for research purposes as already seen in one of the previous findings. Furthermore, the slight differences in the Means and Standard Deviations show that all the items were important to the respondents.

Table 4.40 Items Relating to Interactivity Using ICTs

Items	N	Mean	Std. Deviation
Interaction between you and your lecturers	796	2.7450	0.87108
Relations between you and other students	796	3.0452	0.76592
Interaction between you and the learning material or content	796	3.0905	0.73158
Interaction between you and community resources (experts and organizations)	796	2.4962	0.89372
Valid N	796		

The table shows that the highest mean is 3.0905 while the lowest is 2.4962. These results show that interaction between the student-teacher and the learning material or content scored the highest mean. It also means that interaction between the student-teacher and community resources scored the lowest mean. These results are substantial because most student-teachers use internet frequently to get content as already seen in the previous findings. Also, the slight differences in the various Means and Standard Deviations show that the items were imperative to all the respondents.

Table 4.41 *Items Relating to Attitude towards Learning with respect to ICTs*

Items	N	Mean	Std. Deviation
I am interested in using ICTs (Internet, computer, Mobile devices)	796	3.6018	0.53407
ICTs helps me to manage time well	796	2.9309	0.87538
With ICT, I feel responsible for my own learning in this information age	796	3.3731	0.62865
The use of ICTs has improved my management skills	796	2.9171	0.86913
The use of ICTs has reduced the cost of my education.	796	2.6834	1.11153
I believe the use of ICT s to learn is very important for my career.	796	3.7261	0.51676
ICTs has enabled me to learn where and when I want	796	2.9171	0.90875
ICTs helps me to reflect on how I work	796	3.1005	0.67476
ICTs helps me to work with others in a given context	796	3.2940	0.71040
Valid N	796		

The table shows that the highest mean is 3.7261 while the lowest is 2.6834. These results reveal that most of the respondents believed that the use of ICTs to learn was very important for their career. It also show that a small number of respondents indicated that the use of ICTs has reduced the cost of their education. These results are substantial considering the fact that most Cameroonians are very much interested in the use of ICTs and the Internet in particular. Furthermore, the slight differences in the Means and Standard Deviations show that all the items were vital to the respondents.

Table 4.42 *Items Relating to Support Received by ICT Teachers*

Items	N	Mean	Std. Deviation
ICTs have increased financial assistance given to teachers	796	2.2940	0.95510
ICTs enhances direct/practical assistance to teachers	796	3.0766	0.77405
ICTs facilitate technical support given to teachers	796	3.2374	0.65601
ICTs enable pedagogic support to teachers	796	3.3719	0.62839
ICTs facilitate group development	796	3.1244	0.68652
ICTs facilitate action research.	796	3.4410	0.63664
ICTs helps me to cope with the problem of large group	796	2.9523	0.72180
ICTs helps teachers now to have access to technological infrastructure	796	3.3053	0.66239
ICTs enhance staff training in the systems and equipment	796	3.3279	0.61575
ICTs improve the vision and mission of the institution.	796	3.1796	0.79092
Valid N	796		

The table shows that the highest mean is 3.4410 while the lowest is 2.2940. These results reveal that most of the respondents strongly support the view that ICTs have facilitated action research. It also shows that a small number of respondents were in support of the view that ICTs have increased financial assistance given to teachers. These results are important considering the fact that most student-teachers use ICTs mainly for research as already seen in the previous findings. Also, the slight differences in the Means and Standard Deviations show that all the items were important to the respondents.

Table 4.43 *Items Relating to Development of Values and Principles Suitable for learning*

Items	N	Mean	Std. Deviation
Punctuality	796	3.0917	0.83501
Sharing/collaboration	796	3.4548	0.63778
Empathy	796	2.6457	0.81194
Respect of rights	796	2.6696	0.93976
Hard working	796	3.3040	0.73066
Integrity	796	3.0113	0.79218
Humility	796	2.8317	0.90800
Confidence	796	2.8518	0.86038
Responsible	796	3.1583	0.78191
Self-control	796	3.0779	0.80186
Valid N	796		

The table shows that the highest mean is 3.4548 while the lowest is 2.6457. These findings imply that the majority of the respondents strongly agreed that they have developed the value of sharing/collaboration with ICTs. It also means that a smaller number of respondents agreed that they have developed empathy with ICTs. These results are substantial because ICTs supports collaborative learning and sharing of ideas. Generally, findings show that all the items were very important to the respondents given the slight differences in the Means and Standard Deviations.

Table 4.44 *Items Relating to Challenges faced by teachers in implementing eLearning*

Items	N	Mean	Std. Deviation
Inadequate Information and Communication Infrastructure	796	3.2399	1.01136
high cost of Internet services	796	3.1043	1.02322
lack of qualified electronic instructors	796	3.0352	0.94703
Slow Internet lines or access speed	796	3.2852	0.99954
lack of interest by some students and lecturers	796	2.9523	0.93982
Poor implementation of IT projects in schools	796	3.1256	0.90243
Lack of teacher flexibility and creativity	796	2.9196	0.88229
Ineffective teacher training programme on ICT	796	2.9196	0.96795
Insufficient knowledge about eLearning(learning with ICTs)	796	3.1847	0.88584
Recurrent power failure	796	3.1143	0.96908
Lack of ICT based curriculum development programme	796	3.1055	0.86667
Valid N	796		

The table shows that the highest mean is 3.2852 while the lowest is 2.9196. These findings imply that the majority of the respondents strongly agreed slow Internet lines or access speed constitute a challenge to effective eLearning in Cameroon. It also means that a smaller number of respondents agreed that lack of teacher flexibility and creativity, ineffective teacher training programme on ICT poses a challenge to e-learning. These results are substantial because e-learning depends on the Internet and a strong bandwidth. Generally, the slight differences in the various Means and Standard Deviations show that all the items were very important to all the respondents.

4.6.3 Variability of Professional development of student-teachers by Socio-demographic information

T-Test

Table 4.45 Professional development of student-teachers in relation to Type of School

	Type of School	N	Mean	Std. Deviation	Std. Error Mean
Professional development of student-teachers	GTTC	381	122.0499	15.65668	0.80212
	HTTC/FoEdu	415	120.8578	15.30658	0.75137

Table 4.45.1 Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Professional development of student-teachers	Equal variances assumed	0.339	0.561	1.086	794	0.278	1.19204	1.09800
	Equal variances not assumed			1.085	784.815	0.278	1.19204	1.09907

The results above show that on the average, reported variability of the professional development of student-teachers in the study was not significantly higher for respondents of primary Government Teacher Training Colleges ($M = 122.0499$, $SD = 15.65668$) than for student-teachers of Higher Teacher Training Colleges ($M = 120.8578$, $SD = 15.30658$), $t(796) = 1.086$, $p > 0.05$. We can conclude that professional development of student-teachers does not differ between student-teachers in GTTCs and HTTCs.

One way

Table 4.46 *Professional development of student-teachers in relation to Name of School*

Name of School	N	Mean	Std. Deviation	Std. Error
HTTC Yaounde	133	120.1203	15.08262	1.30783
GTTC Yaounde	44	125.5682	15.02927	2.26575
GTTC Mbalmayo	42	117.0714	15.36133	2.37030
GTTC Mfou	44	126.6364	14.04162	2.11685
FoED Buea	142	122.8028	15.40251	1.29255
GTTC Buea	64	120.2344	15.95305	1.99413
GTTC Limbe	51	120.5098	15.84724	2.21906
HTTC Bambili	140	119.5857	15.33369	1.29593
GTTC Bamenda	53	124.9245	15.31320	2.10343
GTTC Kumbo	43	116.7674	14.24753	2.17273
GTTC Mbengwi	40	125.1000	16.88695	2.67006
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in the various schools involved in the study. For example GTTC Mfou scored the highest Mean of 126.6364 with a Standard Deviation of 14.04162. GTTC Kumbo scored the lowest Mean of 14.24753 with a Standard Deviation of 2.17273. However, the main issue at this level was to test whether the differences were significant between the different schools.

Table 4.47 *ANOVA for Professional development of student-teachers*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5971.428	10	597.143	2.541	0.005
Within Groups	184457.490	785	234.978		
Total	190428.918	795			

The analysis of variance as shown in the tables above reveals that the name of the school has a significant influence on the professional development of student-teachers in the study, $F(10, 785) = 2.541$, $p < 0.05$, $\omega = 0.1378$. We notice that about 13.78% of professional development of student-teachers can be explained by being a student of a particular school and this further explains why the professional development of student-teachers differed from one school to another. For example,

there is a marked difference between schools located in the regional capitals and schools located in the rural areas in terms of ICT infrastructure.

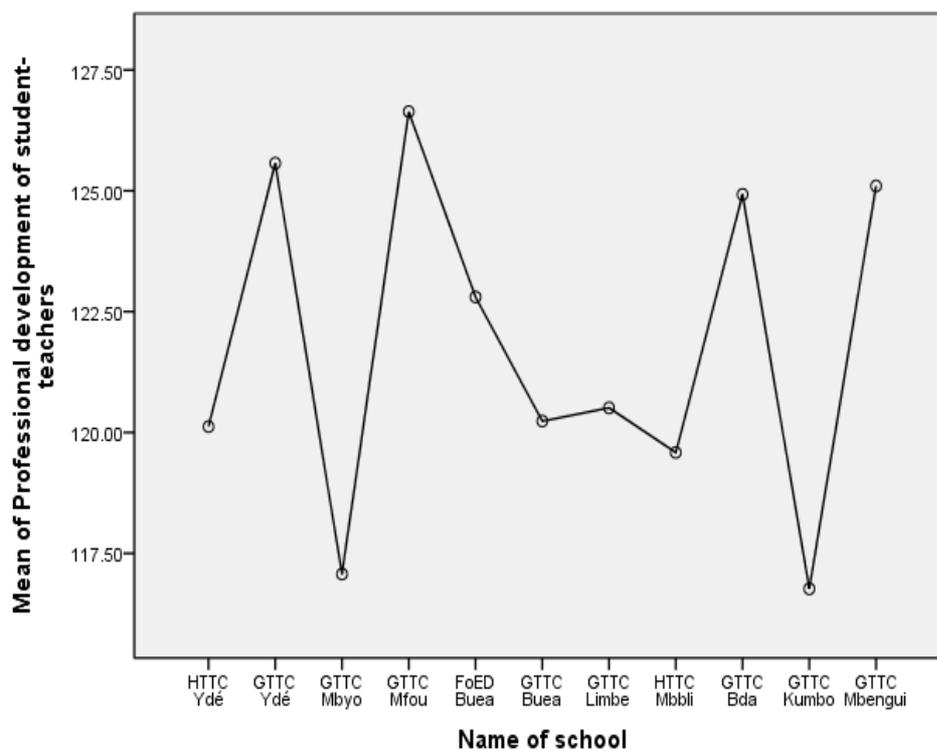


Figure 4.18 Means Plots

One way

Table 4.48 Professional development of student-teachers in relation to Region of Origin

Region of Origin	N	Mean	Std. Deviation	Std. Error
Centre	116	123.1293	16.63706	1.54471
East	23	123.5217	11.90825	2.48304
West	171	122.5380	15.44106	1.18081
Littoral	35	123.0286	17.48022	2.95470
South	48	118.1042	15.62219	2.25487
South-West	177	119.6554	15.63940	1.17553
North-West	208	121.6971	14.78933	1.02546
Adamawa	8	118.8750	14.17682	5.01226
North	6	113.5000	6.71565	2.74165
Far-North	4	120.0000	16.87207	8.43603
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in relation to region of origin of the respondents. For example the East Region and the Centre scored the highest Means ($M=123.5217$, $M=123.1293$) respectively. The North Region scored the lowest Mean of 113.5000 with a Standard Deviation of 6.71565. Nevertheless, the question at this level was to test whether the differences were significant between the regions of origin of the respondents.

Table 4.49 ANOVA for Professional development of student-teachers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2275.895	9	252.877	1.056	0.393
Within Groups	188153.024	786	239.380		
Total	190428.918	795			

The analysis above shows that the region of origin had no significant influence on the professional development of student-teachers in the study, $F(9, 786) = 1.056$, $p > 0.001$, Therefore we can conclude that the region of origin does not influence the professional development of student-teachers in Cameroon.

T-Test

Table 4.50 Professional development of student-teachers in relation to Gender

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Professional development of student-teachers	Female	470	121.2830	13.83865	0.63833
	Male	326	121.6380	17.59259	0.97436

Table 4.50.1 Independent Samples Test

	Levene's Test for Equality of Variances	t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Professional development of student-teachers	Equal variances assumed	29.115	0.000	-0.318	794	0.750	-0.35506	1.11616
	Equal variances not assumed			-0.305	588.694	0.761	-0.35506	1.16484

The results show that on the average, reported variability of the professional development of student-teachers in the study was not significantly higher for male student-teachers ($M = 121.6380$, $SD = 17.59259$) than for female student-teachers ($M = 121.2830$, $SD = 13.83865$), $t(796) = -0.318$, $p > 0.5$. Thus we can conclude that the professional development of student-teachers in Cameroon does not differ according to gender.

One way

Table 4.51 Professional development of student-teachers in relation to Age

Age	N	Mean	Std. Deviation	Std. Error
16-20 yrs	81	131.0617	15.34385	1.70487
21-25 yrs	380	123.6211	14.71644	0.75494
26-30 yrs	206	118.3155	13.72278	0.95611
31-35 yrs	108	114.4722	15.30467	1.47269
36-40 yrs	21	110.9048	18.64646	4.06899
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in the various age groups. For example the age group 16-20 scored the highest Mean of 131.0617 with a Standard Deviation of 15.34385. Also, the age group 36-40 scored the lowest Mean of 110.9048 with a Standard Deviation of 15.47686. However, the main issue at this level was to test whether the differences were significant between the different age groups.

Table 4.52 ANOVA for Professional development of student-teachers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18891.579	4	4722.895	21.778	0.000
Within Groups	171537.339	791	216.861		
Total	190428.918	795			

The analysis of variance as shown in the tables above reveals that age group has a significant influence on the professional development of student-teachers in the study, $F(4, 791) = 21.778$, $p < 0.001$, $\omega = 0.3075$. About 30.75% of professional development of student-teachers in Cameroon can be explained by the age group of the student-teacher.

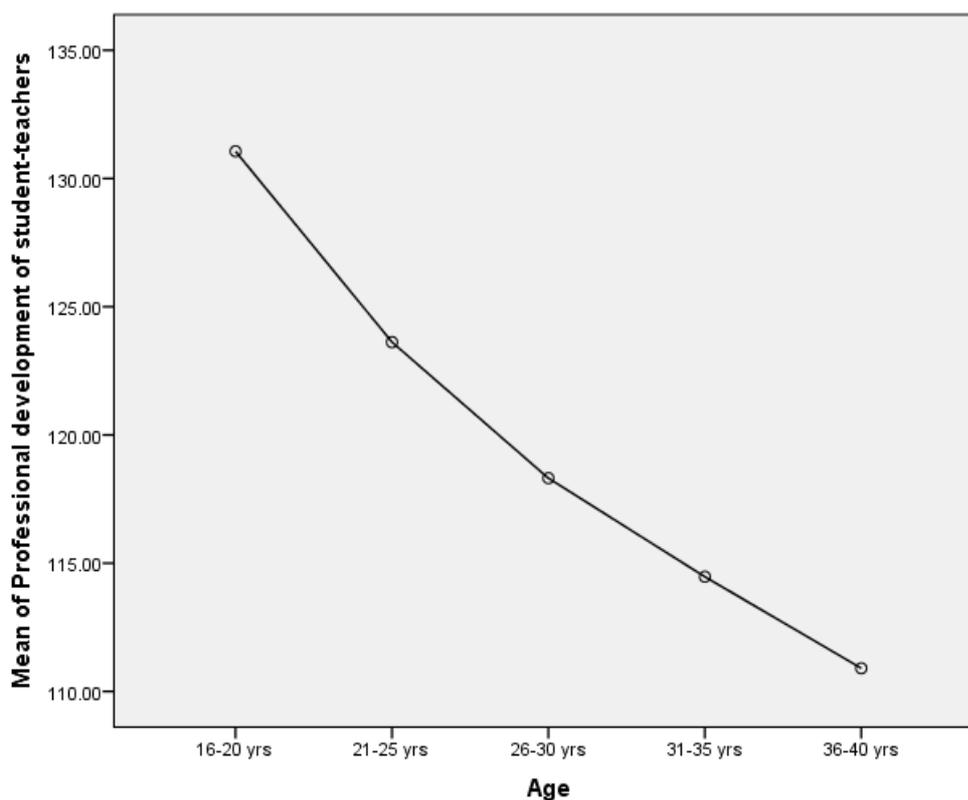


Figure 4.19 Means Plots

One way

Table 4.53 Professional development of student-teachers in relation to Qualification

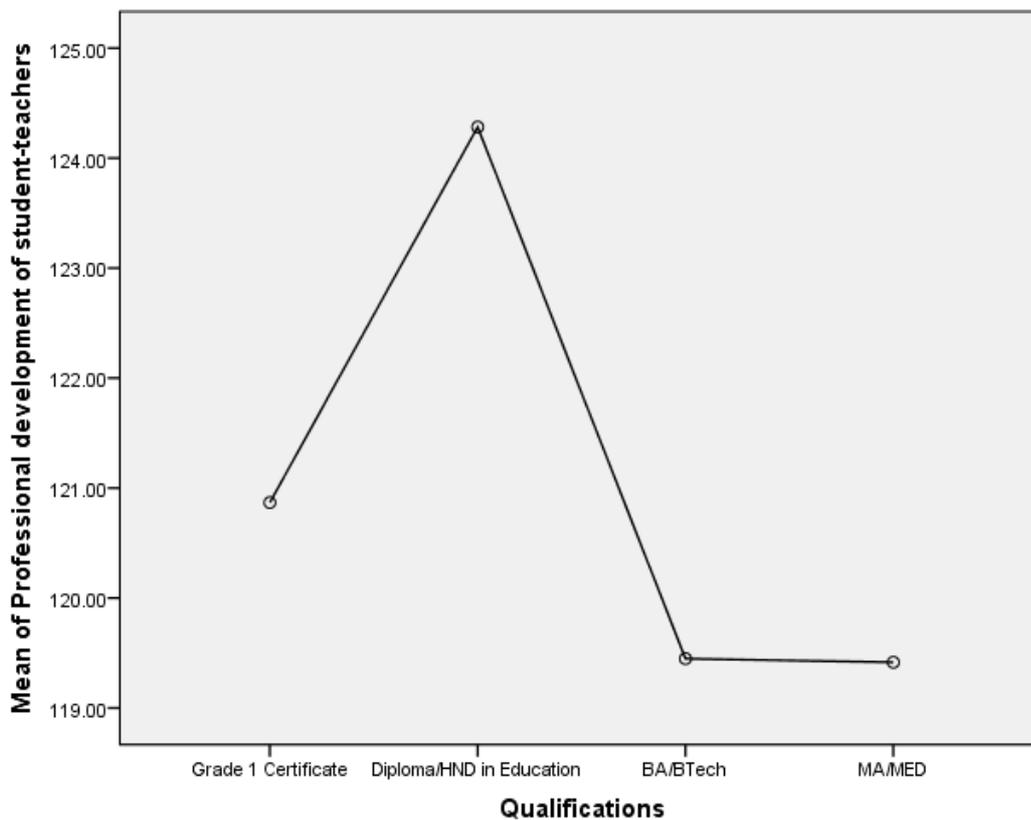
Qualification	N	Mean	Std. Deviation	Std. Error
Grade 1 Certificate	257	120.8677	16.67421	1.04011
Diploma/HND in Education	251	124.2829	12.10833	0.76427
BA/BTech	223	119.4484	16.92154	1.13315
MA/Med	65	119.4154	15.69723	1.94700
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in relation to qualification. For example student-teachers with diplomas/HNDs scored the highest Mean of 124.2829 with a Standard Deviation of 12.10833. On the other hand, student-teachers with MA/MEd scored the lowest Mean of 119.4154 and Standard Deviation of 15.69723. Nevertheless, the question at this level was to test whether the differences were significant between the various qualifications.

Table 4.54 ANOVA for Professional development of student-teachers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3263.558	3	1087.853	4.603	0.003
Within Groups	187165.360	792	236.320		
Total	190428.918	795			

The analysis above shows that qualification had a significant influence on the professional development of student-teachers in the study, $F(3, 792) = 4.603$, $p < 0.01$, $\omega = 0.1158$. We can say that about 11.58% of the professional development of student-teachers in Cameroon can be explained by the qualification of the student-teacher.

*Figure 4.20 Means Plots*

One way**Table 4.55** *Description of Professional development of student-teachers in relation to Experience in using Internet and its facilities*

Experience in ICT	N	Mean	Std. Deviation	Std. Error
< 5 yrs	319	122.3511	13.42516	0.75166
5-10 yrs	297	123.3333	15.79707	0.91664
11-15 yrs	144	112.5000	16.07152	1.33929
> 15 yrs	36	133.2500	11.27925	1.87987
Total	796	121.4284	15.47686	0.54856

The table shows that there were differences in the Means and Standard Deviations in relation to years of experience in using Internet and its facilities. For example those with experience above 15years scored the highest Mean of 133.2500 with a Standard Deviation of 11.27925. Also, those with experience 11-15years scored the lowest Mean of 112.5000 with a Standard Deviation of 16.07152. However, the main issue at this level was to test whether the difference was significant between the different years of experience.

Table 4.56 *ANOVA for Professional development of student-teachers*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17859.491	3	5953.164	27.322	0.000
Within Groups	172569.427	792	217.891		
Total	190428.918	795			

The analysis of variance as shown in the tables above reveals that years of experience in Internet and its facilities has a significant influence on the professional development of student-teachers in the study, $F(3, 792) = 27.322$, $p < 0.001$, $\omega = 0.3004$. This means that about 30.04% of professional development of student-teachers can be explained by the experience of the student-teacher in ICT.

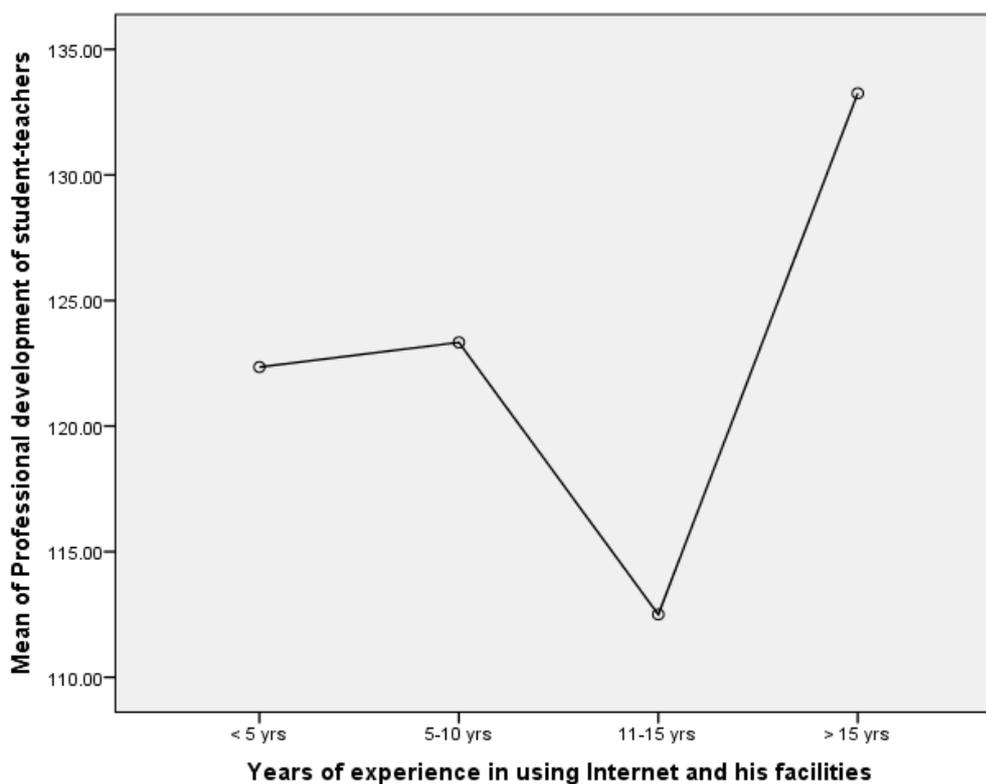


Figure 4.21 Means Plots

One way

Table 4.57 Professional development of student-teachers in relation to Frequency of ICT use

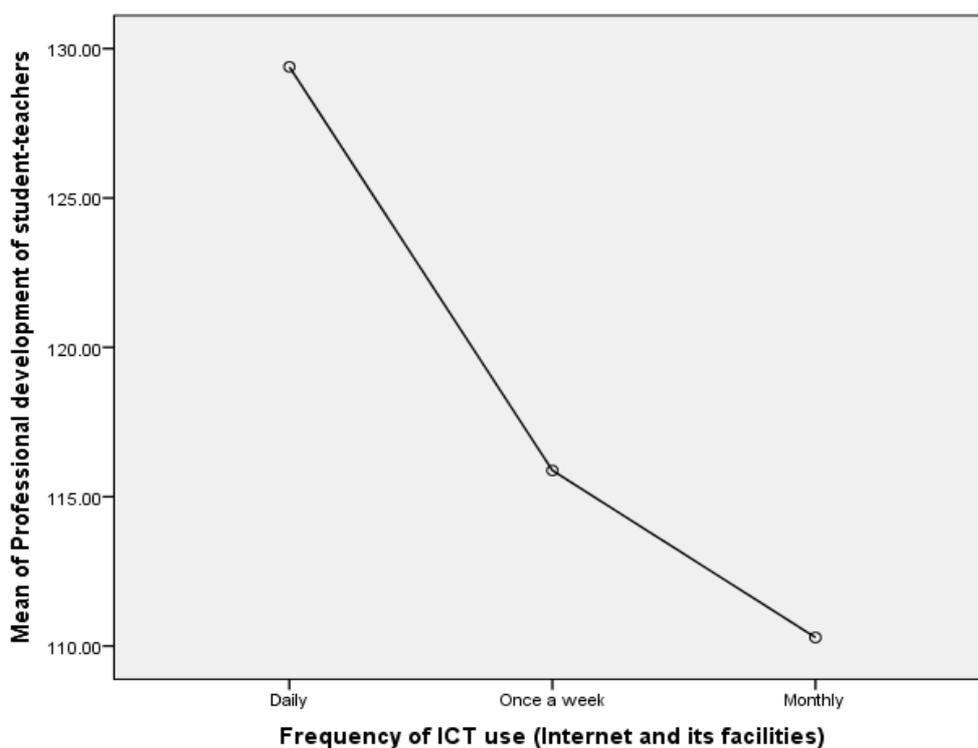
Frequency of ICT Use	N	Mean	Std. Deviation	Std. Error
Daily	353	129.3909	13.70510	0.72945
Once a week	380	115.8789	11.39185	0.58439
Monthly	63	110.2857	23.14849	2.91644
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in relation to frequency of ICT use. For example student-teachers who use ICTs on a daily basis scored the highest Mean of 129.3909 with a Standard Deviation of 13.70510. On the other hand, those who use ICTs on a monthly basis scored the lowest Mean of 110.2857 with a Standard Deviation of 23.14849. Nevertheless, the main issue at this level was to test whether the differences were significant.

Table 4.58 ANOVA for Professional development of student-teachers

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	41905.579	2	20952.789	111.872	0.000
Within Groups	148523.340	793	187.293		
Total	190428.918	795			

The analysis above shows that frequency of ICT use had a significant influence on the professional development of student-teachers in the study, $F(2, 793) = 111.872$, $p < 0.001$, $\omega = 0.4668$. This means that about 46.68% of the results can be explained by frequency of ICT use.

*Figure 4.22 Means Plots*

One way**Table 4.59 Professional development of student-teachers in relation to Type of User**

Type of User	N	Mean	Std. Deviation	Std. Error
Expert	254	129.4370	13.89038	0.87156
Casual user	398	116.5402	14.11601	0.70757
Ordinary user	144	120.8125	16.00960	1.33413
Total	796	121.4284	15.47686	0.54856

The table above shows that there were differences in the Means and Standard Deviations in relation to category of user. For example student teachers who are experts scored the highest Mean of 129.4370 with a Standard Deviation of 13.89038. On the other hand, those who use ICTs occasionally (Casual users) scored the lowest Mean of 116.5402 with a Standard Deviation of 14.11601. Nevertheless, the main issue at this level was to test whether the difference was significant between the different categories of users.

Table 4.60 ANOVA for Professional development of student-teachers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	25855.632	2	12927.816	62.293	0.000
Within Groups	164573.286	793	207.533		
Total	190428.918	795			

The analysis above shows that the category of users of ICT had a significant influence on the professional development of student-teachers in the study, $F(2, 793) = 62.293$, $p < 0.001$, $\omega = 0.3653$. This means that about 36.53% of the professional development of student-teachers can be explained by the type of user of ICT.

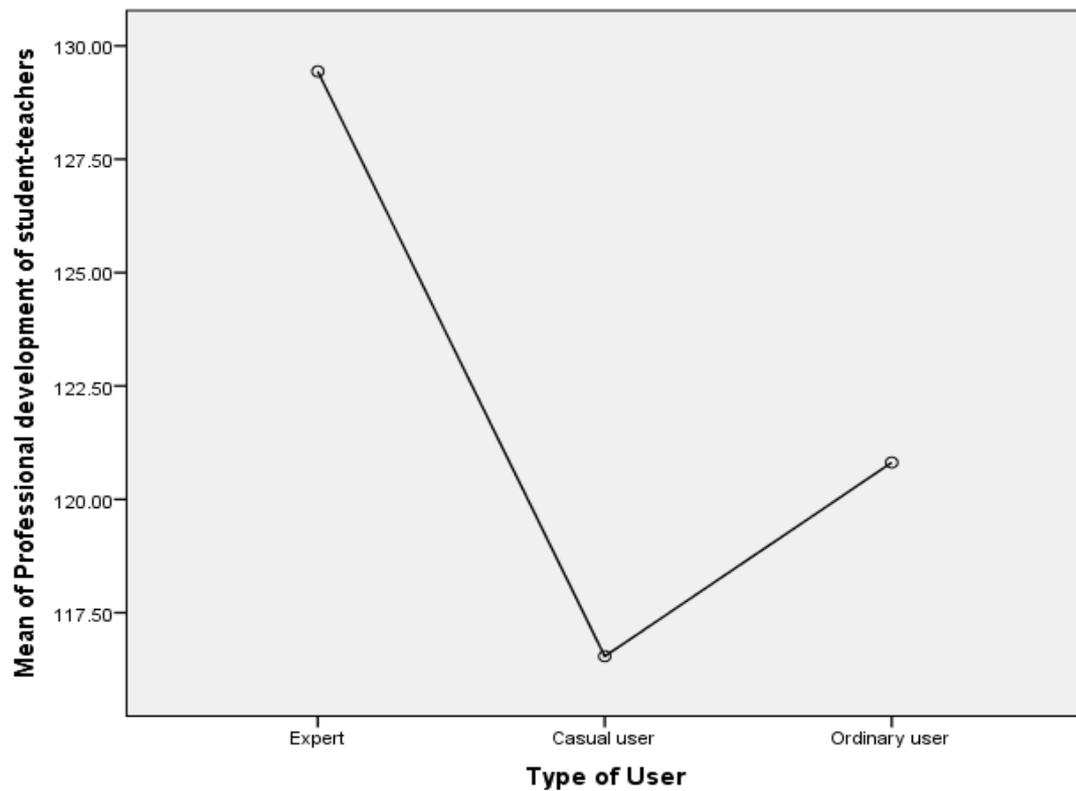


Figure 4.23 Means Plots

4.6.4 Verification of Research Hypotheses

4.6.4.1 Verification of Research Hypothesis 1

The first research hypothesis (RH1) claims that Computer-Based Direct Instruction (CBDI) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between Computer-Based Direct Instruction and the professional development of student teachers, $r(794) = 0.231$, ($p < 0.001$). From this finding we can conclude that Computer-Based Direct Instruction has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.0533; meaning that 5.33% of the variability of the professional development of student teachers is explained by Computer-Based Direct Instruction

Table 4.61 *Correlations between Computer-Based Direct Instruction and Professional Development of Student-teachers*

		Computer-based direct instruction	Professional development of student-teachers
Computer-based direct instruction	Pearson Correlation	1	0.231**
	Sig. (2-tailed)		0.000
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.231**	1
	Sig. (2-tailed)	0.000	
	N	796	796

** . Correlation is significant at the 0.01 level (2-tailed).

4.6.4.2 Verification of Research Hypothesis 2

The second research hypothesis (RH2) claims that Asynchronous Experiential Learning (AEL) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between Asynchronous experiential learning and the professional development of student teachers, $r(794) = 0.070$, ($p < 0.05$). From this finding we can conclude that Asynchronous Experiential Learning has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.0049; meaning that 0.49% of the variability of the professional development of student teachers is explained by Asynchronous Experiential Learning.

Table 4.62 *Correlations between Asynchronous Experiential Learning and Professional Development of Student-teachers*

		Asynchronous Experiential Learning	Professional development of student-teachers
Asynchronous experiential learning	Pearson Correlation	1	0.070*
	Sig. (2-tailed)		0.049
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.070*	1
	Sig. (2-tailed)	0.049	
	N	796	796

*. Correlation is significant at the 0.05 level (2-tailed).

4.6.4.3 Verification of Research Hypothesis 3

The third research hypothesis (RH3) claims that Asynchronous Collaborative Learning (ACL) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between

Asynchronous collaborative learning and the professional development of student teachers, $r(794) = 0.117$, ($p < 0.001$). From this result we can conclude that Asynchronous Collaborative Learning has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.013689; meaning that 1.37% of the variability of the professional development of student teachers is explained by Asynchronous Collaborative Learning.

Table 4.63 *Correlations between Asynchronous Collaborative Learning and Professional Development of Student-teachers*

		Asynchronous Collaborative Learning	Professional development of student-teachers
Asynchronous collaborative learning	Pearson Correlation	1	0.117**
	Sig. (2-tailed)		0.001
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.117**	1
	Sig. (2-tailed)	0.001	
	N	796	796

** . Correlation is significant at the 0.01 level (2-tailed).

4.6.4.4 Verification of Research Hypothesis 4

The fourth research hypothesis (RH4) claims that Internet-Based Problem Solving (IBPS) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between Internet-based problem solving and the professional development of student teachers, $r(794) = 0.296$, ($p < 0.001$). From this result we can conclude that Internet-Based Problem Solving has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.0876. This means that 8.76% of the variability of the professional development of student teachers is explained by Internet-Based Problem Solving.

Table 4.64 *Correlations between Internet-Based Problem Solving and Professional Development of Student-teachers*

		Internet-Based Problem Solving	Professional development of student-teachers
Internet-based problem solving	Pearson Correlation	1	0.296**
	Sig. (2-tailed)		0.000
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.296**	1
	Sig. (2-tailed)	0.000	
	N	796	796

** . Correlation is significant at the 0.01 level (2-tailed).

4.6.4.5 Verification of Research Hypothesis 5

The fifth research hypothesis (RH5) claims that Online Content Representation (OCR) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between online content representation and the professional development of student teachers, $r(794) = 0.180$, ($p < 0.001$). From this finding we can conclude that Online Content representation has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.0324, meaning that 3.24% of the variability of the professional development of student teachers is explained by Online Content Representation.

Table 4.65 *Correlations between Online Content Representation and Professional Development of Student-teachers*

		Online Content Representation	Professional development of student-teachers
Online content representation	Pearson Correlation	1	0.180**
	Sig. (2-tailed)		0.000
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.180**	1
	Sig. (2-tailed)	0.000	
	N	796	796

** . Correlation is significant at the 0.01 level (2-tailed).

4.6.4.6 Verification of Research Hypothesis 6

The sixth research hypothesis (RH6) claims that Online Learning Environment (OLE) has a significant influence on the professional development of student teachers. The results have shown that there was a significant correlation between online learning environment and the professional development of student teachers, $r(794) = 0.120$, ($p < 0.001$). From this result we can conclude that online learning environment has a significant influence on the professional development of student teachers. This test-value gives a coefficient of determination of 0.0144, meaning that 1.44% of the variability of the professional development of student teachers is explained by Online Learning Environment.

Table 4.66 Correlations between Online Learning Environment and Professional Development of Student-teachers

		Online Learning Environment	Professional development of student-teachers
Online learning environment	Pearson Correlation	1	0.120**
	Sig. (2-tailed)		0.001
	N	796	796
Professional development of student-teachers	Pearson Correlation	0.120**	1
	Sig. (2-tailed)	0.001	
	N	796	796

** . Correlation is significant at the 0.01 level (2-tailed).

4.6.5 Stepwise Multiple Regression Analysis

The table that follows presents the parameters of the model for Forced Entry Multiple Regression Analysis. From the results, we noticed that two parameters (Computer Based Direct Instruction and Internet Based Problem Solving) are significant showing that they were better predictors of professional development of student-teachers. At this level we felt the need to conduct a stepwise multiple regression analysis to find out if other models could emerge.

Table 4.67 Table of Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	75.172	5.354		14.040	0.000		
Computer-Based Direct Instruction	0.827	0.196	0.162	4.219	0.000	0.761	1.314
Asynchronous Experiential Learning	-0.381	0.222	-0.064	-1.718	0.086	0.794	1.259
Asynchronous Collaborative Learning	-0.056	0.241	-0.009	-0.232	0.817	0.742	1.348
Internet-Based Problem Solving	1.624	0.242	0.258	6.701	0.000	0.757	1.321
Online Content Representation	0.338	0.238	0.054	1.420	0.156	0.786	1.272
Online Learning Environment	0.006	0.260	0.001	0.023	0.982	0.816	1.226

a. Dependent Variable: Professional development of student-teachers

Table 4.68 Descriptive Statistics of models in relation to Mean and Standard Deviation

	Mean	Std. Deviation	N
Professional development of student-teachers	121.4284	15.47686	796
Computer-Based Direct Instruction	18.3204	3.02636	796
Asynchronous Experiential Learning	14.5704	2.62093	796
Asynchronous Collaborative Learning	14.9636	2.49426	796
Internet-Based Problem Solving	19.6558	2.45454	796
Online Content Representation	16.2399	2.44928	796
Online Learning Environment	12.9020	2.20701	796

The correlations matrix that follows show that all the predictors (Online Learning Environment, Asynchronous Experiential Learning, Online Content Representation, Asynchronous Collaborative Learning, Computer-Based Direct Instruction, Internet-Based Problem Solving) correlate well with the outcome variable (professional development of student teachers). The bivariate correlations among variables are all significant. Thus there is no fear of multi-collinearity between variables, since none of the correlations is above 0.9.

Table 4.69 Table of Correlations Matrix

	1	2	3	4	5	6	7
1 Computer-based direct instruction	1						
2 Asynchronous experiential learning	0.305**	1					
3 Asynchronous collaborative learning	0.317**	0.367**	1				
4 Internet-based problem solving	0.283**	0.318**	0.353**	1			
5 Online content representation	0.355**	0.121**	0.137**	0.303**	1		
6 Online learning environment	0.237**	0.111**	0.294**	0.286**	0.316**	1	
7 Professional development of student-teachers	0.231**	0.070*	0.117**	0.296**	0.180**	0.120**	1

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

N=796

The table below presents the predictor variables that were entered into the Stepwise multiple regression analysis. The table show that all the variables were entered. As a result, two models were extracted to predict the professional development of student teachers.

Table 4.70 Table of Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	Internet-based problem solving		Stepwise (Criteria: Probability-of-F-to-enter ≤ 0.050 , Probability-of-F-to-remove ≥ 0.100).
2	Computer-based direct instruction		Stepwise (Criteria: Probability-of-F-to-enter ≤ 0.050 , Probability-of-F-to-remove ≥ 0.100).

a. Dependent Variable: Professional development of student-teachers

The summary table below shows two models. In the first model, Pearson correlation $R = 0.296$ and $R^2 = 0.088$. This implies that the predictor variable (Internet-Based Problem Solving) accounts for 8.80% of the variability of professional development of student teachers. Also in the second model, Pearson correlation $R = 0.334$ and $R^2 = 0.111$. This implies that the predictor variable (Internet-Based Problem Solving, Computer-Based Direct Instruction) account for 11.10% of the variability of professional development of student teachers. Thus, the second model is a better predictor of professional development of student teachers.

Table 4.71 Table of Model Summary^c

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.296 ^a	0.088	0.087	14.79200	0.088	76.321	1	794	0.000	
2	0.334 ^b	0.111	0.109	14.60825	0.024	21.099	1	793	0.000	1.938

a. Predictors: (Constant), Internet-Based Problem Solving

b. Predictors: (Constant), Internet-Based Problem Solving, Computer-Based Direct Instruction

c. Dependent Variable: Professional development of student-teachers

The ANOVA table below shows two values of F-ratio. In the first model, results displayed in the ANOVA table show that F-ratio is highly significant; $F(1, 794) = 76.321$, $p < 0.001$. This result reveals that there is less than a 0.1% chance that an F-ratio of this magnitude would occur by chance alone. Therefore, we can conclude that our regression model results are significantly a better prediction of the professional development of student teachers. Also, the second model shows that F-ratio is highly significant; $F(2, 793) = 49.676$, $p < 0.001$. This result reveals that there is less than a 0.1% chance that an F-ratio this large would occur by chance alone. Therefore, we can conclude that our regression model results are significantly a better prediction of the professional development of student teachers.

Table 4.72 Regression Model ANOVA^a for professional development of student-teachers

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	16699.232	1	16699.232	76.321	0.000 ^b
	Residual	173729.686	794	218.803		
	Total	190428.918	795			
2	Regression	21201.872	2	10600.936	49.676	0.000 ^c
	Residual	169227.046	793	213.401		
	Total	190428.918	795			

a. Dependent Variable: Professional development of student-teachers

b. Predictors: (Constant), Internet-Based Problem Solving

c. Predictors: (Constant), Internet-Based Problem Solving, Computer-Based Direct Instruction

Now we can consider the parameters of our model. The table below presents b-value estimates. These values indicate the individual contribution of each predictor to the model. We can now consider the parameters of our model. The table gives the b-value estimates. These values indicate the individual contribution of each predictor to the model. It appears that Internet-based problem solving ($t(794) = 7.183, p < 0.001$), Computer-based direct instruction ($t(794) = 4.593, p < 0.001$) are all significant predictors of the professional development of student teachers in Cameroon.

Table 4.73 Table of Model Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	84.727	4.234		20.012	0.000		
	Internet-Based Problem Solving	1.867	0.214	0.296	8.736	0.000	1.000	1.000
2	(Constant)	75.334	4.654		16.186	0.000		
	Internet-Based Problem Solving	1.581	0.220	0.251	7.183	0.000	0.920	1.087
	Computer-Based Direct Instruction	0.820	0.179	0.160	4.593	0.000	0.920	1.087

a. Dependent Variable: Professional development of student-teachers

The magnitude of the t-statistics, suggests that Internet-Based Problem Solving and Computer-Based Direct Instruction have an unprecedented role in fostering the professional development of student teachers. Therefore, replacing b-values into an equation would be able to define our regression model as follows:

$$\text{Professional development} = (1.581) \text{ Internet-based problem solving} + (0.820) \text{ computer-based direct instruction} + 75.334$$

The standardized beta value for Internet-Based Problem Solving indicates that this variable has a higher degree of importance in the model. The following table summarizes the results for our regression model.

Table 4.74 Summary of Stepwise Multiple Regression Analysis

	<i>B</i>	<i>SE B</i>	<i>B</i>
<i>Step 1</i>			
Constant	84.727***	4.234***	
Internet-based problem solving	1.867***	0.214***	0.296***
<i>Step 2</i>			
(Constant)	75.334***	4.654***	
Internet-based problem solving	1.581***	0.220***	0.251***
Computer-based direct instruction	0.820***	0.179***	0.160***

Note : $R^2 = .088$ for Step 1, $\Delta R^2 = .024$ for Step 2 (***) = $p < .001$,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon$$

In conclusion, results of our Stepwise Multiple Regression Analysis reveal that two models (Internet Based Problem Solving and Computer-Based Direct Instruction) are the best predictors of professional development of student-teachers in Cameroon as could be seen in the Stepwise Multiple Regression Analysis above.

4.7 Synthesis

This chapter presented the major findings of the study with respect to the variables exploited.

The next chapter will be devoted to a detail discussion of these findings in relation to the research hypotheses and research questions explored in this study.

CHAPTER FIVE

DISCUSSION OF FINDINGS AND INTERPRETATION OF DATA

5.1 Introduction

In this chapter, the major findings obtained will be discussed with respect to the variables under study. However, the first part discusses findings of the experiment conducted while the second part discusses results of the survey.

5.2 Discussion of Findings of the Experiment

The results of the experiment revealed that on the average, the reported variability of the Mean marks between the first test and the second test was significantly higher for the Experimental Group ($M = 15.660$, $SD = 1.202$) than for the Control Group ($M = 14.188$, $SD = 1.504$), $t(191) = 6.505$, $p < 0.001$, $r = 0.4280$. The magnitude of the effect showed that the difference in performance between the two groups of student-teachers was significant. Thus, inference made was that the use of e-learning as an innovative teaching strategy has a significant effect on the performance of student-teachers in educational technology. This finding offers new evidence that the independent variable (e-learning) has a significant influence on the dependent variable (student-teachers professional development).

In addition, results showed that the field of study had a significant influence on the performance of student-teachers in the first test, $F(2, 188) = 7.581$, $p < 0.001$, $\omega = 0.30$. This means that about 30% of the results in the first test could be explained by the field of study of the student-teachers. The experimental group was made up of level three students studying German and Spanish as foreign languages respectively in the department of foreign languages registered for the course EDI 309. The Control group was a combined class that was made up of level three students studying Chemistry and Physics as teaching subjects and registered for the course EDI 309. Findings of the second test showed that the field of study had a significant influence on the performance of the student-teachers, $F(3, 187) = 23.391$, $p < 0.001$, $\omega = 0.5100$. This means that about 51% of the results could be explained by the field of study of the

student-teachers. This finding gives new proof that the effect of the treatment (e-learning) will vary from one field of study to another. In the same light, the study revealed that student-teachers studying Arts subjects like Languages appreciate e-learning better than student-teachers studying Science subjects like Physics and Chemistry in Cameroon.

Moreover, the ages of the student-teachers in the sample ranged from 20 to 30 years. This age group was sub-divided into three sub-groups. The sub-groups included student-teachers below 25 years, student-teachers between 25 and 29 years and student-teachers above 29 years. The different age groups mentioned, are made up of youths who all have a passion for Information and Communication Technologies especially the Internet and mobile devices like the mobile phone. Although the analysis of variance for the first test revealed that age group or category had a significant influence on the performance of the student-teachers in the first test, $F(2, 188) = 3.814$, $p < 0.05$, $\omega = 0.17$, the same analysis in the second test showed that age did not have a significant influence on the results of the student-teachers in educational technology ($F(2, 188) = 0.424$, $p > 0.05$). Also, when the differences in the Means and Standard Deviations in the various age groups was tested for its degree of significance, Levene's test and the analysis of variance revealed that the ages of the student-teachers did not have a significant effect on the results recorded in this experiment.

More still, results showed that of the 191 student-teachers that participated in the experiment, 71 were made up of females scoring a percentage of (37.2 %) while 120 were males scoring a percentage of (62.8 %). Although male student-teachers dominated in the experiment, findings revealed that on the average, female student teachers performed better than their male counterparts. However, when the difference in performance in the two tests (Test One and Test Two) was tested for its degree of significance, findings further revealed that gender had a significant effect in the results of the study. This result offers new evidence that gender plays a significant role in student-teachers appreciation of e-learning in Cameroon. Female student-teachers in Cameroon appreciate and have more passion for Information and Communication Technologies and their application in learning than the males. Also, the increasing number of female student-teachers in teacher education institutions in Cameroon shows the interest that women are having for the teaching profession and is clear proof of the fact that they are ready to learn and teach like their male counterparts.

Findings further revealed that student-teachers of German and Spanish developed the expected competences which included Knowledge of general culture of ICTs in Cameroon, Usage and Creativity better than student-teachers of Physics and Chemistry. This was testified by the quality of their productions (Test Two). It is worthy to note that the best three productions in terms of design, presentation and description came from the Experimental group; more specifically from Student-teachers studying Spanish and German in the department of Foreign Languages. The group with the best production came from Group 3-Spanish with a total score of 18 on a scale of 20 marks. This group was made up of six members. The group worked on an Audio Media and a Visual Media. The audio device produced was a Compact Disk (CD) on Pronunciation of the Spanish Alphabet. The visual media produced was a Flip chart which complements the audio. The Flip chart presents the different characters with their sounds. The characters were presented on the Flip chart with different colours to make it attractive to learners. The theme of the lesson chosen was Pronunciation of the Spanish Alphabet. The class chosen for the lesson was Form three. That is for beginners of the Spanish Language. It is also interesting to note that the best overall student-teacher in the course came from this group with an average of 18.5 on 20 marks.

Also, the group that came second was Group 4 from the German class with a score of 18 on a total score of 20 marks. This group was made up of five members. The group produced a Video CD on common vocabulary used in the Hospital. The theme chosen was Expressions and Communication in German at the Hospital. The class selected for the lesson was Form three-German class in Cameroon. That is for beginners of the German Language. The group that came third was group 2-German with a total score of 17 on a scale of 20 marks. This group was made up of five members. The group produced an Audio CD on Grammar. The theme chosen was “the use of common Prepositions in German”. The CD produced contained a song with some explanations in between for learners to understand better. The class chosen for the lesson was form four-German class in Cameroon.

Furthermore, comments and questions that were asked to the teacher and those posted on the e-group about the course showed that student-teachers in the Experimental group were more committed in acquiring the necessary competences expected to be developed. The researcher observed that student-teachers in the

Experimental group enjoyed working as a group and as individuals. The discussions that took place in the classroom during the face-to-face meetings and in the e-group as they left the classroom revealed that they had developed a more socio-constructive attitude towards problem-solving. It was equally observed that the student-teachers in this group had developed the attitude of sharing information that concerned them on the e-group. They equally shared comments on the power of e-groups and study groups to accelerate learning following tutorials in the classroom. They made comments such as “I have learned a lot from the yahoogroup”, “I have learnt how to create my own e-group and blog”, “I will use our group work during teaching practice”. As a matter of fact, they all appreciated the yahoogroup and asked questions about “what will happen to the yahoogroup after the course”. There was also cooperative work in this group as the student-teachers were able; to conceive their projects by identifying their learning needs, to define clear objectives, to develop strategies to implement and evaluate the learning that had taken place.

5.3 Discussion of Findings of the Survey

The findings obtained in this section will be discussed under the main variables measured in this study.

5.3.1 Research Hypothesis 1

The first research hypothesis (RH1) asserts that Computer-Based Direct Instruction has a significant influence on the professional development of student teachers. The results of the correlation between Computer-Based Direct Instruction and the professional development of student teachers show that; $r(794) = 0.231$, ($p < 0.001$). From this finding, inference made was that Computer-Based Direct Instruction (CBDI) has a significant influence on the professional development of student-teachers. The magnitude of the effect was verified by the test-value which gave a coefficient of determination of 0.0533; meaning that 5.33% of the variability of the professional development of student teachers could be explained by Computer Based Direct Instruction.

In addition, when the responses of the student-teachers on the questionnaire in relation to Computer-Based Direct Instruction were scored and categorised, it was observed that a majority of the respondents indicated that the Course outline or

programme can be presented to a large group in an online (Internet) learning platform' (Mean = 3.2563). This was followed by the view that ICTs promote competence based teaching with a mean of 3.2387. These results are substantial because online platforms support interactions of all dimensions between learners. In general, results reveal that all the items (presentation of course outline, rules and procedures online, enhancement of face-to-face tutoring and competence based teaching, demonstration and illustration to a large group online) categorized under Computer-Based Direct Instruction were very important to the respondents considering the slight differences in the Means and Standard Deviations. This finding is obvious as Competence Based Teaching is the main approach that is used in all the primary and secondary schools in Cameroon.

Worthy of note is the fact that this result is consistent with previous research by Psychologists like B.F. Skinner and Jerome Bruner whose research indicates that the use of technology facilitates direct instruction. This model supported by ICTs leads to self-directed learning and mastery learning. As a matter of fact, Behaviourism as a theory of learning has influenced the development of Computer-Based Direct Instruction. The views of B. F Skinner lay the foundation for this model in education. Skinner's principles of step-by-step instruction and frequent reward of learners' responses has influenced the development of Computer-Based Direct Instruction. Santrock (2004:220) argues that by breaking down learning into small, simple steps and rewarding students after the completion of each step, mastery learning is achieved. Also, by combining many of these steps, complex behaviours can be learned efficiently. Computer-Based Direct Instruction aims to make knowledge transfer more efficient, flexible, and convenient to both the teacher and the student primarily by ordering the sequence of content and by elaborating on its presentation. For example "simple to complex", "known to unknown", "near- to- far. This study has shown that "online learning platforms" can help students to develop specific competencies and abilities. They are appropriate for distance education, individual training or remedial activity out of classroom time or at home.

Moreover, this finding is consistent with previous research, particularly that of Bottino (2004:556) which indicate that this kind of approach to the use of computers in education is the basis of some distance learning courses on the Internet that are becoming progressively widespread. Computer-Based Direct Instruction has advanced the traditional lecture method of teaching. In this model, almost all the teaching and

learning activities revolve around the computer. The computer substitutes the teacher as the provider of learning objectives, content, learning experiences and evaluation. It is worthy to note that the computer can be incorporated on to each aspect of the teaching and learning process, enhancing teacher lectures with multimedia presentation tools. Crook (2001:32) argues that Multimedia can help lecturers to package their lecture notes as web pages to be consulted at anytime and anywhere by the students. This study has proven that transforming lecture courses into multimedia portfolios, to be accessed at the convenience of the learner, sound attractive. Also, it is important to note that this model has the potential to curb the problem of large group or increasing numbers of students in institutions of learning especially in higher education.

More still, this finding has proven that the lecture in this format has two main social dimensions; the shared or communal nature of participation which makes it a social occasion and the personalised nature of the subject matter or curricular material which also makes it a social occasion. These social dimensions of Computer-Based Direct Instruction promote effective engagement of students in a course or programme. As a result, Computer-Based Direct Instruction as confirmed by this finding, sustains a stronger sense of involvement, motivation and participation in classroom face-to-face tutoring. Thus attendance in face-to-face lecture creates a platform of shared peer experience. This serves as a resource for informal and non-formal education, exploration and evaluative discussion among the students. The social quality to Computer-Based Direct Instruction that is about the personalization of curricular material gives student-teachers the opportunity to access content everywhere and whenever they want. Also, the existence of a voice in the curriculum material thanks to the computer, Tutorial Marked Questions (TMAs) facilitates learning especially distance learning.

Bottino (2004:556) emphasized that in the design of such programmes, importance should be ascribed to factors such as question presentation, objectives, content, presentation of prerequisites and feedback. Presented questions require application of the concepts or rules covered in the instructional sequences. Feedback should be diagnostic by identifying processing errors and prompting remediation or recasting of the instruction. Their use is maximized in distance education rather than classroom practice since they are often perceived more as substitutes for teachers.

5.3.2 Research Hypothesis 2

The second research hypothesis (RH2) asserts that Asynchronous Experiential Learning has a significant influence on the professional development of student teachers. The findings of the correlation between Asynchronous Experiential Learning (AEL) and the professional development of student teachers show that; $r(794) = 0.070$, ($p < 0.05$). From this finding, inference made was that Asynchronous Experiential Learning has a significant influence on the professional development of student teachers. The test-value gave a coefficient of determination of 0.0049; meaning that 0.49% of the variability of the professional development of student teachers is explained by Asynchronous Experiential Learning.

Moreover, when the responses of the students and lecturers on the questionnaire in relation to Asynchronous Experiential Learning were scored and categorised, it was observed that a majority of the respondents indicated that 'ICTs promotes self-directed learning' (Mean = 3.4899). This was followed by the view that there is transfer of learning and generalisation in an online platform with a mean of 2.8744. These results are substantial because online platforms support interactions of all dimensions between learners. In all, results reveal that all the items (enhancement of observation, integration of theory and practice, strengthening of investigation, self-directed learning, transfer of learning and generalisation in an online platform) categorized under Asynchronous Experiential Learning were very important to the respondents considering the slight differences in the Means and Standard Deviations.

It is worthy to note that this finding is consistent with previous research by Psychologists like B.F. Skinner, Jerome Bruner, Lev Vygotsky and the Information Processing theorists whose research indicates that the use of technology facilitates mastery learning, discovery learning, and collaborative learning respectively. Asynchronous Experiential Learning is inductive, learner centred and activity centred. It is based on three principles which include the fact that students learn best when they are involved in the learning experience; knowledge is more meaningful when learners discover for themselves; students are committed to learning when they are free to set their own learning goals. In this model, learners participate in an activity through observation, clarify their thinking and feelings by sharing ideas; draw useful insights,

apply what they have learnt. This study has proven that this model facilitated by ICTs leads to experiential learning, discussion and self-directed learning.

McIntosh (2005:5) views asynchronous model as “individual learning, where the students access the course material when it is convenient for them”. On his part, Piskurich (2004:161) argues that asynchronous refers to activities that do not occur at the same time. Therefore, Asynchronous Experiential Learning is e-learning experience designed for self-learning at anytime and anywhere at your pace. This approach is appropriate for higher education especially teacher education. Long (2004:17) argues that this mode of e-learning is characterized by its nature of learner-facilitator interaction where the contribution of the facilitator is temporally static. According to him, information is presented in recorded format and the learner can interact with it at any time thereafter. He further explains that asynchronous formats may also use online communication but the online learner activity usually is a response to stored data. Here, feedback may be provided by a human or via electronically programmed means.

Furthermore, it is worthy to note that Behaviourism as well as cognitive theories as learning theories lay the foundation for this model. B.F. Skinner is assumed to be one of the most influential psychologists of the behaviourist movement of the 20th century (Diessner, 2008:134). He believed that “the power of the environment could be harnessed for good or evil” (Passer and Smith, 2001:22). Behaviourists see learning as a change in observable behaviour caused by external stimuli in the environment. He uses the phrase “Operant conditioning” to describe a type of learning in which the emitted (operant) rather than the elicited behaviour of the learner is manipulated. An operant refers to a particular response or behaviour that an organism makes (operates) on the environment in order to obtain or avoid a particular consequence. Operant conditioning is based on the view that many of the voluntary responses of animals and humans are strengthened when they are reinforced (followed by a desirable consequence) and weakened when they are punished or ignored.

According to Crook (2001:20) after behaviourism, cognitive psychology came to be the second theoretical force to shape modern accounts of learning. Jerome Bruner’s theory (Cognitive theory of instruction) also lay the foundation for Asynchronous Experiential Learning in Education. Bruner (1956) cited in Santrock (2004:397) emphasized the concept of discovery learning by encouraging teachers to

give students more opportunities to learn on their own. This model can facilitate the concept of discovery learning given that it is learner centred. It has the capacity to encourage students to think for themselves and discover how knowledge is constructed. It equally feeds their natural curiosity and inquiry.

Also, Asynchronous Experiential Learning facilitates discovery learning by providing students with stimulating activities or experiences that activate their natural curiosity. After a critical observation or engagement in an experience, students are able to define a problem, set hypotheses, investigate, analyse, synthesize, and evaluate learning gained. Asynchronous Experiential Learning can be very effective with the assistance of teacher guided questions and directions. The model can also be very effective if students can get help from their peers when experiencing an activity. Bottino (2004:556) argues that learning is progressively considered as being based on an active exploration and personal development, rather than on a transmission model.

In addition, the Information-Processing theory has also influenced the development of this model. Santrock (2004:247) argues that Information-Processing is concerned with how individuals analyse the many sources of information in the environment and make sense of these experiences. Hunt and Ellis (2004:24); Noe (2002:117); Gifford and Enyedy (1999:190) holds that central to this approach are the cognitive processes of memory and thinking. They contend that the amount of learning that takes place depends on the processing capacity of the learner, the amount of effort spent during the learning process, the depth of processing and the learner's knowledge structure. Memory can be defined as the retention of information over time, which involves encoding, storage and retrieval. On the other hand, thinking can be defined as information processing. By processing, we mean activities such as perceiving, organizing, analysing, synthesizing, rehearsing, storing and retrieving. On his part, Semenov (2005:108) emphasized that the time has come for schools to incorporate a wider array of mental processes and activities into the learning process. He argues that unlike the traditional classroom dominated by the spoken and printed word, the new classroom should practise a multisensory enhanced learning. Such learning environments should provide learners with a number of objects and options that can be combined to produce a desired effect. They should be built up around a given competence or competences expected to be developed. Finally, this finding show that Asynchronous Experiential Learning programs are founded on the Information

Processing model of cognition and have a significant influence on the professional development of student teachers.

5.3.3 Research Hypothesis 3

The third research hypothesis (RH3) claims that Asynchronous Collaborative Learning has a significant influence on the professional development of student teachers. The results of the correlation between Asynchronous Collaborative Learning (ACL) and the professional development of student teachers show that; $r(794) = 0.117$, ($p < 0.001$). From this result, conclusion made was that Asynchronous Collaborative Learning has a significant influence on the professional development of student teachers. The test-value gave a coefficient of determination of 0.013689; meaning that 1.37% of the variability of the professional development of student teachers is explained by Asynchronous Collaborative Learning. It is important to note that this finding is consistent with the views of constructivism especially socio-constructivists views on learning.

Moreover, when the responses of the student-teachers on the questionnaire in relation to Asynchronous Collaborative Learning were scored and categorised, it was observed that a majority of the respondents indicated that there is cooperative planning among peers in an online environment (Mean = 3.1608). This was followed by the view that there is Interactive planning with students in an online platform with a mean of 3.1256. These results are substantial because online platforms support interactions of all dimensions between learners. In all, results reveal that all the items (cooperative planning among peers, interactive planning with students, active participation, peer tutoring and mutual understanding in an online environment) categorized under Asynchronous Collaborative Learning were very important to the respondents considering the slight differences in the Means and Standard Deviations.

However, with the penetration of modern technology in education, new interest on research in teaching and learning has emerged. After behaviourism and the cognitive views on learning, came the constructivists. The constructivists especially socio-constructivists views on learning has influenced the development of Asynchronous Collaborative Learning. According to Piskurich (2004:161), Asynchronous Collaborative Learning includes “e-mail (for question and answer or comments), threaded discussions, and reviews of notes, assignments, and feedback”.

There is a lot of sharing of ideas between teacher and students as well as between students and students. It is mainly through discussion. Discussion should be well planned before-hand. This model requires that both the teacher and students give a lot of attention to observation; listening; interpersonal and intervention skills and abilities. On his part, Bottino (2004:558) considers learning not only as an individual construction developed during interaction with the computer but also as a social construction developed within the whole learning activity. This finding confirms this consideration. Semenov (2005:91) defines interactions as “processes where two or more actors influence and affect each other’s actions and behaviour while striving to reach their goal, doing some common work, or performing a joint task”. According to him, any interaction generates information (Semenov, 2005:91). Given the information access and communication facilities of the Internet, an e-learning environment has distinct advantages as a means of providing support to communities of inquiry to promote higher – order learning. Verbal communication such as in oral discussions or telephone conversation and written communication as in text supported by pictorial illustrations and graphs are being rapidly improved by Information and Communication Technologies. This finding illustrates this improvement.

Crook (2001:20) argues that the constructivists conceptualised knowledge in terms of an active and exploratory subject. Constructivism became influential within education through the works of Piaget as well as Vygotsky. Although both theories are constructivist, Vygotsky’s is a social constructivist approach, that emphasizes the social context of learning, and that knowledge is mutually built and constructed (Moore, 2000:15). Diessner (2008:115) points out that Lev Vygotsky is generally considered the greatest Russian developmental Psychologist. He is valued for his thinking now well known and widely respected, on such matters as learning as an essentially social process, the need to engage learners in whole tasks that make sense to them, and the Zone of Proximal (or potential) Development (ZPD). The Zone of Proximal Development is simply the difference between what a student can understand on its own and what it can potentially understand through interaction with others or learning support. Asynchronous Collaborative Learning model provides scaffolding, both from the use of the technology itself and the social interaction stimulated by computers. This finding shows that student-teachers working with some assistance, in the form of adult tutoring, cooperative group work or peer tutoring, learn more than

those engaged in individual discovery learning or chalk-and-talk teaching. This finding also reveals that Asynchronous Collaborative Learning has the capacity to help student-teachers construct their own knowledge through social interactions with others. As a matter of fact, this mode of e-learning creates opportunities for student-teachers to learn with the teacher, community resources, content and more skilled peers. In this model, the teacher as well as the technology serves as facilitator and guide rather than director and builder of learning.

We also have the constructivist approach which is linked to the cultural approach to learning. This approach has influenced the development of this model. Crook (2004:19) reiterates that the emergence of new educational technologies has catalyzed fresh discussion of educational theory and practice. He explains that such discussions embrace pedagogy, epistemology, or psychological development. To him, the cultural view frames intelligent action as something that is mediated. It is worthy to note that Asynchronous Collaborative Learning model opens up new opportunities for elaboration, representation and communication. These new functions and opportunities can change the models of practice which have inspired the construction of the technology used.

Moreover, Crook (2001:30) argues that the motivation to coordinate students working together with computers cannot be taken for granted. This result has shown that ICTs have the potential to support academic interaction that concerns peers more than tutors: that is, informal group discussions. Therefore, student-teachers could be encouraged to get into more informal partnerships conceived to foster collaborative study. Teachers should be trained on how to create and manage learning platforms effectively. Given the necessary learning platform, students can engage in intelligent discussion of their own learning. This study has clearly shown that collaboration learning enhanced by ICTs can be very productive and lead to increased students' achievement.

5.3.4 Research Hypothesis 4

The fourth research hypothesis (RH4) asserts that Internet-Based Problem Solving has a significant influence on the professional development of student teachers. The findings of the correlation between Internet-Based Problem Solving (IBPS) and the professional development of student teachers show that; $r(794) =$

0.296, ($p < 0.001$). From this result, inference made was that Internet-Based Problem Solving has a significant influence on the professional development of student-teachers. The test-value gave a coefficient of determination of 0.0876; meaning that 8.76% of the variability of the professional development of student-teachers is explained by Internet-Based Problem Solving.

Also, when the responses of the respondents on the questionnaire in relation to Internet-Based Problem Solving were scored and analysed, it was noticed that the majority of the student-teachers were in support of the view that ICTs promote lifelong learning (Mean = 3.5226). The view that ICTs fulfil the need for discovery learning with a mean of 3.3417 closely followed. Generally, findings reveal that all the items (open-ended problems, lifelong learning, mini group projects, large group projects and individual assignments) categorized under Internet-Based Problem Solving were very important to the respondents considering the slight differences in the Means and Standard Deviations. Thus, the Internet supports student-teachers' problem solving processes and provides them with the opportunity to carry out open-ended problems; that is, problems which do not have a closed defined answer amongst others.

Garrison and Anderson (2003:4) maintain that institutions of higher education have gradually started to appreciate the fact that the content of an educational experience will not define quality learning but that the context, how teachers design that experience, and the interactions that drive the learning transaction will ultimately distinguish each institution. This model engages students in observing, investigating and drawing inferences or forming hypotheses. It takes advantage of students' interest and curiosity. It is flexible in that it encourages students to explore different possibilities. It encourages students to participate in the learning process without the fear of making mistakes. Also, it fosters creativity and the development of interpersonal skills. Students better understand material and there is transfer of knowledge. The role of the teacher changes from lecturer to facilitator, supporter, and resource person. The teacher arranges the learning environment, provides opportunity for students' involvement and gives feedback.

It is worthy to note that Activity Theory has influenced the development of Internet-Based Problem Solving like Asynchronous Experiential Learning. The penetration of ICTs in education has generated a lot of thinking in education theory and practice. One of this thinking that is based on the Cultural Approach in education

is Activity Centred Design to teaching and learning. Gifford and Enyedy (1999:189) argues that Activity Centred Design (ACD) is a model or design for Computer Supported Collaborative Learning environments, based on the assumptions that: activity is mediated by cultural tools, activity must be conceptualized on a number of interdependent levels, and that conceptual understanding is first established socially. In this light, Gifford and Enyedy (1999:189) view learning as a complex process in which an individual's cognition is defined by its relation to the material setting and the forms of social participation encouraged by these settings. Accordingly, ACD emphasizes the design of computer-mediated environments to support and structure the interactions and interdependencies of an activity system, including the interrelationships between students, their instructors, the tasks they undertake, and the inscriptions they use.

However, Gifford and Enyedy (1999:189) argue that learning theories that lied behind computer-mediated learning environments led to designs that neither fit with nor change the basic participation structures of the classroom. They acknowledged the fact that computer mediated learning environments have increased both student learning and interest, but have not changed the nature of the teaching-learning process, the daily activities of the average classroom. For example, the whole-class, time-based, lecture method still dominates the pedagogical landscape of most schools. Computers have not yet had the profound impact on classroom practice that has been predicted. It is in this backdrop that they recommend Activity Centred Design (ACD). Finally, this finding shows that problem-solving enhanced by ICTs leads to increased student-teachers' outcome. Thus, Internet-Based Problem Solving has a significant influence on the professional development of student-teachers in Cameroon.

5.3.5 Research Hypothesis 5

The fifth research hypothesis (RH5) asserts that Online Content Representation has a significant influence on the professional development of student teachers. The results of the correlation between Online Content Representation (OCR) and the professional development of student teachers reveal that; $r(794) = 0.180$, ($p < 0.001$). From this finding, inference made was that Online Content representation has a significant influence on the professional development of student teachers. The test-value gave a coefficient of determination of 0.0324, meaning that 3.24% of the

variability of the professional development of student teachers is explained by Online Content Representation.

Furthermore, when the responses of the student-teachers on the questionnaires in relation to Online Content Representation were scored and categorised, it was noticed that all the items (text presentation, graphical representation, video representation, pictorial presentation and audio presentation) were very important to the respondents in enhancing learning and also user friendly considering the slight differences in the Means and Standard Deviations. The results showed that the majority of the respondents were in support of the view that video representations enhance learning. This item scored the highest mean of 3.5352 followed by pictorial presentation with a mean of 3.4108. In conclusion, the use of Online Content Representation has a significant influence on the professional development of student-teachers.

It is important to note that this result is consistent with the views of constructivism, information and Processing theory. In concrete terms, these cognitive theories of learning lay the foundation for this form of e-learning (Online Content Representation). Online Content Representations make available tools able to support the relationship between the student-teacher with the knowledge to be learnt (learning object). Online presentations have the potential to support all the learning styles of learners (Visual learners, auditory learners, and kinaesthetic or psychomotor learners). Thus, Online Content Representation has the capacity to help student-teachers to develop full professional competences in the cognitive, affective and the psychomotor domains. As a matter of fact, this finding is in line with previous research carried out by David Jonassen on cognitive tools.

According to Jonassen (2003:362), the key to problem solving is adequately representing the problem to be solved. He further explains that problem solving is at the heart of practice in the everyday and professional contexts. However, over the years, teacher education institutions especially in developing countries like Cameroon are being criticized for their poor outcome. In the same light, Jonassen (2003) remarks that two problems regularly pose problems to students: first, the kinds of problems that students solve in schools (well structured problems) that are quite different from those encountered in everyday and professional situations (ill structured or complex problems); Second, the ways that students learn how to solve well structured problems

usually found at the end of textbook chapters with answers. Worthy of note is the fact that problem-solving in most teacher education institutions is too often proceduralised. Consequently, students' mental models for solving problems contain only procedures.

Furthermore, Jonassen (2003:364) suggests that in order to be able to transfer the skills of solving well-structured and ill-structured or complex problems, it is essential that students learn how to represent the problems they encounter or are solving in more than one way. Thus, problem representation becomes the key to problem-solving. Again, Jonassen (2003:366) asserts that information about a problem can assume different forms: numerical, verbal or pictorial; that information can be organised into meaningful structures including groups, hierarchies, or patterns such as tables, graphs, matrices; that sequencing the problem can take many forms (qualitative and or quantitative). Jonassen (2003:364) remarks that qualitative and quantitative representations are complementary. He further explains that "qualitative representations provide preconditions on which quantitative knowledge can be applied; qualitative reasoning supports construction of quantitative knowledge not available initially. Lastly, it is important to note that qualitative representations support the solutions of quantitative problems" (Jonassen, 2003:369).

Furthermore, given the information access and communication facilities of the Internet, an e-learning environment has distinct advantages as a means of providing support to Online Content Representation to promote higher – order learning. Information in an online learning environment can be presented in an audio format, video, audio-visual, text, pictorial illustrations and graphs. This finding reveals that Online Content Representation supported by ICTs can become very productive and leads to improvements in the professional development of student-teachers.

5.3.6 Research Hypothesis 6

The sixth research hypothesis (RH6) claims that Online Learning Environment has a significant influence on the professional development of student teachers. The findings of the correlation between Online Learning Environment (OLE) and the professional development of student teachers reveal that; $r(794) = 0.120$, ($p < 0.001$). From this result, conclusion made was that the Online Learning Environment has a significant influence on the professional development of student-teachers. The test-value gave a coefficient of determination of 0.0144, meaning that 1.44% of the

variability of the professional development of student teachers is explained by Online Learning Environment. This result is consistent with previous research by the behaviourists, constructivists and the cultural theorist whose research indicates that the use of technology in a defined environment or context facilitates the acquisition of competences.

From another perspective, when the results registered on the questionnaire in relation to Online Learning Environment were scored and categorised, it was noticed that student-teachers responded very positively on the item related to distance learning (Mean = 3.4284). This result implies that Online Learning Environment completely eliminate distance. This was followed by the item related to storage capacity of an online learning environment (Mean=3.3417). Generally, findings show that all the items (accessibility, flexibility, distance learning, and maximum storage features of the Internet) categorized under online learning environment were very important to the respondents given the slight differences in the Means and Standard Deviations.

More specifically, Online Learning Environment make available tools able to support not only the relationship of the student-teacher with the knowledge to be learnt (learning object) but also all the relationships that are established between participants during a teaching and learning activity. Bottino (2004:558) argue that School curricular includes different types of teaching and learning methods and there is no single method or type of tool that can be used for all occasions. Moreover, within any learning domain, students' and teachers' needs evolve during the activities in which they are involved and tools available in the learning environment have to support this evolution. This study confirms that Online Learning Environment supports tools for content representation, solution strategies and processes, communication and evaluation. As a matter of fact, these tools facilitate problem exploration. However, tools and features cannot by themselves guarantee learning. They have to be used in order to support teaching and learning. This study has clearly shown that teaching and learning in an online environment can be very fruitful and lead to increased student-teachers' professional development.

5.3.8 Research Question 8:

What are the challenges faced by teachers in the implementation of e-learning?

This study reveals that there are many Challenges faced by teachers in implementing e-learning. The findings show that the various challenges in implementing e-learning vary from person to person and from one context to another. More specifically, when the responses of the respondents on the questionnaires in relation to challenges faced by teachers in implementing e-learning were scored and categorised, it was noticed that the majority of the student-teachers indicated that slow Internet lines or access speed constitute a serious challenge to effective e-learning in Cameroon (Mean = 3.2852). The problem of slow Internet lines is as a result of inadequate bandwidth. Bandwidth refers to information that can travel between computers per second. Inadequate bandwidth makes it difficult for learners to download graphics and photos from some websites and may even make the system inactive. This result is substantial because e-learning depends on the Internet and a strong bandwidth. The problem of slow Internet lines was compounded by Inadequate Information and Communication Infrastructure with a Mean score of 3.2399. This was followed by insufficient knowledge about e-learning (learning with ICTs) with a Mean score of 3.1847. Following insufficient knowledge about e-learning was Recurrent power failure (Mean = 3.1143). Lack of ICT based curriculum development programmes (Mean = 3.1055).

Generally, findings reveal that all the items (Inadequate Information and Communication Infrastructure, high cost of Internet services, lack of qualified electronic instructors, Slow Internet lines or access speed, lack of interest by some students and lecturers, Poor implementation of IT projects in schools, Lack of teacher flexibility and creativity, Ineffective teacher training programme on ICT, Insufficient knowledge about e-learning (learning with ICTs), Recurrent power failure, Lack of ICT based curriculum development programmes) categorized under challenges faced by teachers in implementing e-learning were very important to the respondents considering the slight differences in the Means and Standard Deviations. These problems identified, are being compounded by the absence of a clear vision for e-learning in teacher training schools and lack of political and financial commitment. Although in Cameroon, there is the political will as could be seen in the country's sector strategic plan and the countries 2035 vision, there is no financial commitment.

Another issue is that of brain drain. Worthy of note is the fact that some of the best and brightest students, teachers and researchers are leaving the country for “greener pastures” in the developed world.

Nevertheless, results of our Stepwise Multiple Regression analysis show that there is the emerging presence of alternative conceptions or models of e-learning challenging institutions in Cameroon to look beyond the limitations of this strategy. These alternative perspectives (models) offer fresh insights and encourage greater research in the area of e-learning in Cameroon and Africa as a whole. In conclusion, the findings of our Stepwise Multiple Regression analysis suggest that Internet-Based Problem Solving and Computer-Based Direct Instruction have an unprecedented role in fostering the professional development of student teachers in Cameroon.

5.4 Synthesis

This chapter presented discussions of major findings with respect to the variables exploited in this study.

The next chapter will be devoted to conclusion, limitations, implications recommendations and suggestions for further research.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusion, limitations, implications, recommendations that could hopefully lead to improvement in teacher education especially in the initial professional development of student-teachers and suggestions for further research.

6.2 Conclusion

Findings revealed that:

- ❖ Computer-Based Direct Instruction has a significant influence on the professional development of student-teachers.
- ❖ Asynchronous Experiential Learning has a significant influence on the professional development of student-teachers.
- ❖ Asynchronous Collaborative Learning has a significant influence on the professional development of student-teachers.
- ❖ Internet-Based Problem Solving has a significant influence on the professional development of student-teachers.
- ❖ Online Content Representation has a significant influence on the professional development of student-teachers.
- ❖ Online Learning Environment has a significant influence on the professional development of student-teachers.
- ❖ The use of e-learning has a significant influence on the performance of student teachers in educational technology

Also, results indicated that the problem of inadequate Information and Communication Infrastructure, high cost of Internet services, lack of qualified electronic instructors, slow Internet lines or access speed, lack of interest by some students and lecturers, poor implementation of IT projects in schools, lack of teacher flexibility and creativity, ineffective teacher training programmes on ICT, insufficient knowledge about e-learning (learning with ICTs), recurrent power failure, lack of ICT based curriculum development programme amongst others contribute the greatest

impediments to effective e-learning in teacher education in Cameroon. Findings further reveal that two models or variables (Internet-Based Problem Solving and Computer-Based Direct Instruction) of all the main models or variables studied (Computer-Based Direct Instruction, Asynchronous Experiential Learning, Asynchronous Collaborative Learning, Internet-Based Problem Solving, Online Content Representation and Online Learning Environment), came out as the best predictors of the professional development of student-teachers in Cameroon.

Worthy of note is the fact that the findings of this study are supported by sound theoretical assumptions of learning, approaches and principles. Thus, these results are in general agreement with earlier research indicating that the use of pedagogic resources especially ICTs have a positive impact on education theory and practice and the outcome of education. However, despite the challenges on the field, the respondents showed an amazing familiarity with the Internet and its facilities as could be seen under socio-demographic results. This study offers new evidence, as well, that the penetration of ICTs in education and the use of e-learning in particular influence the professional development of student-teachers. Also, it is worth noting that these results could be of specific interest to all teacher education establishments and other institutions of higher learning envisaging distance education and e-learning. It could also be of specific interest to the Higher Teacher Training College Yaounde where the experiment on e-learning was carried out as the institution is very conscious of the importance of ICTs in education, its vision and mission.

6.3 Implications of the Study

E-learning and ICTs will continue to be a growing area of study in education and has significant implications for theory, principles and practice of teaching. The growth is so significant that it seems to have the solution to most of the problems in education especially in developing countries like Cameroon. The implications of e-learning will be discussed in these subsections as follows:

6.3.1 Pedagogic Implications

E-learning is multi-dimensional or multi-faceted and all encompassing. Also, problems in education are becoming complex. Consequently, strategies to address these problems must be viewed in a multi-dimensional or multi-faceted manner with respect to the context and the availability of means. However, the professional development of student-teachers must be the first priority for the country to solve its present and future educational problems. This is the key to education for sustainable development. DFID (1997:4); Cunningham and Cunningham (2004:1) state that sustainable development means “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. Thus, the educational system must strive to meet the needs of prospective teachers today and those of future generations.

Furthermore, the educational system will not be able to support the incessant growth and penetration of ICTs in education without an effective initial professional development of student teachers that is based on these technologies. This statement corroborates the previous statement that professional development is the key to our common future. As a matter of fact, there should be a link between Initial training and ongoing professional development of student-teachers. UNESCO and UNICEF (2012:27) share the view that initial training is the primary means of raising teachers’ competence, but in-service training, selection standards and other factors also have a similar strong influence on students and their achievement. People need to understand the challenges this generation and generations to come are faced with in terms of ICTs. This understanding can only come from fresh research of this nature.

Darling-Hammond et al. in UNESCO and UNICEF (2012:27) argue that there is enough evidence which show that students taught by teachers who have acquired strong skills in pedagogy and corresponding certifications tend to perform better than those taught by teachers without such training. Consequently, researchers in the field of education must engage themselves into this kind of research for capacity building purposes. This kind of research will help institutions of learning and the country in particular to solve its current and future educational challenges. Teacher training institutions need to revise or change their training approaches and strategies and activities. They need to become more flexible by adopting more flexible learning approaches like blending learning (incorporating face-to-face tutoring with online

learning). Watkins and Verma (2008:19) assert that institutions must begin to develop and nurture a culture of innovation and excellence.

Moreover, ICT tool influence and transform learning by fundamentally changing the way in which content can be taught and learnt. When considering the design and use of such environments it is important to consider the whole learning situation, for example, not only the tool, but the teachers who will be using the programme, the ways in which it will be used, the curriculum objectives, the social context and the way in which learning is organised. This means that consideration needs to be given not only to the programme design but also to the definition of possible ways it might be used effectively. The design of new tools should include, where appropriate, the use of pictures, figures, drawings, films and sound, and should also offer the learners the opportunity to interact with one another, objects and content. This will enable them to access knowledge from different viewpoints. Collaboration and communication needs should be considered both for subject based and cross-curricular based teaching.

6.3.2 E-Learning and Communication

This study shows that effective communication is an important ingredient as far as the teaching-learning process is concerned. There are two main types of communication (Verbal and Non Verbal). These modes of communication have been, and are being, radically changed by ICTs and e-learning in particular. For example the Internet, TV, radio, complemented by mobile phones or handhels helps students as well as lecturers to express their opinions on pertinent issues concerning the school and the society. As a result, education stake holders need to redefine their communication strategies and policies with respect to e-learning. Also, student-teachers need to acquire effective communication skills while in training schools in order to be able to do their job effectively when they graduate. On her part, World Bank (2003:2) outlines requirements of a knowledge economy which include among others: an educated and skilled population to create, share and use knowledge; a dynamic information infrastructure to facilitate the creation, effective communication, dissemination and processing of information. Individuals should value conversation, collaboration and egalitarianism over egocentric or self-centred teaching and learning approaches. Institutions of learning should identify knowledge, skills and attitudes that might be conducive to the creation of sustainable programmes.

6.3.3 E-Learning and Interactivity/ collaborative skills

In addition, teacher education institutions and systems must establish genuine partnerships to develop attractive and sustainable learning programmes such as Computer Based Direct Instruction, Asynchronous Collaborative Learning programs, Asynchronous Experiential Learning programmes that are primarily ‘bottom up’ (Demand Driven). This will encourage designers and the government to become more involved in e-learning. They must recognise the importance of involving the community in identifying technological issues that are relevant to them, involving them in conceptualising training, implementation and evaluation. The different stake holders should also be involved in setting time frame, developing activities and defining indicators for evaluation. Bottom-up initiative help create trust, shared vision, enabling networks and expanded possibilities.

6.3.4 E-Learning and Attitudes

More still, there is greater need for a change in mindset. Student-teachers as well as teachers must change their ways of seeing teaching and their roles in it. They must learn that the penetration of ICTs in education is a global issue that concerns everyone. Teachers should be courageous to change from existing practices that lead to poor outcomes and embrace new strategies in teaching that have potentials to revolutionize the educational system, for example, by adopting alternative methods of teaching with technology like e-learning. Education stakeholders should thrive to become innovators and instead of fighting change brought by ICTs, embrace it as a new source of energy.

6.3.5 E-Learning and Technical skills

To expand the quantity and improve the quality of higher education in Cameroon, teacher education institutions need to provide increasing numbers of student-teachers with specialized skills necessary for adaptation in the field. Also, teacher training institutions need to produce student-teachers with a general education that encourages flexibility and innovation. They should teach student-teachers what is current and also how to keep their knowledge up to date so that they will be able to cope with the challenges of the fast changing learning environment. The amount and quality of research on e-learning should increase. This will allow institutions to create and disseminate new knowledge faster as their environment gradually improves in terms of

infrastructure. ICTs should serve as mediation during interactions in the learning environment. Therefore, student-teachers must be equipped with the necessary knowledge and skills such as Surfing, Blogging, social networking, content organisation, uploading and downloading, mastery of basic computer programs like Word, Excel and PowerPoint, critical thinking, Curriculum mapping/organisation, Problem – solving skills amongst others. Wheeler, Hesselink, and Corli (2005) point out that people should be learning individuals in transforming organisations. Therefore, teaching in teacher training schools should empower prospective teachers and prepare them for effective teaching in schools with ICTs. Their capacities should be enhanced so that they can make informed choices and transform those choices into desired actions and outcomes. UNESCO and UNICEF (2012:42) support that quality education does not only ensures every child's right to access education but also improves cognitive skills, promotes attitudes, values and other non-cognitive traits that are considered essential for the well-being of individuals, societies and nations.

6.3.6 Implications concerning challenges

Moreover, results showed that if Cameroon must solve its educational problems, then the country must effectively implement e-learning with the collaboration of Telecommunication companies, national and international organisations. The educational system must be receptive and embrace positive change, strengthen education for sustainable development with the use of e-learning, take immediate action, develop sustainable programmes with technology, help student-teachers to understand the role of e-learning, integrate technology in all educational activities to involve the whole community and finally make maximum use of information and communication technologies to enhance teaching and learning. Student-teachers should be able to distinguish between information and knowledge, to get what they need, to process information into knowledge and use that knowledge to solve real life problems. Therefore, information has to be used intelligently and wisely.

6.3.7 E-Learning and human capital

In conclusion, Teacher education supports development. It promotes income growth. The vitality of teacher education is a fundamental determinant of a nation's position in the world. It contributes to skilled labour, productivity, quality of life, enhances social capital, and strengthens institutional structures. It does this by

producing people with new knowledge. Knowledge is a catalyst for economic growth. Economic growth is a powerful determinant of poverty alleviation and improvements in peoples' lives. It generates classes of well trained teachers for all levels of the educational system. UNESCO and UNICEF (2012:27) support that teacher quality is important in determining the achievement levels of students from disadvantaged socio-economic background. Teacher education promotes the choices that people can make. It is absolutely necessary for training specialists, generalists, who can invent, adopt and operate modern technology in all sectors. The information revolution that is driving the new economy is dependent on educated and literate workers and more than ever, the ideas fuelling this expansion have come from people with tertiary degrees.

Government needs to attract and retain the best and brightest student-teachers to work in Cameroon by ensuring that good performance leads to higher remuneration, better benefits, career growth, recognition, and ample learning opportunities. Without this, the ongoing exodus of teachers from poor to more lucrative jobs in the west will increase, further weakening the educational system in less developed nations. It is worthy to note that realising the potential of ICT applications is not an automatic process. It requires substantial research and development of this nature for adaptation, experimentation and localisation. Nagy (2008:2) emphasized that local knowledge and learning are particularly important for ICT enabled development, because it is still a largely unexplored territory. Lessons from pedagogy, social learning, and development assistance underline the importance of locally driven development. Thus, government should encourage research that will directly contribute to economic growth.

World Bank (2003:4) points out that investment in human capital are critical for economic growth. Particularly important are new technology, its dissemination through education and related externalities. Human capital refers to people's knowledge and skills. It is as important for production as valuable to people who have it. Most human capital is built up through training that increases a person's economic productivity- that is enables him or her to earn a higher income. World Bank former president Paul Wolfowitz stressed that capacity is at the heart of development effectiveness (World Bank, 2006:2). He further argues that capacity is the ability of individuals, institutions, and societies to solve problems, make informed choices, define their priorities and plan their futures. By improving initial student-teacher's ability to function as educators in their communities, training also increases social

capital (social cohesion or social ties) thereby helping to build human capital, increase economic growth, and stimulate development. Teacher education must therefore be considered as fundamental to any meaningful development, not just because it creates and enhances human capital, but because it increases social capital as well.

6.4 Limitations of the Study

This study was affected by some shortcomings or constraints. Some of these constraints are highlighted below:

1. E-learning is still a new practice in education and lacks enough documentation. There are only a few practical studies that have attempted to investigate “the role of ICTs on the teaching/learning process”. Most of the studies conducted in this sector focus on continuous professional development of teachers already in the field forgetting the important part that initial professional development play on learning in later years.
2. The constant changes coming from new technology, hardware and software respectively, are changing the scope and status of earlier technologies. For example what used to be considered a computer in terms of characteristics ten years ago is no longer the same today. This incessant change is also affecting the scope and status of e-learning.
3. The study is limited in its population sample; the sample constituted only final year students in Government Teacher Training Colleges in three regions of Cameroon. The main reason for this sample was due to the fact that it is the sample that could furnish the researcher with reliable information given that they are all final year students who are familiar with research on the Internet for their assignments and long essays, communication online, typing and editing of academic research projects. Also, the sample was limited due to financial constraints since an extensive population and large sample will require much money and even time. Keen interest was given to Government Teacher Training Colleges because they are located in major towns where the use of telephones, computers and Internet is evident as the Government is struggling to create Community Tele Centres in the whole country. Also, in major towns, Cyber cafes are cropping up every day and people are already

getting interested in personal Internet offered by the major providers like CAMTEL, Orange and MTN.

4. It was difficult getting the exact statistics of student-teachers in the final year in the Higher Teacher Training Colleges as some students were still to register for the academic year. However, it was easier getting the statistics of student-teachers for the Government Teacher Training Colleges from the Ministry of Secondary Education and the regional delegations as they are all registered for the final certificate exams.
5. Also, during the administration of the instrument, it took days for the delegates in some regions to issue authorization to the researcher to get down to the schools.

6.5 Recommendations for the Study

Based on the objectives and findings of this study and given that e-learning is still a very new concept or strategy in many teacher training colleges in Cameroon, the following recommendations are made to teacher education institutions, students, lecturers and the government:

1. All the student-teachers as well as lecturers should be encouraged to develop a positive attitude towards e-learning and incorporate in their activities.
2. Student – teacher interaction, student – student interaction, student/lecturer – instructional material or content and student/lecturer – community resources facilitated by e-learning should be encouraged.
3. Internet services should be offered at moderate costs. The teacher education institutions could get in to partnership with telecommunication companies like MTN, ORANGE, and CAMTEL MOBILE so that they can offer their services at subsidized rates to students and lecturers.
4. Teacher education institutions should reinforce their vision and mission statements with a policy and strategy for e-learning.
5. In-service training should be given to lecturers on e-learning for capacity building.
6. Student-teachers should be sensitized on the advantages of Online Learning Environment, Asynchronous Experiential Learning, Online Content Representation, Asynchronous Collaborative Learning, Computer-Based Direct

Instruction, Internet-Based Problem Solving. They should learn to be able to identify their learning needs, define their learning strategies, develop and implement a learning plan and evaluate the learning gained, with or without the help of others (Self-directed Learning).

7. Also, student-teachers as well as lecturers (learners) should be sensitized on the advantages of collaborative learning enhanced by ICTs. For example, the use of e-groups, USENET news groups, audio conferencing, video conferencing and teleconferencing
8. Student-teachers as well as lecturers should be given scholarships to develop expertise in challenging areas like e-learning.
9. The government in collaboration with the different ministries of education should support teacher training colleges with Information and Communication Infrastructure. Also, partnership with international bodies (World Bank, UNESCO, and UNICEF among others) involved in knowledge generation, dissemination and capacity building in all key areas of education including teacher education should be strengthened.
10. The last but not the least, given the state of Information and Communication Infrastructure in schools, teacher education institutions should exploit the two models revealed by this study as the best predictors of professional development of student-teachers in Cameroon. That is, Internet-Based Problem Solving and Computer-Based Direct Instruction. The study shows that these two models have an unprecedented role in fostering the professional development of student teachers in Cameroon. For this reason, greater attention should be given to these models in schools.

6.6 Suggestions for Further Research

- A similar study should be carried out using a comparative research design to validate these results.
- A similar study should be carried out but with a wider scope to include all the teacher training colleges in the ten regions of Cameroon.
- A study should be carried out to examine the role of e-learning on continuous professional development of Student teachers.
- A study should be carried out to investigate the role of e-administration on the professional development of student teachers in Cameroon.

6.7 Summary

This study was set to explore the role of e-learning on the professional development of student-teachers in Cameroon. The background to the problem, which culminated to the formulation of the problem, was examined. This led to the formulation of research objectives, questions and hypotheses to guide the study. Related literature was reviewed based on the impact of ICTs and e-learning in particular on the teaching – learning process. This review was set up within a framework of concepts, models and theories. The study involved a mixed methodological approach. In this respect, a survey of 796 student-teachers drawn from eight (8) Primary Government Teacher Training Colleges and three (3) Higher Teacher Training Colleges in the Centre, North West and South West Regions of Cameroon was carried out. Also, an experiment that involved 191 student-teachers of the Higher Teacher Training College was conducted using blended learning. The target population was made up of all the final year student-teachers. Data collected was analyzed using descriptive and inferential statistics. Results as described in the conclusion section of this chapter show that e-learning has a significant influence on the professional development of student-teachers in Cameroon.

6.8 Key Concepts

E-learning, blended learning, e-learning models, quality education, direct instruction, experiential learning, collaborative learning, problem solving, content representation, professional development

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- Terry, T. and Daryl, N. (1996) *Opening Education: Policies and Practices from Open and Distance Education*. Routledge, New York
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APPENDICES

7. Qualification:

- Grade 1 Certificate
- Diploma /HND in Education
- BA / BTech
- MA/MED

8. Experience: How long have you been using the Internet and its facilities?

Less than 5 years , 5-10 years , 5-15years , more than 15 years
Have never used

9. Frequency of ICT Use: How often do you use the Internet and its facilities?

- Daily
- At least once a week
- Monthly
- Never

10. Type of User: What type of user are you?

Expert user , casual user , End user

11. Reasons For Using ICTs:

- To increase my effectiveness in teaching
- To improve relations with students
- To get instructional content
- To improve relations with colleagues
- To do research
- To get information concerning the school
- To chat with friends in Face book/Twitter
- To listen to music
- To watch movies
- To make cheap calls

12. In your opinion, do you think students taught with ICTs perform better?

Yes No

SECTION B

Please indicate the extent to which you agree with the following statements by placing a tick (✓) in any of the boxes for each row:

4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree.

	Statements	4	3	2	1
B1	Computer-based direct instruction				
13	Course outline or programme can be presented to a large group in an online (Internet) learning platform.				
14	Rules and procedures can be clearly presented in an online platform				
15	ICTs enhances face-to-face tutoring				
16	Demonstration to a large group is possible in an online platform				
17	Illustration to a large group can be carried out in an online platform				
18	ICTs promotes competence based teaching				
B2	Asynchronous experiential learning				
19	Online learning environment enhances observation				
20	There is integration of theory and practice in an online platform				
21	An online learning platform strengthens investigations				
22	ICTs promotes self-directed learning				
23	There is transfer of learning and generalisation in an online platform				
B3	Asynchronous collaborative learning				
24	There is Cooperative planning among peers in an online environment				
25	There is Interactive planning with students in an online platform				
26	There is active participation in an online platform				
27	ICTs promotes peer tutoring				
28	There is common understanding among learners in online platform.				
B4	Internet-based problem solving				
29	Open-ended problems can be carried out in an online platform				
30	ICTs fulfils the need for discovery learning				
31	ICTs promotes lifelong learning				
32	Mini group projects can be created in an online learning environment				
33	Large group assignments can be carried out in an online platform				
34	Individual assignments can be accomplished in an online platform				
B5	Online content representation				
35	Text presentation online (on the internet) is user-friendly				

36	Graphical representation on a computer facilitates learning				
37	Video representations enhances learning				
38	Pictorial representations enhances learning				
39	Audio presentation sustains learning				
B6	Online learning environment				
40	There is accessibility to unlimited information in an online environment				
41	There is flexibility in an online learning environment				
42	Internet-based learning environment completely eliminates distance				
43	Internet-based learning environment offers maximum storage facilities				

SECTION C

How would you rate your ability or communication skills in each of the following aspects using ICTs (Internet, computers, and mobile phones)?

4 = Very Good, 3 = Good, 2 = Poor, 1 = Very Poor

	Communication skills	4	3	2	1
44	Emailing/SMS (that is sending emails)				
45	Teleconferencing (interactive communication with telephone)				
46	Group discussions				
47	Face to face discussions.				
48	Web publishing				
49	Speaking				
50	Listening				
51	Writing				

SECTION D

How would you rate your ability or technical skills in each of the following aspects using ICTs (Internet, computers, and mobile phones)?

4 = Very Good, 3 = Good, 2 = Poor, 1 = Very Poor

	Technical skills using ICTs	4	3	2	1
52	Surfing (searching for information that interest you on the Internet)				
53	Blogging (that is creating personal mini websites)				
54	Social networking (for example use of face book or twitter)				
55	Content organisation (Presentation of information)				
56	Uploading and Downloading(posting content and copying to a computer)				
57	Mastery of basic computer programs like Word, Excel and PowerPoint				
58	Curriculum mapping/organisation: breaking curriculum into sections that can be assigned and assessed				
59	Problem – solving				
60	Deep thinking				

61	Reading and typing				
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SECTION E

How would you rate your interpersonal skills/interactivity with respect to the following components of the teaching – learning process using ICTs (Internet, computers, and mobile phones):

4 = Very Good, 3 = Good, 2 = Poor, 1 = Very Poor

	Interactivity using ICTs	4	3	2	1
62	Interaction between you and your lecturers				
63	Relations between you and other students				
64	Interaction between you and the learning material or content				
65	Interaction between you and community resources (experts and organizations)				

SECTION F

How would you rate or assess your attitude towards electronic applications and processes?

Please, place a tick (√) after each statement in any of the boxes that describes you:

4 = Very Positive, 3 = Positive, 2 = Negative, 1 = Very Negative

	Attitude towards learning with respect to ICTs	4	3	2	1
66	I am interested in using ICTs (Internet, computer, Mobile devices)				
67	ICTs helps me to manage time well				
68	With ICT, I feel responsible for my own learning in this information age				
69	The use of ICTs has improved my management skills				
70	The use of ICTs has reduced the cost of my education.				
71	I believe the use of ICT s to learn is very important for my career.				
72	ICTs has enabled me to learn where and when I want				
73	ICTs helps me to reflect on how I work				
74	ICTs helps me to work with others in a given context				

SECTION G

Please indicate the extent to which you agree with the following statements by placing a tick (√) in any of the boxes for each row:

4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree.

	Statements (Support Received by ICT Teachers)	4	3	2	1
75	ICTs have increased financial assistance given to teachers				
76	ICTs enhances direct/practical assistance to teachers				
77	ICTs facilitate technical support given to teachers				
78	ICTs enable pedagogic support to teachers				
79	ICTs facilitate group development				
80	ICTs facilitate action research.				

81	ICTs helps me to cope with the problem of large group				
82	ICTs helps teachers now to have access to technological infrastructure				
83	ICTs enhance staff training in the systems and equipment				
84	ICTs improve the vision and mission of the institution.				

SECTION H

How would you rate or assess yourself with respect to the development of values and principles of learning using electronic applications?

Please, place a tick (√) after each value in any of the boxes that describes you:

4 = Very Positive, 3 = Positive, 2 = Negative, 1 = Very Negative

	Values and principles suitable for learning	4	3	2	1
85	Punctuality				
86	Sharing/collaboration				
87	Empathy				
88	Respect of rights				
89	Hard working				
90	Integrity				
91	Humility				
92	Confidence				
93	Responsible				
94	Self-control				

SECTION I

Please indicate the extent to which you agree with the following statements by placing a tick (√) in any of the boxes for each row:

4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree.

	Statements (Challenges faced by teachers in the implementation of eLearning)	4	3	2	1
95	Inadequate Information and Communication Infrastructure				
96	high cost of Internet services				
97	lack of qualified electronic instructors				
98	Slow Internet lines or access speed				
99	lack of interest by some students and lecturers				
I00	Poor implementation of IT projects in schools				
I01	Lack of teacher flexibility and creativity				
I02	Ineffective teacher training programme on ICT				
I03	Insufficient knowledge about eLearning(learning with ICTs)				
I04	Recurrent power failure				
I05	Lack of ICT based curriculum development programme				

Contact: Email: kibinkirieric@yahoo.com, Tel: 77 79 03 82

APPENDIX C
CONSENT FORM

I, the undersigned, (profession or specialization).....hereby accept to participate in the research project by which the contract of confidentiality is binding. I also declare that in case of any inconvenience or commitment that necessitates any withdrawal, I notify the researcher.

Signature.....

Date.....

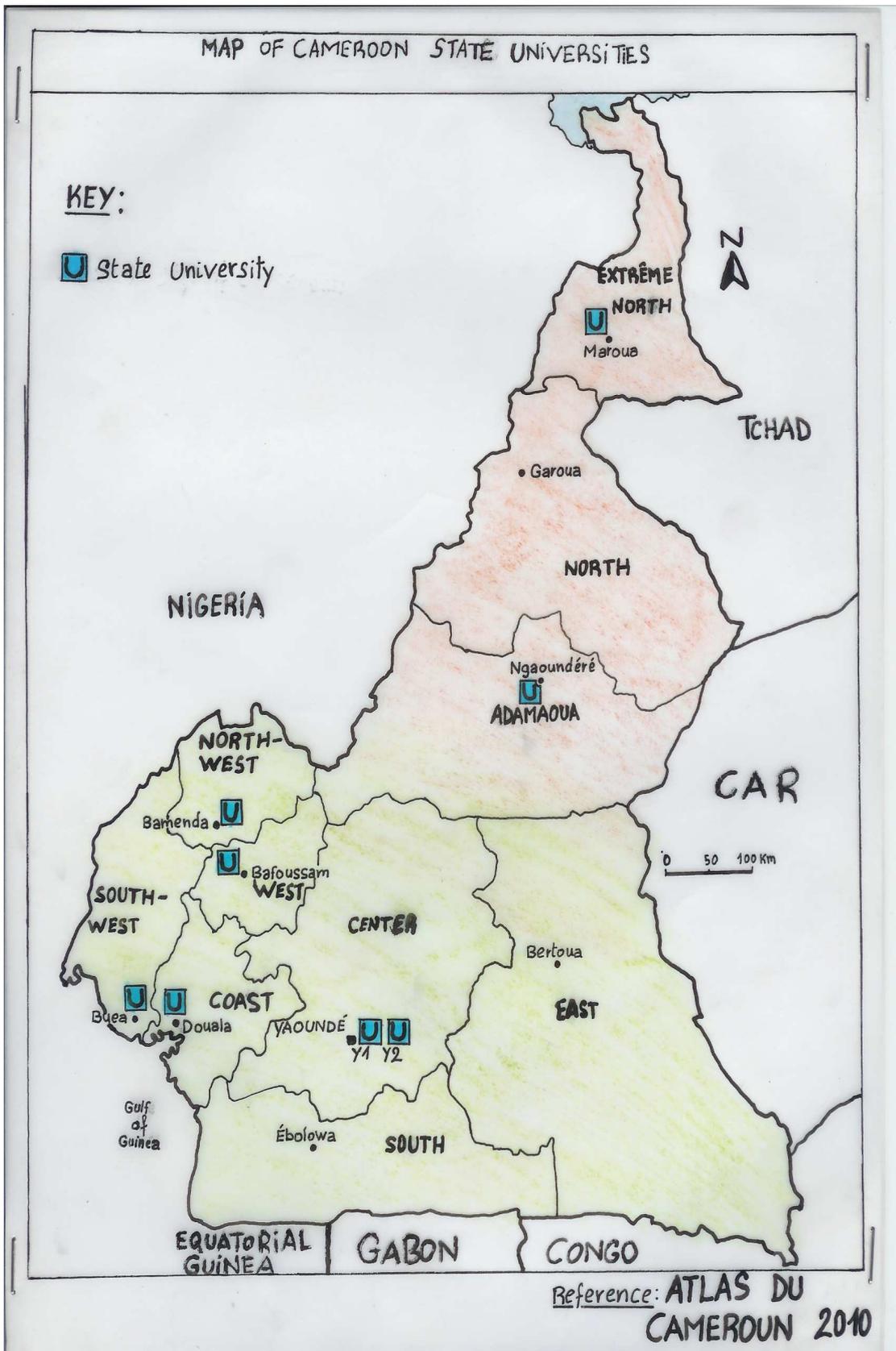
APPENDIX D

Determining the size of a random sample (s) for a given population size (N)

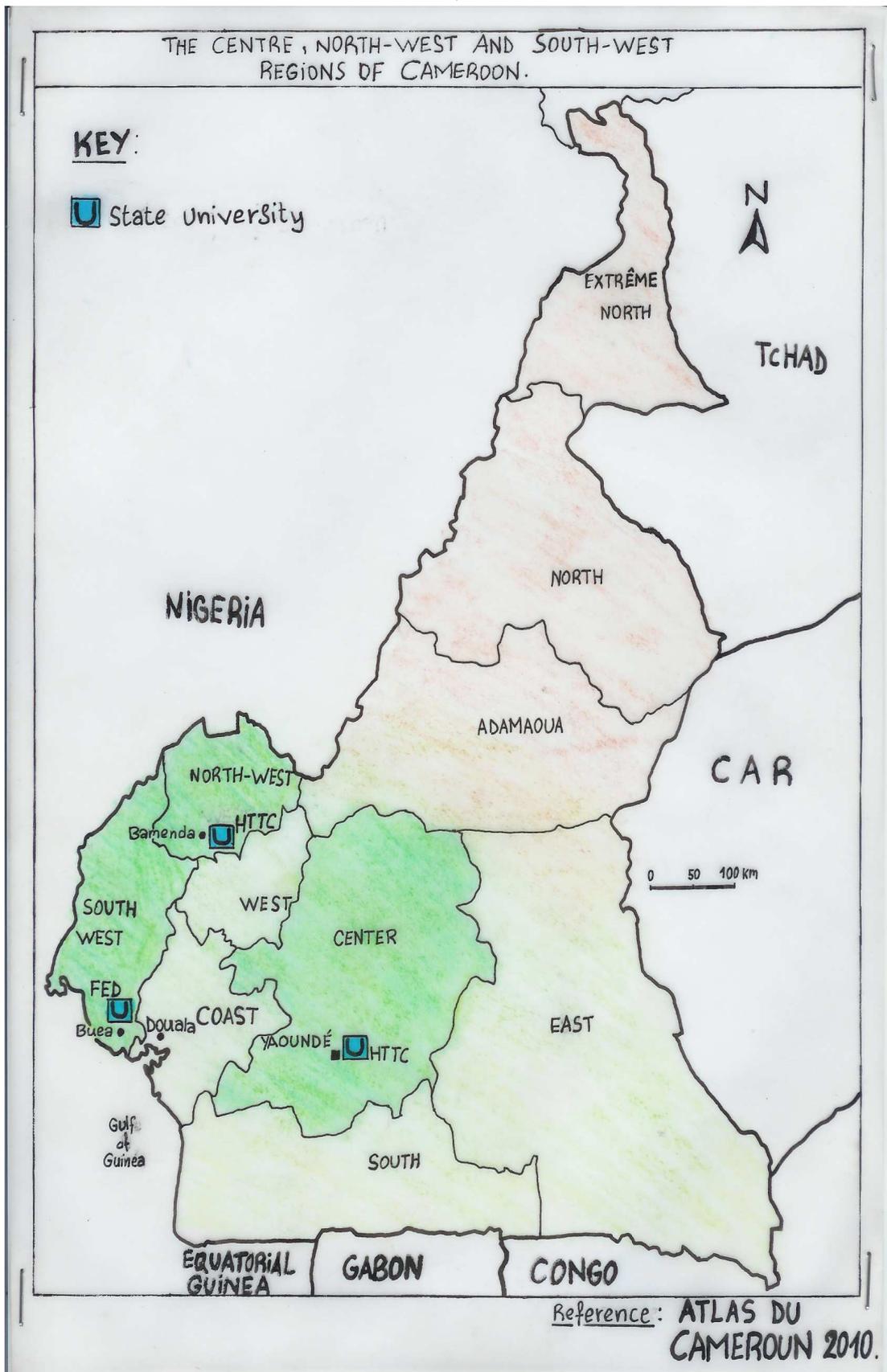
N	S	N	S	N	S
10	10	220	140	1,200	291
15	14	230	144	1,300	297
20	19	240	148	1,400	302
25	24	250	152	1,500	306
30	28	260	155	1,600	310
35	32	270	159	1,700	313
40	36	280	162	1,800	317
45	40	290	165	1,900	320
50	44	300	169	2,000	322
55	48	320	175	2,200	327
60	52	340	181	2,400	331
65	56	360	186	2,600	335
70	59	380	191	2,800	338
75	63	400	196	3,000	341
80	66	420	201	3,500	346
85	70	440	205	4,000	351
90	73	460	210	4,500	354
95	76	480	214	5,000	357
100	80	500	217	6,000	361
110	86	550	226	7,000	364
120	92	600	234	8,000	367
130	97	650	242	9,000	368
140	103	700	248	10,000	370
150	108	750	254	15,000	375
160	113	800	260	20,000	377
170	118	850	265	30,000	379
180	123	900	269	40,000	380
190	127	950	274	50,000	381
200	132	1,000	278	75,000	382
210	136	1,100	285	100,000	384

Note: From R.V. Krejcie and D. W. Morgan (1970), Determining sample size for research activities, Educational and psychological measurement, 30, 608, Sage Publications.

APPENDIX E



APPENDIX F



APPENDIX G

KIBINKIRI ERIC LEN,
Assistant Lecturer,
E.N. S – Yaounde,
TEL.: 77 78 03 82
10 – 05 – 2013

Through the Head of Department,
Curriculum Studies and Teaching,
To
The Dean, Faculty of Education,
University of Buea

Dear Sir,

Subject: AN APPLICATION FOR A LETTER OF AUTHORIZATION

I have the honour to apply for authorization to carry out research in the department of Curriculum studies and Teaching in the Faculty of Education, University of Buea. I am an Assistant Lecturer in the Higher Teacher Training College Yaounde and a PhD student in the University of South Africa. The title of my research is “The Role of ELearning on Professional Development of Student-Teachers in Cameroon”.

Sir, I will be very grateful if my application is accepted. Thanks for your support.

Yours Sincerely,

Kibinkiri Eric L.

APPENDIX H

UNIVERSITY OF BUEA

P.O. Box 63
Buea, South West Region
CAMEROON
TEL: (237) 33 32 21 34 / 33 32 26 90 / 33 32 27 06
FAX: (237) 33 43 25 08 / 33 32 22 72



REPUBLIC OF CAMEROON

PEACE – WORK – FATHERLAND

FACULTY OF EDUCATION

Dean: Professor André Mvesso

Vice Dean / Programmes and Academic Affairs: Dr. Nnane Peter Ebotane

Vice Dean / Studies and Student Affairs: Dr. Titanji Peter Fon

Vice Dean / Research and Cooperation: Dr. Andrew Ekoka Molindo

Faculty Officer: Mr. Ekema Patrick Esunge

Date: 10 MAI 2013

Your Ref.:

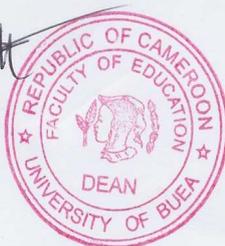
Our Ref.: 2013/00123/UB/FED

Authorization for Research

I, Dean of the Faculty of Education, University of Buea, hereby authorize Mr. KIBINKIRI ERIC LEN, a Doctorate student at the University of South Africa and also an Assistant Lecturer at the Higher Teacher Training College Yaounde of the University of Yaounde I, to carry out his Ph.D. research on the topic: “The Role of E-Learning on the Professional Development of Student-teachers’ in Cameroon” in the Department of Curriculum Studies and Teaching.

This authorization is issued to serve where it is desired.

Professor André Mvesso
Dean



APPENDIX I

KIBINKIRI ERIC LEN,
Assistant Lecturer,
E.N. S – Yaounde,
TEL.: 77 78 03 82
08 – 05 – 2013

Through the Head of Department,
Science of Education,
To
The Director of H.T.T.C Bambili,
University of Bamenda

Dear Sir,

Subject: AN APPLICATION FOR A LETTER OF AUTHORIZATION

I have the honour to apply for a letter of authorization to carry out research in your institution. I am a PhD student in the University of South Africa. The title of my research is “The Role of ELearning on Professional Development of Student-Teachers in Cameroon”.

Sir, I will be very grateful if my application is accepted. Thanks for your collaboration.

Yours Sincerely,

Kibinkiri Eric L.

APPENDIX J

REPUBLIC OF CAMEROON
Peace – Work – Fatherland

THE UNIVERSITY OF BAMENDA

HIGHER TEACHER TRAINING COLLEGE
(HTTC) BAMBILI

P.O. BOX 39 Bambili TEL 33 36 36 94
FAX 33051069



REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

UNIVERSITÉ DE BAMENDA

ÉCOLE NORMALE SUPÉRIEURE(ENS)
DIE BAMBILI

Tel :: 33 36 36 94

BAMBILI THE

08 MAI 2013

THE DIRECTOR

REF: **0408/052013**/UBa/VC/DHTTC

AUTHORIZATION FOR RESEARCH

I, the Director of the Higher Teachers' Training College (HTTC) of The University of Bamenda in Bambili, hereby authorizes **Mr. KIBINKIRI ERIC LEN**, a PhD student at the University of South Africa and also an Assistant Lecturer at the Higher Teacher Training College Yaoundé of the University of Yaoundé I to carry out his PhD research on the topic "**The role of E-Learning on the professional development of student - teachers in Cameroon**", at HTTC.

This authorization is issued to serve wherever it is desired.



Lukong Cornelius Firi
PROFESSOR

APPENDIX K

KIBINKIRI ERIC LEN,
Assistant Lecturer,
E.N. S – Yaounde,
TEL.: 77 78 03 82
28 – 04 – 2013

The Regional Delegate,
For Secondary Education,
Centre Region

Dear Sir,

**Subject: AN APPLICATION FOR A LETTER OF AUTHORIZATION FOR
RESEARCH IN G.T.T.Cs**

I have the honour to apply for the above mentioned document. I am an Assistant Lecturer in the Higher Teacher Training College Yaounde and a PhD student in the University of South Africa. The title of my research is “The Role of ELearning on Professional Development of Student-Teachers in Cameroon”.

Sir, I will be very grateful if my application is accepted. Thanks for your support.

Yours Sincerely,

Kibinkiri Eric L.

APPENDIX L

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

DELEGATION REGIONALE DU CENTRE

SOUS DIRECTION DES AFFAIRES GENERALES

INSPECTION DE PEDAGOGIE CHARGEE DE
L'ENSEIGNEMENT NORMAL

BP : 5281 Yaoundé-Nlongkak

Tél. /Fax 22235187

REPUBLIQUE OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF SECONDARY EDUCATION

CENTRE REGIONAL DELEGATION

Sub Department of pedagogy in
charge of Teachers Training

AUTORISATION DE RECHERCHE ATTESTATION OF RESEARCH

N° 001 /13/MINESEC/DRES-CE/S-DAG/IC-EN

Le Délégué Régional des Enseignements Secondaires pour le Centre soussigné,
The Regional Delegate of Secondary Education for the Centre, undersigned

Atteste que M./Mme/Mlle KIBINKIRI ERIC LEN
Hereby testifies that Mr.

Matricule Solde 1731793W

Qualité : professeur Assistant à l'E.N.S.de Yaoundé

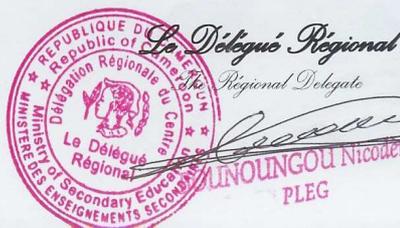
Effectue dans le cadre de sa formation, une recherche ayant pour thème : « The role of ICTS on the professional development of student teachers in Cameroon ».

Ce travail l'oblige à s'adresser à certaines institutions ou services en vue de la collecte des données nécessaires pour sa réalisation.

En foi de quoi la présente Attestation lui est délivrée pour servir et valoir ce que de droit,

This Attestation is issued to serve the purpose it is intended for.

Yaoundé, le 02 MAI 2013
On the



APPENDIX M

KIBINKIRI ERIC LEN,
Assistant Lecturer,
E.N. S – Yaounde,
TEL.: 77 78 03 82
10 – 05 – 2013

The Regional Delegate,
For Secondary Education,
South West Region

Dear Sir,

**Subject: AN APPLICATION FOR A LETTER OF AUTHORIZATION FOR
RESEARCH IN G.T.T.Cs**

I have the honour to apply for the above mentioned document. I am an Assistant Lecturer in the Higher Teacher Training College Yaounde and a PhD student in the University of South Africa. The title of my research is “The Role of ELearning on Professional Development of Student-Teachers in Cameroon”.

Sir, I will be very grateful if my application is accepted. Attached are copies of letters received from institutions visited. Thanks for your support.

Yours Sincerely,

Kibinkiri Eric L.

APPENDIX N

REPUBLIQUE DU CAMEROUN
Paix – Travail – Patrie

MINISTRE DES ENSEIGNEMENTS SECONDAIRES

DELEGATION REGIONALE
DU SUD-OUEST
P.M.B. 10.015 BUEA

Ref: *3182/404*/MINESEC/RDSW/SDGA/SPS
E-mail: delesecbuea@yahoo.com
Tel: 33 32 22 38

REPUBLIC OF CAMEROON
Peace – Work – Fatherland

MINISTRY OF SECONDARY EDUCATION

REGIONAL DELEGATION
FOR THE SOUTH WEST
P.M.B. 10.015 BUEA

10 MAI 2013
Buea,

The Regional Delegate
Le Délégué Regional

AUTHORIZATION FOR RESEARCH

I, The Regional Delegate for Secondary Education, for the South West Region of Cameroon, hereby authorizes **Mr. KIBINKIRI ERIC LEN**, a Doctorate Student at the University of South Africa and Lecturer at E.N.S – Yaounde to carry out his PHD research on the topic “The Role of E- Learning on the Professional Development of Student- Teachers in Cameroon” in Government Teacher Training Colleges in the South West Region.

This authorization is issued to serve wherever it is desired.

*For the Regional Delegate
and by Order*

**The Sub Director
General Affairs**

Jacob Akwete Nyadjroch
PLEG



REGIONAL DELEAGTE

NGUNDU FRANCIS MOKOMBA

APPENDIX O

KIBINKIRI ERIC LEN,
Assistant Lecturer,
E.N. S – Yaounde,
TEL.: 77 78 03 82
10 – 05 – 2013

The Regional Delegate,
For Secondary Education,
North West Region

Dear Sir,

**Subject: AN APPLICATION FOR A LETTER OF AUTHORIZATION FOR
RESEARCH IN G.T.T.Cs**

I have the honour to apply for the above mentioned document. I am an Assistant Lecturer in the Higher Teacher Training College Yaounde and a PhD student in the University of South Africa. The title of my research is “The Role of ELearning on Professional Development of Student-Teachers in Cameroon”.

Sir, I will be very grateful if my application is accepted. Attached are copies of letters received from institutions visited. Thanks for your support.

Yours Sincerely,

Kibinkiri Eric L.

APPENDIX P

REPUBLIQUE DU CAMEROUN
PAIX – TRAVAIL – PATRIE

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

DELEGATION REGIONALE
DU NORD OUEST

Tel. No. 3336 11 49
3 336 28 63
Fax: 3336 29 08

REPUBLIC OF CAMEROON
PEACE – WORK – FATHERLAND

MINISTRY OF SECONDARY EDUCATION

REGIONAL DELEGATION
FOR THE NORTH WEST

Ref. No. B 663 / 6168 /MINESEC/RDSE/NW/SMACEA

Bamenda, the

17 MAI 2013

THE REGIONAL DELEGATE
LE DELEGATION REGIONALE

SUBJECT: AUTHORISATION TO CARRY OUT RESEARCH

TO: Mr KIBINKIRI Eric Len,
Mle731793W,
ASSISTANT LECTURER,
ENS YAOUNDE.

With reference to your correspondence of 8th May, 2013 on the subject matter cited above, you are by this note authorised to carry out your research on the topic: 'The role of E-learning on the Professional Development of Student- Teachers in Cameroon' in all the Government teacher training colleges found in the North West Region.

Considering the importance of this exercise that necessitates the collection of data from these training institutions, and the fact this is almost at the end of the academic year, you are advised to get in touch with the Principals concerned as soon as possible and to work in close collaboration with them. This exercise should be done in strict respect of the rules and regulations in force.

CC- All teacher training colleges concerned
- Divisional Delegates
- Files

THE REGIONAL DELEGATE



Plejo George
PLEJ, Hars échelle

APPENDIX Q

UNIVERSITÉ DE YAOUNDÉ I
UNIVERSITY OF YAOUNDE I
ÉCOLE NORMALE SUPÉRIEURE
HIGHER TEACHER TRAINING COLLEGE

BP : 47 Yaoundé
Tél : 22 23 12 15

12 / - 0 1 1 7
N° _____ UYI/ENS/D/gn



RÉPUBLIQUE DU CAMEROUN
REPUBLIC OF CAMEROON

Paix - Travail - Patrie
PEACE- WORK- FATHERLAND

Yaoundé, le 09 JAN 2012

CERTIFICAT DE PRISE DE SERVICE

Le Directeur de l'École normale supérieure de Yaoundé
soussigné,

Certifie que : Monsieur **KIBINKIRI Eric LEN**

A effectivement pris service à l'ENS le : **28 Décembre 2011**

En qualité d' : **Assistant**

Département de : **Sciences de l'Éducation**

En foi de quoi le présent certificat de prise de service lui est
délivré pour servir et valoir ce que de droit.


LE DIRECTEUR DE L'ENS

Nicolas Gabriel ANDJIGA
 Professeur