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THE UNIVERSITY OF YAOUNDE I
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PEDAGOGIC INTEGRATION OF ICT IN GOVERNMENT BILINGUAL SECONDARY SCHOOLS TO ENHANCE COMPETENCY BASED APPROACH TEACHING/LEARNING METHODS IN CAMEROON

A Thesis Submitted in Partial Fulfillment of the Requirements for the Award of a Doctorate Degree in Fundamental Studies in Education

Specialty: *ICT and Education*

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CERTIFICATION

I, the undersigned, certify that this research was carried out by Thecla DZEKASHU FANSO, of the Post Graduate School of Human and Social Sciences of the University of Yaounde I, Faculty of Education, Department of Fundamental Studies in Education.

DEDICATION

To my Family

ACKNOWLEDGEMENTS

It takes more than these words on paper to express my gratitude toward the many important people who deserve my acknowledgements. I am keenly aware of my indebtedness to all the people and sources of inspiration that helped to make the work successful.

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ABBREVIATIONS AND ACRONYMS

ADEA	Association for the Development of Education in Africa National Agency
ANTIC	Agence Nationale des Technologies de l'Information et de la Communication
AfDB	African Development Bank
A	Agree
APA	American Psychological Association
ASU	Actual system use
BBLMS	Blackboard Learning Management System
BMS	Baptist Missionary Society
CA	Communicative Approach
CAMTEL	Cameroon Telecommunication Information
CAI	Computer-Assisted Instruction
CBA	Competency-Based Approach
CBE	Competency-based education
CBET	Competency-based education and training
CBTA	Competency-Based Teaching Approaches
CEMAC	Central African economic monetary community
CD	Compact Disc
COVID	Coronavirus disease of 2019
CEP	Certificat d'Études Primaires
CBTA	Competency-Based Teaching Approaches
CD-ROM	Compact disc read-only memory
CPC	Cameroon Protestant College
DA	Disagree
DCD	Domain Centered Design
EFA	Education For All
E-learning	Electronic learning

ESSP	Education System Strategy Plan
FS	Free Software
FGD	Focus Group Discussion
GBHS	Government bilingual high school
GESP	Growth and Employment Strategy Paper
GCE	Government Certificate of Education
GII	Global Innovation Index
IICD	International Institute for Communication and development
ICT	Information and Communication Technology
IT	Information Technology
LCD	Learner Centred Design
LTM	Long Term Memory
MCQ	Multiple-choice questions
MINEDUC	Ministère de l'Education
MOOC	Massive Open Online Courses
MPTP	Multimedia Portable for Teachers Pilot
MP3	Musical Play
MTN	Mobile Telephone Network
NA	Native Authority
NCHE	National Commission on Higher Education
NCLB	No Child Left Behind
NEPAD	New Partnership for Africa Development
NICI	National Information and Communication Infrastructure
OBA	Objective-Based Approach
PC	Personal Computer
PDA	Personal Digital Assistants
PTA	Parent-Teacher Association
QDA	Qualitative Data Analysis
ROM	Read-Only Memory

SA	Strongly Agree
SDA	Strongly Disagree
STM	Short-Term Memory
TAM	Technological Acceptance Model
TCO	Total Cost of Ownership
TIMSS	Trend in Mathematics and Science Study
TV	Television
UDHR	Universal Declaration of Human Rights
Un	Uncertain
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNO	United Nations Organization
WWW	World Wide Web
ZPD	Zone of Proximal Development

ABSTRACT

This work is entitled “Pedagogic Integration of ICT in Government Bilingual Secondar Schools to enhance CBA Teaching/Learning Methods in Cameroon.” The ongoing CBA teaching and learning method in Cameroon secondary schools is greatly impacted by the skills learners develop. The CBA which resulted from the objective-based approach (OBA) is fruitfully implemented so as to shift from teacher-centered learning approach to a student-centered. The Cameroon secondary school students have not yet got a full grasp of the ongoing CBA learning approach, making teaching less practical. Pedagogic ICT integration is proposed as a booster to the CBA. The main hypothesis of this study states that there is a relationship between ppedagogic ICT integration in Cameroon Government Secondary schools and the CBA teaching/learning method. Four theories were mobilized for this study: The Behavioural Theory of Learning by Skinner, that of instruction by Bruner, the information-processing theory by Simon, and the social development theory by Vygotsky. The research design of this study was descriptive, exploratory and correlational using mixed methods approach and the sampling technique was purposive sampling. Total population consisted of 1,109 students, 18 resource persons and 8 experts for the focus group discussion who had profound experience in the topic under study. Data was collected using a questionnaire, semi-structured, and focus group discussion through interview guide questions. Quantitative data was analyzed using SPSS v.0.22. For all the hypotheses, alpha was 0.05 and the level of significance was 0.000. The Spearman rank correlation analyses were carried out at four different levels. From the obtained results, all the hypotheses were conformed at a P value of 0.000 showing a correlation among variables. Conclusively, pedagogic ICT integration has a significantly high and positive influence on CBA teaching and learning methods. Based on the results, resilient recommendations were made.

Key words: pedagogic, ICT, integration, CBA, teaching and learning methods

RESUME

Le présent travail est intitulé “Intégration pédagogique des TIC dans les lycées bilingues en vue d’améliorer les méthodes d’enseignement et d’apprentissage de l’APC au Cameroun”. L’APC dans les lycées du Cameroun, est grandement influencé par les compétences que les apprenants développent. Cette approche est mise en œuvre de manière fructueuse afin de passer d'une approche d'apprentissage centrée sur l'enseignant à une approche centrée sur l'élève. Les élèves fréquentant les établissements d'enseignement secondaire au Cameroun n'ont pas encore pleinement compris cette approche, ce qui rend l'enseignement moins pratique. L'intégration pédagogique des TIC est proposée comme un stimulant pour l’APC. L'hypothèse principale de cette étude est qu'il existe une relation entre l'intégration pédagogique des TIC dans les lycées du Cameroun et la méthode d'enseignement/apprentissage de l’APC. Quatre théories et une approche ont été mobilisées pour cette étude: la théorie comportementale de l’apprentissage de Skinner, la théorie de l’instruction de Jerome Bruner, la théorie du traitement de l’information de Simon, la théorie du développement social de Lev Vygotsky et l’approche culturelle. Cette étude est descriptive, exploratoire et relationnelle et a utilisé l’approche mixte ainsi que la technique d’échantillonnage ciblé. La population est composée de 1109 étudiants, 18 personnes ressources et 8 experts pour les groupes de discussion qui ont une expérience approfondie du sujet étudié. Les données ont été collectées à l'aide d'un questionnaire, un guide d’entretien et du focus group discussion. La technique de l’analyse de contenu est utilisée pour les données qualitatives et les données quantitatives sont analysées avec le logiciel SPSS v.0.20. Pour toutes les hypothèses, le niveau de signification est de 0.000 avec 0.05 comme Alpha. Les analyses corrélationnelles de rang de Spearman ont été effectuées à quatre niveaux. D'après les résultats obtenus, toutes les hypothèses ont été confirmées à une valeur P de 0,000, ce qui montre une corrélation entre les variables. Ainsi, l'intégration pédagogique des TIC a une influence positive sur les méthodes d'enseignement et d'apprentissage de l'APC.

Mots Clés : pédagogie, TIC, intégration, APC, méthodes enseignement/apprentissage.

GENERAL INTRODUCTION

1. CONTEXT AND JUSTIFICATION

It is important to remember that Cameroon has a huge demand for education at all levels as a result of the fight to meet national and international standards for education. In Cameroon, education is available from early childhood through secondary school and up to college or higher education. The Republic of Cameroon's 2008-revised constitution, the 1948 Universal Declaration of Human Rights (UDHR), the United Nations charter, and the country's ratification of the United Nations Organization Convention on the Rights of the Child all uphold citizens' rights to an education. 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).

Global educational reform policies call for a change from a school that was primarily focused on contextual information acquisition to a school designed to give students the tools they need to handle a variety of complicated and challenging real-life circumstances. Instead of having schools that are shut off from society, these reform agendas suggest that we should have schools that are firmly established in a society that considers sustainable development, local knowledge, and cultures. Consequently, there is a critical need to transform the instruction provided in secondary general schools in Cameroon from its conventional content-based approach to the adoption of a pedagogical paradigm related to the more useful and practical Competency-Based Teaching Approaches (CBTAs). This paradigm shift is in accordance with the 2009 Growth and Employment Strategy Paper (GESP) and the general purpose of education in Cameroon as stated in section 4 of Law No. 98/004 of April 14, 1998. It establishes standards for education in Cameroon whose orientations are focused on preparing citizens for their intellectual, physical, civic, and moral development and their easy integration into society in the year 2035. Both Kerka (1998) and Moon (2007) claim that CBE, which analyzes each student's progress against a set of competency criteria rather than against the performance of another student, justifies this paradigm shift.

In a similar vein, Erridge & Perry (1994), Harris, R., Guthrie, H., Hobart, B., & Lundberg (1995), and Moon (2007) support this viewpoint when they state that since CBE promotes a link between education and the requirements of the workplace, it is seen to provide individuals with opportunities to gain competencies that are relevant to the workplace. By 2035, the nation's people resources will have the knowledge, skills, and attitudes required to develop a rising Cameroon thanks to education that follows the CBA. As a result, as part of the ongoing worldwide reform, the Cameroonian educational system underwent reform in this regard in the 2012–2013 academic years, adopting the CBA in teaching as the new education policy. Although the Cameroonian education community asserts that the educational system is competency-based, there is no conclusive data from research to show the breadth of this policy's application or the obstacles to a successful implementation. In other words, it is not clear whether secondary school instructors are actually carrying out the educational policy to warrant such hyperbole. Studies conducted elsewhere generally have revealed low levels of implementation and implementation constraints. The constraints are characterized by a severe shortage of highly qualified and experienced teachers capable of guiding students through the new competency-based curriculum and learning styles, as well as the absence of an assessment and examination regime able to reinforce the new approaches and reward students for their ability to demonstrate what they know, understand, and do.

The use of ICTs in the world of today provides a wealth of opportunities. According to the World Bank (2006), ICT has revolutionized how individuals and societies connect, conduct business, and compete on global markets. It has also opened up completely new possibilities in information access and retrieval. Furthermore, education has the potential to reduce the income disparity between wealthy and developing nations, but this potential is only fulfilled if access to education is increased and its quality is raised. Education is essentially the result of the ongoing ICT revolution and the use of the Internet (Tchamabe, 2011). The fact that Cameroon is unable to take advantage of these changes is what is most alarming. Jemez, Kiso, and Ridao-Cano (2007) make it very evident that many young people still lack the fundamental skills

required for employment and daily living in the majority of developing nations, despite the significant progress made in educational attainment.

For the government, school administrators, teachers, and other stakeholders, teaching ICT has been and still is a challenging issue (Decree No: 3475/d/63 of June 17, 2003). The policy to apply ICT in Primary, Secondary, and Tertiary Institutions was adopted in 2003. After seven years, in 2010, ICT instruction began in secondary schools. There were no higher teachers training colleges in the nation at the time that had a department of computer science to prepare teachers of computer science and ICT. It was noted that certain private partners and teachers of other topics were used to teach computer science and ICT. The schools financed the systematic training of teachers of different subjects in ICT and computer science. The program was then implemented in fewer schools. Many instructors are now accessible to teach ICT as a result of the development of the Computer Science department in the majority of Higher Teachers Training institutes nowadays. Despite the fact that both children and parents are increasingly realizing the significance of the topic, this is still insufficient. Teaching and learning material continue to be a big concern due to the constantly growing population of applicants. ICT, which began in 2011 with 281 candidates and appeared in 16 of 17 courses at the Advanced level, was only present in 13 of 20 topics at the GCE Advanced level as of 2016, with 3474 students registered overall (GCE Advanced Level Examination by Subjects statistics booklet, 2011 & 2016).

Additionally, the majority of Cameroon's teacher training institutions lack or have limited access to learning resources for their student teachers, making the teaching and learning environments there undesirable. As a result, they are unable to fully acquire the initial professional competencies required for teaching and learning in subsequent years. Prospective teachers who struggle academically find teaching to be a very frustrating occupation and are unable to handle its great expectations, especially if they are assigned to challenging areas or education priority zones after graduation. In Cameroon, there has recently been interest in researching cutting-edge methods to improve access and learning possibilities for instructors and students. Furthermore, the World Bank (2006) notes that young people's readiness for the workforce and adult life

is still quite low, despite significant improvements in basic schooling in developing nations. In the same vein, WBI (2007, p. 125) notes that "many developing nations still experience challenges related to issues including growing educational coverage in a sustainable manner, access and result inequities, educational quality and relevance, and rigid governance structures and management practices".

The government of Cameroon created an Education System Strategy Plan (ESSP) in 2006 to support comprehensive and sequential improvements in the education sector in order to address some of its issues (Cameroon/World bank Report, 2012). In several of the Millennium Development Goals, Cameroon's Education Sector Strategic Plan (2006) highlights essential outcomes for the education sector. The following are the primary goals of the education secto r strategic plan:

- enhancing pedagogical resources in the classroom, decreasing pupil-teacher ratios, eliminating grade repetition, and bettering educational management and administration
- Implementing changes in secondary, technical, and higher education;
- Increasing access to preschool;
- Controlling access to postsecondary education in accordance with the demands of the labor market (Cameroon/World bank Report, 2012)

The government of Cameroon has also highlighted the importance of ICT skills for its future workforce. The establishment of pedagogy and computer science departments inside the ministries of basic education, secondary education, and higher education is a blatant indication of the governmental will to use ICTs to revolutionize the educational system in Cameroon. Skill development is becoming more important with the professional approach to teaching and learning with technology. This has impacted the curricula offered at the preschool, elementary, secondary, and tertiary levels. For instance, since 2007, ICT has been included as a discipline in the curriculum, and the Higher Teacher Training College Yaoundé has established a department for ICT. As a result, it is expected of instructors at all levels to possess a certain level of ICT proficiency.

Furthermore, the current law on education in Cameroon (Law Number 98/004 of April 14, 1998) aims to professionalize the country's educational system and advance the teaching of ICTs in classrooms. The Strategic Sector Plan document for education, created by the Ministry of National Education (MINEDUC) at the request of the World Bank, complements April 14, 1998, Law on education in Cameroon (Fonkeng, 2007). This proposal calls for government involvement to boost resources, optimize their usage through sensible allocation, and effectively control public spending. Tambo (2000, p. 69) further notes that "one of the key policy concerns for professionalizing the educational system in Cameroon is the promotion of scientific and technological advancement". According to the National ICT policy and strategy document created by the National Agency for Information and Communication Technology (ANTIC) in 2007, ICT skills are 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 (Nkwenti, 2007).

Various theories have shaped the development of ICT in Cameroon educational system. They use a diverse set of learning theories and ICT. Behavioural Theory of Learning by Skinner (1904-1990), the theory of instruction by Jerome Bruner (1950), the information-processing theory by Simon (1978), the social development theory by Lev Vygotsky (1978), and the cultural approach. These theories are all used in this study. Notwithstanding, we have deemed it necessary to discuss these theorists that encourage students to take responsibility for the learning process. The use of multi-media technologies (those that combine text, graphics, video, animation, and audio) in teaching and learning, according to Silva (2015), guarantees a very productive, interesting, motivating, interactive, and quality delivery of classroom instruction while meeting the needs of diverse learners (Zhou & Brown, 2015).

Harvard professor B.F. Skinner (1904-1990) thought that the environment's power might be used for good or evil (Zhou & Brown, 2015; Passer and Smith, 2001). According to Leeder (2022), Skinner was the psychologist who had the most impact on the behaviorist movement of the 20th century. In the years between 1953 and 1956,

Skinner helped develop a teaching technology known as the “teaching machine,” a gadget that used his step-by-step education methods. The development of the Transmission model and domain-centered design in instruction has been influenced by behaviorism as a theory of learning. The instructional theory developed by Jerome Bruner is used with ICTs.

In order to stress the idea of discovery learning, Bruner (1956), cited in Santrock (2004, p. 397), "encouraged teachers to provide students more chances to learn on their own". The information processing theory is yet another key hypothesis in this investigation. Memory and thought processes on the cognitive level are at the heart of this strategy. According to Santrock (2004), it is an effort to provide an explanation for how the human mind functions. Jerome Bruner's theory of learning and the Information-Processing theory, like Jean Piaget’s, had an impact on the creation of the Learner-Centered Design approach to instruction.

2. PROBLEM

Pedagogic ICTs in today's digitalised world has come to improve secondary education, which is fundamental in the creation of effective human capital in any country. In Cameroon, we observed a fast change in the role of teachers given the changing nature of her educational system and the entire society as a whole. The coming of COVID-19 and the technological society, thus explained the fast change witnessed by the Cameroon educational system. The ongoing CBA teaching and learning method secondary schools is greatly impacted by the skills learners develop. The CBA which resulted from the objective-based approach (OBA) is fruitfully implemented so as to shift from teacher-centered learning approach to a student-centered. The Cameroon secondary school students have not yet got a full grasp of the ongoing CBA learning approach, making teaching less practical. Pedagogic ICT integration is therefore proposed as a booster to the CBA. Teaching and learning with and through ICTs trigger constructivist innovation in the classroom, which contributes to the realisation of meaningful authentic, active-reflective and problem-based learning. This is a challenging method to both students and teachers. They both have to learn how to use ICTs efficiently and effectively. To this, they have to seek solutions to real world

problems, which, based on an ICT framework, are used to engage their curiosity, initiate learning thus leading to critical and analytical thinking. Even though the entire educational team is faced with some challenges integrating ICT, they are expected to adapt to them.

The present study is peculiar in that pedagogic ICT and CBA integration in educational system are faced with similar challenges that challenged proper implementation in Cameroon Secondary Schools. The difficulties faced by teachers in teaching with ICTs and learners' misuse of these technological tools for leisure and immoral activities rather than realising meaningful authentic, active-reflective and problem-based leaning is postulated by the constructivists.

3. LITERATURE REVIEW

The integration of ICT into any educational system is a topical issue in this 21st century. A lot of research has been carried out on ICTs in education. In industrialised countries, ICTs were introduced around the 1980's yet their use for education purposes is still not obvious to teachers thus making it the subject of several studies. Proper use of ICTs by students has been a call for concern to many researchers as well. This review of related literature opens up with a deeper conceptualization of the main concepts presented alongside related literature, drawing links between pedagogic ICT integration and CBA teaching and learning methods. It basically presents cases of best practices of how pedagogic ICT integration is embedded into secondary schools in Cameroon.

3.1. Brief History of Cameroon and Evolution of Education

According to Neba (1999), the Republic of Cameroon is located at latitudes 2º and 13 º North of the Equator and longitudes 8 º and 16 º East of the Greenwich Meridian. It is found in Central Africa with Yaoundé as the headquarters, even though some sources place Cameroon in West Africa. The country is bounded by Nigeria in the West, Gabon, Equatorial Guinea, and Congo in the south, in the North by the Lake Chad basin, and Chad and the Central African Republic in the East. Due to its demographic and cultural characteristics, and geographic diversity (particularly pedology, climatology, and biodiversity), the country is known as a microcosm of

Africa. Owing to its long political domination and history, Cameroon is a bilingual country with French and English as its official languages.

According to Cia (2010) demographic statistics, Cameroon has a total population of about 19,294,149 inhabitants with a growth rate of 2.19%, an economic growth rate of 2.8%, and a human development index of 0.46. According to World Ethnology, the number of individual languages listed for Cameroon is 286. Archaeological findings show that humankind has existed in Cameroon for at least fifty thousand years, with very important and strong kingdoms. One of the most prominent was the Sao which was found around the Lake Chad area in about 5th Century AD (Fanso, 1989). From the 15th to the 19th century, the Cameroon population witnessed several waves of North-South and center-south, east, west, and south migration, and today, the country has about 250 ethnic groupings. This migration was mostly due to political domination, slave raids, dynasty quarrels, and economic purposes.

By the early 1800s, conquest, Islam, and commerce forced people in different regions of Cameroon to move. Islamic flag-bearers of Uthman Dan Fudio like Modibo Adama forcefully spread Islam in North Cameroon and so many people decided to flee to the south and center (Ngoh, 1987). While Islam was in the northern part, Christianity was in the south entering through the coastal regions spreading the gospel and education. In 1845, British Baptist missionaries led by Alfred Saker started establishing schools in the coastal regions and inwards towards the hinterlands. This marked the coming of Islam, Christianity, and formal western education to Cameroon. Consequently today, the country is made up of Muslim north and a Christian south, with an intermixture of the two, with others and traditional beliefs.

According to Fanso (1989), Cameroon has undergone several political transformations in its name and organizational structures resulting from the long European imperialist rule. In 1472 Portuguese explorer Fernand Po came as the first European explorer to the coast of Cameroon. Hanno – Carthaginians, however, reached Cameroon 2000 years before him and named Mount Cameroon chariots of the Gods as he saw it from afar spitting fire. At the Wouri River in Douala, Fernand do Po found

many shrimps and named it Rio dos Cameroes- Meaning a River of prawns. This marked the evolution of the name Cameroon today.

During the Scramble for Africa from the 1880s, Germany annexed Cameroon and Cameroon remained its colony from that time until the end of the First World War in Cameroon in 1916, and it changed Cameroes to Kamerun. Britain and France seized Kamerun from Germany after the end of World War I and partitioned it among themselves to compensate for the losses incurred during the war. Cameroon was now in two entities, recognized by the League of Nations in 1922 as mandated territories. French Cameroon was therefore administered as part of French Equatorial Africa while British Cameroon was administered as an integral part of Nigeria. After the Second World War in 1945, the two Cameroons were assigned again to Britain and France as Trusteeship territories under the supervision of the United Nations Organization.

In 1960, French Cameroon gained its independence as La Republique du Cameroun (The Republic of Cameroon). In the course of deciding their fate through a UN-supervised plebiscite in 1961, British Southern Cameroon opted to reunify with French Cameroun. Britain Northern Cameroon joined with Nigeria. The country was then known as the Federal Republic of Cameroon consisting of East (former French Cameroun) and West Cameroon (former British Southern Cameroon). By 1972, the two Cameroons massively voted for a unitary state in a referendum and its name changed again to the United Republic of Cameroon in 1985, it became known as the Republic of Cameroon, with the intention to wipe out the "Unitary notion," which reminded Cameroonians of their joined but divided entities.

To sum up, Cameroon has four important historical dates and changes of name from the 1880s. These are: 1884; annexation by the Germans; 1916; end of World War I and the partition of Cameroon between France and Britain; 1960-61; independence and reunification, and in 1972; the referendum for a one and indivisible Cameroon.

3.2. Primary and Secondary school

There was no form of higher education in Cameroon before independence in 1960. Pre-colonial education was informal, consisting of parents passing on

information, teachings, and way of life to children or the next generation. European missionaries used education to preach and spread the gospel. Formal education came to Cameroon in 1884 through European exploration and exploitation. Missionaries therefore introduced formal education in Cameroon in 1844, with the first primary school opened in Bimbia (Tchombe, 2001). Attendance in these schools was, however, voluntary. British missionaries translated the bible into the native language after learning it. Before the German annexation of Cameroon in 1884, there were 15 mission primary schools in Cameroon with about 368 pupils sponsored by the London Baptist Missionary Society. Teaching at this time was totally teacher-led with fingers and counting sticks used in calculations.

After annexation, schools were opened in Douala, Garoua, Limbe, and Victoria between 1987-1910, with a curriculum to teach the *Three Rs* (Reading, Writing, and Arithmetic) and religion and the German language. The Germans did not expand education and it was in the hands of Merchants (Tchombe, 2001). Cameroonians were given the opportunity to further education in Germany in order to effectively enforce the German colonial policy. Elementary education was made obligatory and the German administration gave subvention to mission schools. Before the Germans were ousted from Cameroon in 1916 after the end of the First World War in Cameroon, a total number of 531 primary schools were found in the country with an enrolment of 341117 pupils. The few middle schools that existed could be attributed to the status of secondary education (Tchombe, 2001).

During the rule of the French beginning from 1914 to 1960, education was still largely under the missionaries and French was strictly the only medium of communication and instruction in schools. The curriculums, however, changed to prepare children for secondary education by teaching children Cameroon-based issues and metropolitan issues. The educational cycle and entry age evolved to six years in primary school and by 1945, education was classed into levels and certificates awarded (Tchombe, 2001). A ministry of education was set up in 1952 to improve and encourage girl child education, especially in the North part of Cameroon where the rate of literacy was and it is still largely low. Secondary schools also existed and end-of-course

examinations like Baccalaureate taken by students were assessed in France using the French evaluation standards.

In British southern Cameroon, education was centrally controlled and dominated by the Indirect Rule policy. The Native Authorities and the British administration cooperated to provide education in Cameroon with an education cycle nine years before 1932 (Tchombe, 2001). The Vernacular was prohibited only in government schools because children came from different linguistic backgrounds. Education was free at the pre-elementary school level. Primary schools prepared children for the Standard Six Certificate marking the end of primary school (Tchombe, 2001).

Enrolment and the number of institutions in French Cameroon were far more than in British Cameroon. At independence, French Cameroon had 977 primary schools and 20 secondary schools while British Cameroon had only 499 primary schools and 6 secondary schools. For enrolment, French Cameroon had 515635 pupils and 4742 students, while British Cameroon had 86257 pupils and 903 students only (Tchombe, 2001).

3.3. Cameroon education during Post Independent Period to Present day

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 (Ngoh, 2006; Fonkeng, 2007). 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, notably, the Federal period between1961 and 1972, the Unitary period between 1972 and 1982, and the Republic from 1982 to now. The period 1961 to 1982 was under Ahmadou Ahidjo as President of Cameroon (Ngoh, 2006). President Paul Biya took over from President Ahidjo in 1982 (Ngoh, 2006).

The major curriculum policies during the Federal period included the policy of Harmonisation, Ruralisation and Bilingualism. Cameroon/World bank Report (2012) 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 manpower 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 worth noting that dramatic changes that come as a result of ICTs pose a great challenge to so many teachers as well as student teachers and consequently to all the stakeholders. 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 harbour 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 of accessibility, ownership, and use of these technologies by students in and out of school. 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, have 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 Facebook, 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 them 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.

4. STATEMENT OF THE RESEARCH PROBLEM

Secondary education, which is essential to the development of productive human capital in every nation, has improved because of the integration of ICTs into the classroom. The CBA approach to teaching and learning in Cameroon schools is greatly impacted by this integration given that CBA just like ICT is aimed at encouraging learners. Therefore, this CBA is the result of the Objective-Based Approach, whose objective requires educators and institutions to reflect carefully on their goals and to take the first step toward a methodological approach to course design and course monitoring. ICTs in education did not align with the aforementioned objective of the Objective-Based Approach teaching technique. ICT in education, on the other hand, aims to move away from a teacher-centered learning approach and toward a student-centered one, much as the advanced technique of teaching and learning CBA. Notably, the Objective-Based Approach, which was eventually replaced by the CBA after six years, was implemented into the Cameroonian educational system in February 2001, five years after the OBA.

The integration of ICTs in teaching has come to improve secondary education, which is fundamental to the creation of effective human capital in any country. This integration is of great influence on the CBA method of teaching and learning in Cameroon schools. This CBA evolved from the Objective-Based Approach whose goal forces teachers and institutions to think deeply about what they are trying to achieve and makes them take the first step towards a systematic approach to course design and course monitoring. The said goal for the Objective-Based Approach teaching method did not tie with ICTs in education. On the contrary, ICT in education just like the

advanced method of teaching and learning CBA, aimed at shifting from teacher-centred learning approach to student-centred. It is worth noting that ICT was introduced into Cameroon educational system in February 2001; five years after the OBA which after six years gradually advanced to CBA. ICT is out to reflect and respond to present and future needs of people functioning in an intensely changing and challenging intellectual environment as is the case in Cameroon. According to Mbangwana (2008), the right use of these technologies results in a significant educational improvement. ICTs, to him, serve as a vehicle and a platform for ICT aims to reflect and address the current and future demands of people navigating a mentally demanding and rapidly changing environment, like that of Cameroon. Mbangwana asserts that effective application of these technologies leads to a notable improvement in schooling. According to him, when used properly, ICTs are a means and a platform for significant educational change aimed at a transition from didactic "instructionism" to constructivism. Therefore, its integration is a current concern in education. Meaningful educational reform is geared towards a shift from didactic "instructionism" to constructivism when appropriately used. Its integration is therefore a topical issue in education.

However, given the challenges teachers experience when using ICTs to educate and when trying to help students develop the skills and aptitudes required by the CBA, integrating ICT into secondary schools in Cameroon is tough. Another issue is the misuse of these technology instruments for leisure activities rather than the constructivists' hypothesized meaningful authentic, active-reflective, and problem-based learning. Because there is still more to be done to ensure adequate integration, ICT pedagogic integration is still a work in progress in Cameroon secondary schools. It has had some indirect consequences on the CBA, which, like ICT use in education, lends itself to more student-centered learning environments and frequently leads to certain tensions for some instructors and students. Thus, the current state of secondary education in Cameroon necessitates a thorough inquiry and complex analysis, as revealed by the research question.

Research Questions

To effectively carry out this study, the following research questions were formulated to enhance data collection and formulation of hypotheses.

General Research Question

How does the pedagogic ICT integration in Cameroon Government Secondary schools influence the CBA teaching and learning method?

Specific Research Question

1. How does the use of ICT tools in Cameroon government secondary schools facilitate CBA teaching and learning process?
2. How do ICT infrastructures promote the CBA teaching-learning method in Cameroon government secondary schools?
3. How does E-learning in Cameroon government schools foster CBA teaching-learning method?
4. How does Computer-based direct instruction in Cameroon government schools enhance CBA teaching-learning method?

Hypothesis of the Study

General Hypothesis

This work is built on the hypothetical premise that Pedagogic ICT integration in Cameroon Government Secondary schools has an influence on the CBA teaching and learning method.

Specific Research Hypothesis

Ha_1: The use of ICT tools in Cameroon government secondary schools facilitates CBA teaching and learning process

Ha_2: ICT infrastructures promote the CBA teaching-learning method in Cameroon government secondary schools

Ha_3: E-learning in Cameroon government schools fosters CBA teaching-learning method

Ha_4: Computer-based direct instruction in Cameroon government schools enhances CBA teaching-learning method

5. THEORETICAL FRAMEWORK

A theoretical review forms the framework for this study. Skinner helped develop a teaching technology known as the "teaching machine", a gadget that used his step-by-step education methods. The development of the Transmission model and domain-centered design in instruction has been influenced by behaviorism as a theory of learning. The behaviorists, cognitivists, and constructivist teachers provide students more chances to learn on their own. ICT, however, assists students in producing their own knowledge. The development of the cultural approach to instruction has been impacted by Lev Vygotsky's theories of learning, which is noteworthy. Socio-constructivists and sociocultural theories are developed in this work and the cultural approach.

5.1. Behavioural Theory of Learning by B.F Skinner (1904-1990)

Skinner (1904-1990), a Harvard professor, reportedly thought that "the power of the environment may be used for good or evil" (Leeder, 2022, p. 22). According to Fauzi, Nawangsari, & Rosyada (2022; Diessner (2008), Skinner was a psychologist who had the most impact on the behaviorist movement of the 20th century. According to behaviorists, learning is a change in observable behavior brought on by environmental external stimuli. They argue that rather than what is happening in the learner's thinking, what determines if he has learned something is the learner's visible conduct. However, Skinner's theory served as the foundation for several applications to human behavior in addition to successfully combining a wide range of ideas. He utilizes the term *operant conditioning* to define a style of learning in which the learner's emitted (operant) behavior is changed rather than their solicited conduct. An operant is a specific reaction or behavior that an organism produces (operates) on its environment in order to achieve or avoid a specific result. Operant conditioning is predicated on the idea that many of an animal or human's voluntary actions are increased when they are rewarded (followed by a desired consequence) and decreased when they are penalized or ignored.

5.2. Transmission Model/Domain Centred Design to Instruction

According to the transmission model, "knowledge can be transferred from a teacher's mind to a student's mind and is something that an individual owns that is

independent of any social setting" (Gifford and Enyedy, 1999, p. 189). In the same vein, Schlinger (2021), Brown (2002, p. 53) note that "behaviorists see knowledge as a type of substance" and that this viewpoint results in teaching that promotes the best possible pouring of knowledge into a student's brain from a storage device. For his part, Bottino (2004) asserts that behaviorism had an influence on the early uses of computers in education.

According to behaviorists, learning is the induction of a necessary behavior. The goal of this type of pedagogy was to improve the effectiveness of knowledge transfer. This theoretical presumption is naturally extended by the conventional classroom, with its lock-step lectures and texts that present the learner with facts, theories, and explanations (Leeder, 2022). Brown (2002, 53) emphasized that "the cornerstone of behaviorists' conception of teaching and learning is Cartesian". The more abstract the knowledge is, the better, according to Descartes's philosophy of *I think, therefore I am*, which was prevalent around three hundred years ago, the author continues. Thus, when the material being taught to the student grows more abstract, the teacher may boast of being competent or bright.

CAI is the best example of instructional technology created from this approach, according to Gifford and Enyedy (1999). They clarified that CAI primarily tries to increase the effectiveness of information transfer by organizing the content order and elaborating on its presentation. For instance, "near-to-too-far, known-to-unknown, and simple to complex" (1999, p. 189). Drill and practice programs and tutorial systems are a couple of examples of CAI. Programs that involve drills and practice assist students in acquiring particular skills and capabilities. They merely provide very basic content training. These programs are used for individual training or remedial work during *ad hoc* hours or at home, not during regular class hours.

It is important to keep in mind that these programs have changed throughout time. In contrast to drill and practice systems, tutorial systems involve content training on a specific topic. Important considerations in its design include aspects that encourage memorization, explain objectives, outline requirements, and elicit and evaluate performance (Diller, 2021; Bottino, 2004). The concepts or laws discussed in the

instructional sequences must be used in order to answer the presented questions. Feedback frequently serves as a diagnostic tool by highlighting processing flaws and triggering corrections or rewriting of the instruction. Their usage in classroom instruction is restricted since they are frequently viewed more as teachers' replacements than as aids to their work. It is seen that some distance learning courses on the web, which are more popular, are based on this kind of approach to using computers in education (Diller, 2021). Drill and practice and tutorial programs both have very few educational benefits. Their usefulness has been highlighted in some situations, such as corrective exercises or the development of particular abilities during initial training.

This kind of approach to training is known as Domain Centered Design (DCD) or Teacher Centered Design, according to Gifford and Enyedy (1999). The teacher, whether a real person or a computer substitute, is typically thought to be the only one who has the disciplinary information that needs to be passed on to the students. In line with this perspective, the majority of classroom activities center on the teacher or computer as the information supplier and assessor. The teacher occupies the majority of the class time in a domain-centered classroom, giving students little opportunity to initiate and finish a two-way educational exchange. Each step of the teaching and learning process can be enhanced by technology, for example, by using multimedia presentation tools to enhance teacher lectures. Worthy of note is the fact that this does not alter the basic nature of this teaching and learning approach.

Despite having some advantages, the transmission model of education and domain-centered design has continually come under fire for encouraging memory and imitation while preventing real conversation and interaction. It makes the assumption that learning is essentially an individual activity while ignoring the social context of learning. As a result, very small learning benefits have been produced by the DCD approach to instructional technology (Gifford and Enyedy, 1999).

5.3. Theory of Instruction by Jerome Bruner (1956)

Crook (2001, p. 20) asserts that “cognitive psychology emerged as the second theoretical influence on contemporary theories of learning, following behaviorism”. The cognitive theory of teaching developed by Jerome Bruner is used to explain how

ICTs work. In order to stress the idea of discovery learning, Bruner (1956), cited in Santrock (2004), encouraged teachers to provide students more chances to learn on their own. Being learner-centered, e-learning supports this concept of discovery learning. According to Bruner, exploration learning enables students to exercise independent thought and learn how information is created. It also satisfies their inquisitive nature. By giving students engaging activities that spark their innate curiosity, e-learning supports discovery learning.

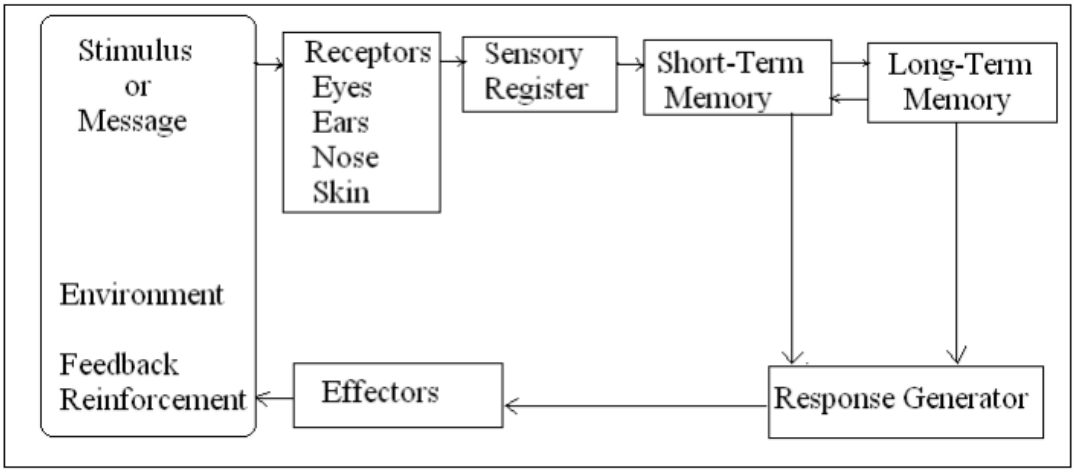
According to Santrock (2004), discovery learning is compatible with Piaget's theories. Piaget reportedly remarked that every time you teach a youngster something, you prevent them from learning. However, few children actually gain from working entirely independently. According to Mosston and Ashworth (1990), the guided discovery teaching method suggests a constant and mutually beneficial contact between the teacher and the student. E-learning can also support guided discovery learning, which encourages students to build their understanding with the help of teacher-led questions and instructions. Additionally, students can use e-learning to access peers and mentors in other locations.

5.4. Information – Processing Theory (Simon, 1978).

The information-processing theory by Simon (1978) is the third theory, which deals with cognitive theory that is suitable or relevant to ICTs and CBA in particular and which has become, for many cognitive psychologists, a well-liked method for the study of learning. Santrock emphasizes that information processing is concerned with how people interpret their experiences and the various environmental sources of information (2004). Guida, Moretto, Caniato & Ronchi (2022), Santrock (2004), and others assert that it is an attempt to describe how the human mind functions. In actuality, the human brain and the computer are contrasted. Cognitive processes are compared to the software of the computer and the physical brain to its hardware. Although brains and cognitive processes cannot be perfectly compared to computers and software, the parallel has helped us to think of a child's mind as an active information-processing machine.

Additionally, Guida et al., (2022) assert that this strategy's core components are the cognitive functions of memory and thought. According to cognitive psychologists, learning is a process that occurs inside and involves the use of memory, motivation, thought, and metacognition. According to their argument, the quantity of learning that occurs depends on the learner's processing power, the amount of effort put forth during learning, the depth of processing, and the learner's knowledge structure. The ability to remember information over time through the processes of encoding, storing, and retrieval is known as memory. On the other hand, thinking is simply the process of processing information. Processing includes tasks including observing, planning, organizing, synthesizing, rehearsing, storing, and retrieving information. Noe (2002, p. 117) emphasizes that "information-processing theories place a greater emphasis on internal processes that take place when training content is learned and remembered than other learning theories". An illustration of an information-processing model is found below.

Figure 1: Model of human information- processing model



Source: (Adapted from Noe, 2002, p. 117)

According to information-processing theories, the learner's brain goes through many changes after taking in information or a message. As seen in the diagram above, information processing starts when receptors pick up a message or stimulus from the environment (which could be sound, smell, touch, or pictures) (ears, nose, skin, eyes). The sensory register or memory then records the message. Information is stored in the sensory memory for one to two seconds. What enters depends on a person's ability to

pay attention, perceive, and recognize certain things. The time has come for schools to include a larger variety of mental processes and activities in the learning process, according to Semenov (2005). In contrast to the conventional classroom, where the spoken and written word predominated, he contends that the modern classroom should promote multimodal improved learning.

5.5. The social development theory by Lev Vygotsky (1978)

Crook (2001) argues that during the 1970s, behaviourism and cognitive psychology, defined the fourth 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, p. 21) states that "constructivism, most especially socio-constructivism, confronted behaviourism and cognitivism which makes it more appealing". Diessner (2008) points out that Lev Vygotsky is generally considered the greatest Russian developmental Psychologist. In the same light, Santrock (2004, p. 51) asserts that, like Piaget, Vygotsky (1896–1934) "believed that children actively construct their knowledge". What this means in practice is that, teachers actively assist children who are engaged in learning tasks. 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 to move through the ZPD. The zone of proximal development is the difference between what a child understands on their own and what he/she can potentially understand through interaction with others or learning support. Computer-assisted learning or ICTs for example is used to provide scaffolding, both from the use of the technology itself and the social interaction stimulated by computers. In the same light, Taber (2020) 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, learns 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" (Taber, 2020).

Santrock (2004) 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 acquire personal meaning. They believe that there is more to learning than just a change in behavior postulated by the behaviorists.

According to Teixeira (2022, p. 9), 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 this establishes 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 a 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. According to Seymour (1980), constructionist learning theory is based on the following principles:

- Constructionist learning involves students drawing their own conclusions through creative experimentation and the making of social objects.
- The constructionist teacher takes on a mediator role rather than adopting an instructional role.

- Teaching students are replaced by assisting them to understand and help one another to understand their problems.
- The teacher's role is not to be a lecturer but a facilitator who coaches students to attain their own goals.

Constructionist learning theory advocates student-centred, discovery learning where students use information they already know to acquire more knowledge. He also argues that students learn through participation in project-based learning where they make connections between different ideas and areas of knowledge facilitated by the teacher through coaching rather than using lectures or step-by-step guidance. In the context of this study the use of ICT by the teachers should help students to construct the knowledge and reflect the information on their academic performance in different subjects. The teacher should know and use the learning potential of students to build up his/ her teaching. The theory also holds that learning can happen most effectively when people are active in making tangible objects in the real world. In this sense, the constructionist learning theory is connected with experiential learning. In this study the teachers are supposed to use the relevant teaching and learning resources like ICT resources to achieve academic performance of the students.

Seymour (1980) emphasised the way in which knowledge is structured using computers and how the students' own perception of their prior experiences leads to the knowledge structure. In the context of this study, the theory clarifies the duty of teachers on checking on the prior knowledge of their students and attitudes they held towards ICT which may influence their performance. Furthermore, it helps investigate the integration of ICT in pedagogy in secondary schools CBA teaching and learning in Cameroon and how teachers and students are making use of them in teaching and learning process. The constructionist theory also focuses on the view of learning as a reconstruction rather than as a transmission of knowledge, hence students should have the experience of manipulative materials because learning is most effective when part of an activity the learner experiences is constructing a meaningful product. In this study, teachers use ICT as teaching aids to access students' ability and understanding which can be reflected on their performance.

Constructionist Theory offers various benefits in integrating ICTs in pedagogy. First, constructionist learning theory is based on the principle that students build knowledge based upon prior knowledge and there is no knowledge independent of the apprehender, only the knowledge that they create for themselves based on the information that they obtain from the world around them. In this research, this strength helps teachers check students' skills on ICT before they teach them in the classroom. It can also contribute to check teachers and students' attitudes towards ICT.

6. METHODOLOGY

Any research work is a scientific process aiming at producing an objective knowledge of reality, which requires the development of a rather rigorous methodological approach. Thus, the central concern of any scientific process is the construction of knowledge in relation to the observations resulting from the theory or the field. Moreover, the construction of knowledge follows a logical and scientific itinerary and is always a goal of any researcher. The latter, starting from an idea, theory, observation, or interrogation, will follow a research design to reach its final result (production of knowledge). This methodological approach is often a function of the question that the researcher asks himself and of the objective that he/she has set during the elaboration of the problematic research question.

The methodological choice is conditioned by the research question and the theoretical anchoring. Moreover, the scientific process of research remains a long process of back and forth and adjustment between the researcher's desire to study a particular or singular phenomenon, seeking the originality of a subject, and the reality of the field and the access and quality of the data collected. Thus, the feasibility of the research project only comes into being after immersion in the field, the choice of the number of cases to be studied, and the questions likely to be of interest in relation to the literature and practice. This methodology concerns in particular the steps which are taken to obtain the main materials of the study, which is the data, as well as the procedures for processing them. It focuses on the description of the methods and instruments used to collect the information in the study. It handles the research design, the area of study, the population, the sample and sampling technique, instruments used

to collect data, validation of instruments, administration of instruments, techniques of data analysis, variables, and operationalization of variables.

In this correlational study, we chose to use a mixed method approach, which is a procedure for collecting, analysing, and integrating both quantitative and qualitative data at some stage of the research process within a single study (Hirose & Creswell, 2022). The rationale for mixing both types of data was that neither quantitative nor qualitative methods were sufficient by themselves to capture the details of situations. Basically, this study took a sequential explanatory approach, which was characterized by the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. The priority was typically given to quantitative data, and the two methods were integrated during the interpretation phase of the study. The interviews were analyzed to explain the findings from the quantitative analysis and to provide detailed descriptions to compensate for the limits of the survey.

Integrating both quantitative and qualitative analyses also help to build well-validated and substantiated findings. The Spearman rank correlation and the multiple regressions were used to analyze quantitative data while the qualitative data was analyzed through an interpretative-qualitative approach, deemed appropriate in enhancing part of the conduct of the study and in analyzing the meaning made by the participants about the phenomenon of CBA teaching and learning methods. The researcher makes meaning from the participants' views. As regards the qualitative aspect of this research, the researcher as in other forms of qualitative research was the primary instrument of data collection and analysis. According to Creswell (2022), it is an inductive investigative strategy and the end product is richly descriptive, where the researcher:

- is focused on understanding how participants make sense of a phenomenon or situation; in our case, CBA teaching and learning methods,
- is the instrument, of which the construction of meaning is mediated,
- the strategy is inductive, and
- the outcome is descriptive.

6.1. Quantitative and Qualitative Study

The question of method is often an unavoidable outcome for researchers when it comes to having the results of their investigations accepted. They have two choices: the qualitative method or the quantitative method. Insofar as each social phenomenon can be analyzed according to the qualitative or quantitative method of analysis, it is useful to know what is the scope, on the cognitive level, of these two methods.

This study involves 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 research triangulation of method. Åkerblad, Seppänen-Järvelä & Haapakoski (2021) assert that triangulation is the idea of looking at something from multiple points of view. On his part, Dawadi, Shrestha & Giri (2021) define triangulation as the term for the use of multiple methods, data collection strategies, and or data sources. Creswell (2021) 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, p. 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 approaches in a particular study under investigation. According to him, the presentation or use of only qualitative or quantitative approaches often presents only a myopic view of things".

Kimmons (2022) confirms that relying exclusively on a quantitative or any single form of research restricts researchers' understanding of the problem. Onwuegbuzie & Johnson (2021) postulate that the two approaches are 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 offer 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, reduces adversarial relationships among researchers, and promotes collaboration. Mixed methods encourage the use of multiple worldviews. 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, Harrison, Reilly & Creswell (2020) support that the idea of looking at something from different angles or viewpoints improves accuracy. Qualitative and quantitative representations are complementary (Stern et al., 2020).

On the one hand, qualitative research is viewed as a research study that explores the quality of relationships, activities, situations, or materials. According to Onwuegbuzie & Johnson (2021), 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 analysis. Amin (2005, p. 43) states that the 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 a theory or pattern) or participatory perspective (collaborative)".

This approach has the capacity to provide a complete picture of the integration of ICT into CBA teaching and learning methods in secondary schools 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 the construction of quantitative knowledge not available initially. It supports the findings of quantitative research.

On the other hand, quantitative research is defined as a research approach that investigates how well, how much, to what extent, or how accurately different learning, attitudes, or ideas are being developed. Amin (2005, p. 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". Dawadi, Shrestha

& Giri (2021) 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 indicate that more of the variable is present than do lower scores. Kimmons (2022) postulates that *quantitative researchers emphasize precisely measuring variables and testing hypotheses that are linked to general causal explanations*. The 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 integration of ICT influences the CBA teaching and learning methods in Cameroon. That is, the extent to which the integration of ICT influences practicing teachers' communication skills; technical skills; interpersonal skills; teachers' attitudes towards ICT; support received by ICT teachers; values and principles suitable for learning.

The use of a survey research design necessitates the study of a representative sample, which allows the researcher to make inferences or generalizations about the population under study. The use of a survey permits the collection of quantitative data. Flick (2018), points out clearly that quantitative data is one of the most powerful research methodologies researchers use. According to them, it is the best way to establish a cause-and-effect relationship between variables.

The distinction between Quantitative and Qualitative Research

Distinction according to the nature of the data

It is traditional in research to make a distinction between the qualitative and the quantitative, as Grawitz (2000) points out. However, according to Thietart (2014), this distinction is both equivocal and ambiguous. The distinction is equivocal because it is based on a multiplicity of criteria and is ambiguous insofar as none of these criteria allows an absolute distinction between the qualitative and quantitative approaches. In an attempt to highlight this distinction, we will focus on criteria such as the nature of

the data, the orientation of the research, the objective or subjective nature of the results obtained, and the flexibility of the research.

According to Pras, Roux, Desmet, Dussaix & Lilien, (2009), qualitative data corresponds to variables measured on nominal and ordinal (non-metric) scales, while quantitative data are collected with interval (or weak cardinal) and proportion scales.Yin's (2003) contribution is based on the idea that numerical data provide evidence of a quantitative nature while non-numerical data provide evidence of a qualitative nature. However, the nature of the data does not dictate a qualitative or quantitative research approach, hence the need to evaluate other criteria.

Distinction according to the orientation of the research

In the area of research in the social sciences in general and in the educational sciences in particular, there are two main orientations: the construction or the testing of a theoretical object. If the researcher is oriented toward verification, he or she has a clear and established idea of what he or she is looking for. On the other hand, if he or she is moving towards an exploratory approach, characteristic of theoretical construction, the researcher is largely unaware of the content of what he or she will uncover.

It is common to link exploration to a qualitative approach and verification to a quantitative approach or even to oppose the inductive approach of qualitative research and the hypothetical-deductive approach of quantitative research Brabet, (1988). Thus, Silverman (2006) distinguishes two schools in the social sciences, one oriented towards the quantitative testing of hypotheses and the other towards the qualitative generalization of hypotheses. To this end, two schools are distinguished:

- The first is oriented on the quantitative testing of hypotheses and uses the hypothetico-deductive approach. This school aims at the verification of a theory which calls for questioning: how can a theory be confirmed or invalidated?
- The second school is oriented towards the qualitative generation of hypotheses and uses the exploratory approach. It aims at the construction

of a theory that seeks to answer the following question: how to create a concept from observations?

In general, the first approach of the first school consists of formulating hypotheses not only from existing theories but also from a field investigation that allows us to confirm or refute these hypotheses. Whereas the second approach, which comes from the second school, consists in building a theory by creating concepts from the observed facts.

The distinction between objective and subjective results

It is generally recognized that the quantitative approach offers a greater guarantee of objectivity. The imperatives of rigor and precision that characterize statistical techniques plead in this sense. It is therefore not surprising that the quantitative approach is rooted in the positivist paradigm, as Silverman (2006) points out. However, the objective or subjective nature of the results constitutes a dividing line between the qualitative and quantitative approaches. However, this dichotomy is not relevant, not only because not all quantitative researchers have advocated the existence of an objective reality, independent of the conception that scientific knowledge can allow, but it is above all the postulate of a de facto relationship between the qualitative approach and a particular epistemological position that can be questioned (Hammersley, 2000). According to Erickson (1986), the most distinctive feature of qualitative inquiry is the emphasis on interpretation. As a result, the authors assert that qualitative development has been informed by the subjectivity of the researcher.

Distinction according to research flexibility

The question of the flexibility available to the researcher to carry out his research project is also a crucial element in the choice of a qualitative or quantitative approach. With a qualitative approach, the researcher generally has a great deal of flexibility. The research question can be changed midway through the research to ensure that the results are truly grounded in the field. The researcher can also incorporate alternative explanations and modify the data collection. It is in the researcher's best interest not to

overly structure his or her strategy in order to maintain the ability to consider the unexpected and to be able to change direction, if necessary.

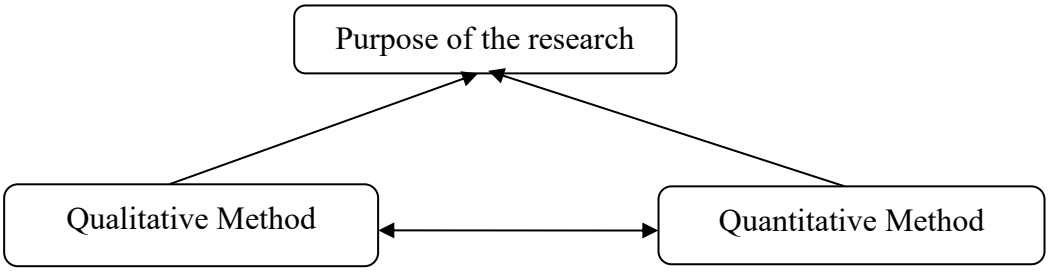
The quantitative approach does not offer this flexibility because it generally involves a more rigid schedule. In surveys, sampling and questionnaire construction are carried out before data collection. Similarly, in experimental research, the definition of the independent and dependent variables, as well as the definition of the experimental and control groups, is part of a preparatory stage. It is obviously very difficult to change the research question in the more structured approach to quantitative research, given the cost of doing so.

Complementarity of research methods

In view of the above, it is established that the qualitative method diverges from the quantitative method. However, it is difficult, even hazardous, to speak of qualitative or pure quantitative. Each method has its strengths and weaknesses, and by inference, the weaknesses of one are in the strength of the other. In the context of this posture, Bryman & Burgess (1999) support the idea of integrating the two methods by pointing out the differences between them in terms of their advantages and disadvantages and that it is therefore useful for research to combine them. In the same vein, we can conclude that far from being opposed to each other, qualitative and quantitative approaches complement each other, hence the need to combine them. From this perspective, it is understandable, for example, that an exploratory study, conducted through a qualitative approach, should be an essential prerequisite to any quantitative study. This is in order to delimit the research question, to become familiar with this question or with the empirical opportunities and constraints, to clarify the theoretical concepts, or to make the research hypotheses explicit. In this case, the qualitative approach is a necessary step in conducting a quantitative approach under the best conditions. In addition, researchers can combine qualitative and quantitative approaches through what is known as “triangulation.” This involves using both approaches simultaneously for their respective qualities. Triangulation allows the research design to be tested by ensuring that the findings are not just a reflection of the methodology; in fact, using complementary data is not triangulation per se, but a natural occurrence

in most research. It would therefore be a mistake to assume that the "qualitative" researcher does not use quantitative data. The following figure shows triangulation.

Figure 2: Triangulation across research methods



Source: (Thietart, 2014)

Nevertheless, in the course of carrying out research, it is common to find that researchers make use of elements of both methods, without this distorting the logic of their evidence. In reality, this is so because, in accordance with the complex nature of educational facts, it often appears that a single method does not cover all the dimensions that the analysis of educational phenomena requires to be taken into consideration. Consequently, it is a question of responding effectively to the needs of a more general method, a mixed method whose aim is to complement the respective differences. The main characteristics of these two methods are presented in the table below.

Table 1: Main characteristics of Qualitative and Quantitative Methods

	Qualitative Method	Quantitative Method
Objectives	Explore, discover, in-depth understanding, formulate hypotheses	Evaluate attitudes, weight, and group variables, explain phenomena or behaviors
Types of data	Discourse or text	Measures
Method of data collection	Individual or group interviews	Questionnaires
Sample	Reduced, representativeness is	Important and

	not required	representative
Types of data analysis	Subjective interpretation	Statistical analysis
Postulates	Importance of the unconscious meaning of behaviors	Ability to measure and generalize
Limits	Difficulty in generalizing the results, the validity of the techniques used contested	Possible response bias

Source: (adapted from Giannelloni and Vernette, 2001)

This distinction is both methodological, mobilizing the notion of counting (the qualitative approach functions without counting, whereas, in the quantitative approach, it is counting that allows us to reach the results). Epistemologically, insofar as qualitative approaches analysis and interpretation are done “by eye” or “by hand” or even, one might say, “by human hand”, whereas, in the quantitative approaches, analysis and interpretation are done “by instrument”, “by software”, “by augmented human hand” or even “by post-human hand” (Paveau, 2017, p. 44).

6.2. Area of the Study

According to Galisson and Coste (1976), an investigation is motivated by the need to verify a hypothesis or to discover a solution to a problem and consists in as methodologically as possible a set of testimonies likely to answer the objective aimed at. As for a survey, according to Dubois and Candel (2005), it is the action carried out by the researcher in order to collect information, following appropriate methods and techniques. Therefore, it is real fieldwork, in the sense that the researcher leaves his office and puts an end to the so-called preparation phases that is preliminary reflection and conceptualization. From now on, it is a matter of executing the prepared plan, starting by defining the nature, the number, and the characteristics of the objects or individuals that will be subjected to observation (interview, questionnaire, tests, and measurements).

In principle, hypotheses indicate with sufficient precision the area of investigation: where all the elements that come into play in the research problem are to be found, and above all, the points of verification to be uncovered and analyzed. The

universe of the investigation will thus be constituted by the global environment that includes this area: geographical as well as economic, professional, and social environment.

Conducting a survey is an example of technological production. The final product or survey report, whatever the medium, is a set of information that has been collected, analyzed, and represented. Like any technological production, the realization of a survey must obey a coherent and logical approach.

From this point of view, it seems obvious that the first question to ask is “For whom?” since the survey is necessarily conducted for someone. Next, is the question of the “Why?” of the survey, what are the reasons why the researcher wants to conduct a survey? What do they want to know? What information do they want to collect and what type of information is it? Only then the question “What?” is answered, which refers to the type of survey to be used, since the questionnaire survey is only one type of survey among others and finally, we must ask “How?” This is the question about how to administer the survey. Is it an exhaustive survey? In this case, an entire population is surveyed. Is it a sample survey? In this case, only a sample of the population is surveyed. If the second solution is chosen, how should the sample be drawn? It will then be necessary to question its size and its representativeness.

Therefore, this study was carried out in Cameroon. The country covers a surface area of 475,440 square kilometers and has an ethnically and linguistically diverse population of about 27,943,840 million with about 200 linguistic and ethnic groups (Africa Atlases: Cameroon Population, 2022). It is bordered to the south by Equatorial Guinea, Gabon, and Congo; on its southwest 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 subdivided 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 subdivided into Divisions and Sub-Divisions. These regions are each administered by appointed Governors in addition to Divisional and Sub-divisional officers while

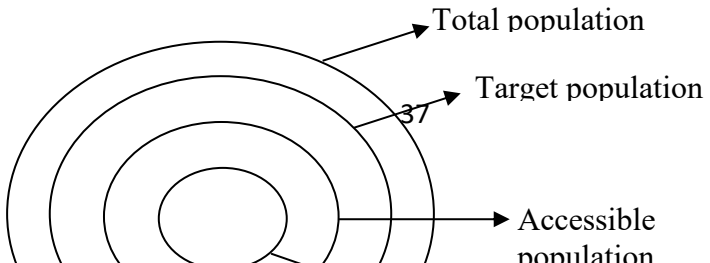
executive powers are conferred to the President of the Republic. The economy is basically Agricultural and commonly described as Africa in miniature or the basket of West Africa.

The choice of the study area was first of all because the researcher is a Cameroonian, born and living in Cameroon. Secondly, the multiplicity of schools in Cameroon and the interest of so many graduates in becoming teachers, especially at the secondary, primary, and nursery schools. Thirdly, a great need for these young Cameroonians aspiring to become employees to acquire the necessary academic and professional skills, attitudes, and values suitable for learning in the 21st century. Fourthly, the incessant love of ICT gadgets like computers, the Internet, digital radios, digital Televisions, and handheld 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 telecenters 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 secondary school teacher in Cameroon. Moreover, the study is carried out in the center region precisely at the GBHS Emana, Essos, Ekounou, and in the SW region, GBHS Limbe and Molyko, the reason being that these were the schools that were open for this study.

6.3. The population of the Study

Amin (2005, p. 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 generalized (Moussy, 2022). Thus, the population of the study was made up of form 5, lower, upper sixth, and teachers in secondary schools in Cameroon. The survey research design meant sample design. As such, a purpose-based research design was used and the type was based on a descriptive survey.

Figure 3: Research Population



Source: Modified from Amin (2005, p. 236)

Total population

Educational research is concerned with behaviours as a whole. The information sought and deemed necessary to solve or propose solutions to a problem can normally only be obtained from the entities that make up a group. The study population refers to the set of individuals on whom the research is focused. In other words, it is the set of individuals subjected to a statistical study, cases that meet a given set of characteristics. It also refers to the group of individuals, events or things of interest that the researcher wishes to study.

According to Grawitz (1993), the study population refers to *a set whose elements are chosen because they all possess the same property and are of the same nature. It can be a set of people classified according to a given criterion (ethnic, social, national)*. Indeed, any research work must be interested in such a population with similar characteristics and properties. This macro population is segmented into micro populations according to their specificity, namely: the parent population, the target population, and the accessible population, which we should now present. According to Selltiz, Wrightsman & Cook (1977), the parent population refers to a set of elements that are chosen because they are of the same nature. In the context of our work, these are the learners, the teachers of all the secondary schools in Cameroon.

Target population

It is understood as a group of people who give the information that the researcher wants to possess in order to carry out his/her research with precision, harmony, and accuracy. According to Amin (2004, p. 6), a target population is a 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 secondary school students in Government Bilingual High Schools (GBHS) in Cameroon. That is the form 5, lower, and upper sixth students in Cameroon. The choice of these students is first of all because these students provide a mature analysis, their use of ICT tools, and the methods their teachers use in class with them since it concerns the CBA, they reason more maturely than those in the lower classes. The experiences of these students count as well because they have been schooling for years. Their minds are more mature at the level but from form 1 to form 4, the child simply apprehends things the way they are and is able to judge but from form 5, the mind is able to reason and analyze situations properly.

Accessible population

This is the population from which the sample is actually drawn (Moussy, 2022; Amin, 2004). It is the set of people that the researcher can reach during his or her field investigations. It often meets certain characteristic requirements, including proximity and language accessibility. The accessible population was comprised of form 5, lower and upper sixth students, and teachers of GBHS in two Regions. This includes Centre Region and Southwest Region.

Probabilistic Sampling

In a probability sample, each entity in the population has a known a priori non-zero probability of belonging to the sample. The selection of the elements of the sample is done according to a random procedure. This means that the choice of one element is different or even independent of the choice of the other elements. Since individuals are selected at random, calculations can be made to measure the accuracy of the survey results. In probabilistic methods, several construction strategies can be distinguished:

Simple random sampling: this is the most basic method. Each element of the population has a probability of belonging to the sample. Here, the random draw is made from a sampling frame where all the elements are numbered, thanks to the use of tables of pseudo-random numbers. Its disadvantage is that it requires an exhaustive and numbered list of the population.

Systematic sampling: this method is very similar to the previous one. It has the advantage of not requiring a numbering of the elements of the population. Here, the first element is chosen randomly and the other elements are selected at regular intervals called no selection.

Stratified sampling: the principle consists in segmenting the population according to one or more criteria defined a priori. The objective is to obtain segments that are as homogeneous as possible with respect to the phenomenon under study.

The degree sampling: here, the researcher makes successive draws at different levels. The first stage corresponds to the selection of elements called "primary unit". In the second stage, the researcher randomly selects the sub-elements called secondary units within each primary unit. The process continues in this way until the last stage. The entities selected at the first stage correspond to the study sample.

Cluster sampling: It is noted that this is a special case of a two-stage sample. The elements are not selected one by one, but by a sub-group called a cluster. Each entity of the population is attached to one cluster and one cluster only. At the first level, the researcher selects the clusters randomly and at the second level, he/she carries out a census of the individuals.

In this study, we have chosen probability sampling by simple random sampling where the random draw is made from a sampling frame where all the elements are numbered and have an equal chance to be selected.

Sample and Sampling Technique

A sampling method is an approach characterized by a set of operations used to select a sample from a given population on which to base statistical tests. The sample is a part of the population, made up of one or more individuals from that population. The word "sample" comes from the Old French "eschandillon" which means "scale for measuring". Its linguistic ancestor gives this term a very clear idea of the role it must play in the research work: to serve as a standard measure, as a basis for measurement (Cash, Isaksson, Maier & Summers, 2022).

The sample is defined as a small quantity of a product, intended to make known its qualities or to appreciate them, or a representative portion of a whole, a specimen. Since in the research process it is not possible to make measurements or observations on all the objects or persons concerned with the subject, it is necessary to extract a sample. Thus, to extract a sample is precisely to select, according to well-defined criteria in advance, a certain number of individuals among the individuals composing a defined set, in order to carry out on them measurements or observations which will make it possible to generalize the results to the first set.

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 her colleagues and used her own personal judgment to select the level and classes that she believed provided data needed for the study based on their prior experiences and knowledge of ICTs and CBA teaching and learning methods. The researcher is a teacher in one of the target schools and conducted research on the integration of ICT and CBA teaching and learning methods.

Since the sample is known, it is necessary to determine the size of the sample, that is the number or quantity of individuals that will be used to conduct the survey. The sample was done through a purposive sampling technique which consisted of selecting, the various regions and schools, form 5 to upper-sixth students who gave information on how teachers teach using the CBA learning and teaching method. At the GBHS Yaounde, a total number of 1323 students, GBHS Emana, a total number of 503 students, GBHS Ekounou, a total number of 1102 students, GBHS Limbe, a total number of 564 students, and GBHS Molyko, a total number of 556 students. Therefore, a total number of 3929 students were sampled and we had a total sample of 1230 students.

Table 2: Sample Selection and Categories of Respondents

Categories	Class	Number per class	Total number	Sample
GBHS Yaounde	Form 5	532	1323	297
	Lower Sixth	460		
	Upper Sixth	331		

GBHS Emana	Form 5	280	503	217
	Lower Sixth	113		
	Upper Sixth	110		
GBHS Ekounou	Form 5	487	1102	285
	Lower Sixth	321		
	Upper Sixth	294		
GBHS Limbe	Form 5	210	445	205
	Lower Sixth	140		
	Upper Sixth	95		
BGS Molyko Buea	Form 5	282	556	226
	Lower Sixth	159		
	Upper Sixth	115		
Total		3929		1230

Source: (MINESEC, 2022)

In fact, the desire to extract a sample stems from the concern to make the research operational. This is especially true when it is difficult to work with the entire population concerned, given certain difficulties related to its size, time, material, financial or other conditions. These methods can be grouped into two categories: probabilistic and non-probabilistic methods.

After selecting the schools with their respective levels, the number of students selected from each school makes up the desired sample size. 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 students in each school selected. After the data collection, 121 questionnaires were not useful. Only 1,109 were useful and this number was adopted as the sample.

Non-Probabilistic Sampling

In non-probability sampling, the entities in the population are not known and identified. That is, there is no numbered list of entities in the population. Therefore, there is no need to resort to statistics to constitute the sample for the study. For this purpose, there is a different non-probability sampling:

Quota sampling: This is a non-random sampling method that makes it possible to obtain a sample that is representative of the study population. It can be used when the researcher does not have a sufficiently detailed sampling frame, or for cost reasons. As in the stratified random sample method, the population is segmented on the basis of one or more criteria defined a priori in such a way that each element of the population belongs to one and only one segment. In this method, the selection procedure consists of randomly choosing the first element of the list, then systematically going through it until the desired number of responses is reached.

Convenience sampling: In other words, it refers to those selected solely on the basis of the opportunities presented to the researchers, without any criteria for selection having been defined beforehand. These opportunities are based on the availability and accessibility of participants. Thus, the profile of the sample depends on the field chosen on the one hand and on the other hand on the people who have agreed to participate in the study on a voluntary basis. Our choice of this type of sample is also justified by the hypothetical-deductive nature of this research on Cameroon.

Purposive sampling; while probabilistic methods aim to eliminate the researcher's subjectivity, this method relies fundamentally on the researcher's judgment. No special procedure or sampling frame is required to construct a purposive sample. This is an advantage because there is rarely a pre-established sampling frame for organizational phenomena; it increases the flexibility of the researcher in the field. Even if it were possible to create one, the difficulty and cost would often be prohibitive; in some cases, the snowball technique can provide a solution to the difficulties of identifying entities in the population.

On the other hand, for small samples, a purposive method works just as well as a probabilistic method. The constitution of a sample by purposive choice is carried out according to theoretical criteria. To do this, the researcher must have a good knowledge of the population studied or, more generally, of his or her field of research. Thus, in the context of this study, the sampling method chosen is purposive sampling, although it also involves clusters and convenience. For the interview, 18 teachers were selected and

8 administrators were for focus group discussion. The categories and size of the respondents are herein presented in table 3.

Table 3: Distribution of the Interview and Focus Group Discussion Sampling

Categories	Interview	Focus Group Discussion
GBHS Yaounde	4	1
GBHS Emana	5	1
GBHS Ekounou	3	2
GBHS Limbe	3	2
BGS Molyko Buea	3	2
Total	18	8

Source: (MINESEC, 2022)

In this study, the selection of the sample was done through a purposive sampling technique, which consisted in selecting, viewed as a judgmental form of sampling technique in which researchers; based on their knowledge of the population, handpick certain individuals for their relevance to the issues being studied. It is evident from this description of purposive sampling that one of its major advantages is that it increases the likelihood that researchers get at least some relevant information from the respondents at sites considered to possess certain characteristics crucial to the study.

6.4. The Research Instruments

The research instrument according to Stransky, Bodnar, Bassett, Cooper, Anastasio & Burkey (2022) refer to the support, the particular intermediary in terms of material that the researcher will use to collect the data that he must submit to analysis. We have thus used some instruments or elements that make it possible to meet the specific needs of our research in terms of information, the processing of which led to the objectives that we have set above. Two main techniques for data collection instrument are used in this work including the quantitative and qualitative tools for data collection.

6.4.1. Quantitative Tools for Data collection

The quantitative tools used to collect data for this research work includes Questionnaire and the Experimental method and which are presented below.

Questionnaire: It is one of the most widely used instruments in social, human and educational science research. It consists of a set of written questions on a particular subject that obey precise rules of preparation, construction and execution. It is therefore an effective way of gathering information in a methodical way, with a view to verifying hypotheses. It is the most suitable primary data collection instrument for conducting surveys and polls based on quantitative information. It allows the collection of a large amount of information from a large sample of respondents. Unlike a transcript of free interviews, the questionnaire makes it possible to record responses whose modalities have been defined beforehand. It is therefore a very powerful tool whose effectiveness and reliability depend on its correct implementation (its design and administration). According to Grawitz (1993), it is an indispensable means of communication between the researcher and the respondent. In presenting it, she adds, the reseacher is provided with a series of questions concerning the problems about which the respondent is asked to give information and his or her points of view.

The value of administering the questionnaire is that it provides relevant and usable data. Ateudjieu et al., (2022) point out that it is a data collection tool that is well suited to quantitative research because it allows for large samples to be processed and to make statistical relationships or numerical comparisons. The questionnaire is a set of written questions on a particular subject, with the questions serving as the basis for a survey depending on the purpose. A survey through a questionnaire consists of asking a series of questions relating to the information sought, by a set of respondents most often representative of a population. It differs from a simple opinion poll in that it aims to verify hypotheses and the statistical tests that these hypotheses require. It is obvious that the fundamental element that gives the questionnaire its meaning and scope is the question itself. There are several types of questions, depending on its use and on the degree of precision or finesse desired in the answers. Our questionnaire was developed on the basis of two types of questions: factual question and closed-ended questions.

In fact, we began our questionnaire in the simplest, if not the most objective, way possible, by asking respondents for information about their classes, and experience, in short, some basic facts that are, to say the least, unmistakable. These are indeed so-called factual questions. The purpose of these questions was to get a sense of the characteristics of the population being investigated. Closed questions are questions that, as their name indicates, close the type or content of possible answers. They are therefore questions for which the subject must provide a short answer with unambiguous content. They must therefore be formulated in a simple, direct manner and in such a way as to fix the modalities of answers in advance. According to Aktouf (1992), this type of question should only concern elements that are simple enough to express and objective enough to be covered by yes/no answers or strongly agree, agree, neutral, disagree, and strongly disagree.

Experimental method: it allows quantitative treatments and statistical exploitation of the data collected. The quality of an experiment is based on the participants' condition (behavior, will, and environmental conditions). In no case should the participants feel obliged to adopt a behavior induced by the experimental situation? The researcher's job is therefore to create the conditions that encourage participants to behave as naturally as possible. Different methods are used to conduct experiments. The researcher can use the protocol method: the subject is then invited to reconstruct and describe "aloud" the internal processes of information processing that underlie his decisions. Other methods of experimentation consist of the participation of subjects in a role-playing game or in simulation games. These experimental methods are rich in information for the researcher. The variables are measurable and controllable. It is quite possible to make comparisons and test causal relationships between events. On the other hand, these methods are sometimes too simplistic and are limited in terms of external validity. The results they produce must be analyzed with care because their generalization is limited.

6.4.2. Qualitative Tools for Data collection

The qualitative tools used to collect data for this research work includes Interview, Discrete measures, Direct observation, Interview guide and focus group discussion which are presented below.

Interview: this method makes it possible to collect data with a view to their analysis. The data are clear and reflect the mental, conscious or unconscious world of the individuals. A distinction is made between individual and group interviews. The individual interview is a face-to-face interview between an investigator and a subject, whereas the group interview consists of bringing together different subjects around one or more investigators.

Discrete measures: Finally, there is another form of primary data collection that cuts across the classification of different modes of data collection. These are the discrete measures. These measures consist in the collection of data that are not affected by the reactivity of the primary data subject-sources because they are collected without their knowledge.

Direct observation: In fact, direct observation was originally an investigative technique used in anthropology and which, according to Nga Ndongo (1999), participated in the identification of cultures and social routines. According to this author, to resort to direct observation is to proceed to the recording, by descriptive or analytical notes, of actions or observations perceived in the field, in a natural context.

In addition, direct observation is also and above all based on, according to Beitoine & Al (2000), keeping a field diary in which the data collected is recorded daily. These facts or events may occur in the media, schools, institutions and structures such as the services of the Ministry of Secondary Education, daily life, with the aim of observing in these various places, all useful information thus collected and all things seen and heard, accompanied by any comment or remark inspired by it (Beitoine & Al 2000). In other words, the direct observation proceeds in priority by the human senses; in particular the sight and hearing. To complete and facilitate the understanding and exploitation of the data thus observed, the study used a questionnaire as well.

Interview guide and focus group discussion : Qualitative content analysis is one of numerous research methods used to analyze text data (Sultana, Rashid, Mohiuddin, & Mazumder, 2013). It is widely used as qualitative research technique. In case of study research, data analysis follows an iterative process, proceeding from more general to specific observations (Creswell, 2013). This analysis could start during the data collection phase and continue through the data transcription stage, when themes, pattern and categories becomes apparent.

Our data analysis consisted in three distinct stages. The first started with the process of coding and subsequently organizing the data in the conceptual categories. The process involves a careful, more focused re-reading and review of the data and performed coding and category construction based on the data characteristics to uncover themes pertinent to the phenomenon.

For Creswell (2013, p. 184) "code or category represents the heart of the qualitative data analysis." For this study, the strategy of coding interview, documents and observations data enabled to ensure consistency with theoretical construct of the study. This initial coding proceeded, new themes and codes were discovered, some were added and existing ones have been modified. The next stage of the analysis involved constructing of a case description and interpretation (Miles & Huberman, 1994). This technique helped to reduce the large volume of data and combined data from all three sources. The final stage of analysis entailed using software to guide the research. In fact, since a decade, there are different tools that assist scholars in their research. To be most faithful to the narrative and the reality of our observation analysis, we used the qualitative data analysis (QDA) Miner software. Even if the software world is changing at lightning speed and dizzying, QDA Miner according to Miron & Dragon (2007) is characterized by the simplicity of its functions. It is an appropriate software that fit with our study.

Apart from the questionnaires used in this study, a semi-structured interview approach was also found suitable for this study because it can yield unexpected and insightful information, thus enhancing the findings (Hair, Babin, Money & Samouel, 2003; (Toma, 2011). It gave us a better opportunity to immediately clarify with the interviewee the data that was being sought. A large part of data was gathered through

semi-structured interviews with staff members who are directly involved in planning and implementation of the e-governance. All interviews were conducted by trained qualitative researchers, digitally recorded, and lasted between 45 minutes and an hour and half. The interview guided was developed based on the review of the current literature During the interview, we memorize the question and their order to minimize losing eye contact with the participants (Creswell, 2013, p. 169) and we have tried to be natural as possible as we can.

Observation: it is a method of data collection in which the researcher observes, on his or her own, processes or behaviors taking place in an organization (a classroom) during a defined period of time. Observation is an alternative mode of data collection to the interview in that the researcher analyses factual data whose occurrences are certain. An observation framework is constructed like a questionnaire: it is based on the conceptual model of the research, it depends on the researcher's choice of data analysis, and it allows statistical processing. Bastien (2022) notes that observation is not a very common collection method in quantitative research because it is difficult to conduct observations on large samples. The researcher overcomes this difficulty by mobilizing several observers. In addition to its cost, the multiplication of observers poses a problem of reliability because the different observations may not be homogeneous. In all cases, the use of a systematic observation framework to describe observed behaviors identically is essential.

6.5. Justification of the Instrument Used

Starting orientations were with regard to the students' attitude and their interest during the deployment of the lesson. For the teachers, the emphasis was on the deployment of certain parameters around the integration of ICT in pedagogy. Concretely, it was a question for us to carry out class visits during teaching in different classes at the GBHS Yaounde, Emana, Ekounou, Limbe, and Molyko. Thanks to the principals and the collaboration of colleagues' teachers, it was possible for us to experience the real difficulties linked to the inappropriate practices of CBA in teaching-learning in secondary schools.

In this study a questionnaire was constructed for the collection of data for the quantitative phase of the research. This was constructed for students. The questionnaire was chosen because it saves time and is easy to code. On the other hand, appropriate structured interview questions were constructed to elicit relevant information in the interviews with the content lectures, teachers, and administrators from secondary schools and MINESEC. This information was relevant in verifying and backing up information from the questionnaire and also to ease the verification of the hypotheses. The teachers and administrators of secondary schools, who finally accepted to participate, took part in face-to-face interviews at their different places of work and at their convenience. Interviews were digitally recorded and transcribed immediately following each interview by the researcher.

Upon completion, each transcript was read and reread to ensure the accuracy of data and sent to the individual participants for member checking to verify if the transcripts accurately reflected participants' views and to determine if any modifications, corrections, or clarifications of comments were needed. Finally, the qualitative data was analysed following (Creswell 2022), which is an inductive investigative strategy where the end product is richly descriptive. Here the researcher is the primary source of data collection and does the following:

- focuses on understanding how participants make sense of the phenomenon under study, in this case, employability,
- is the instrument, of which the construction of meaning is mediated,
- carries out the inductive strategy, and
- describes the final outcome.

On the other hand, the questionnaire was constructed in line with the research hypotheses, modalities, and indicators so as to verify the various hypotheses and answer the various research questions. If the questionnaire is not well constructed, it alters the responses and affects the study negatively. Kelle (2022, p. 12), underscores the importance of this by saying that "even if the sample is perfectly representative, the response rate 100 percent, and the research design is elegantly planned and perfectly executed, the survey results are useless if the questionnaire has been poorly

constructed". The overall methodology in this study was therefore comprised of both qualitative and quantitative methods of data collection where the instruments, both questionnaires, and interviews were constructed in line with the hypotheses.

In the end, it must be said that the questionnaire survey was chosen for several reasons:

- It permits a large survey field to be covered, it is less costly and saves considerable time;
- It allows better control of the study population;
- It allows a large number of people to be sampled, then solving the problem of representativeness.

This technique has many advantages, including the possibility of quantifying multiple data and conducting numerous statistical analyses, easy counting... However, it should be noted that this technique does not have only advantages as it also has limitations:

- The individualism of the respondents, who are considered independently of their social networks;
- The superficiality of the answers which do not always objectively reflect the opinions of the respondent;
- Our insufficient training as a researcher.

6.6. Validation of Instruments

After constructing the questionnaire and the interview guide, the researcher found out if the questions and information were properly framed in such a way that the respondents easily understand what information was being asked for. To do this, she presented the first drafts to her affinity peer group where she was advised to avoid using technical terms or jargon, and even when such words were used, their corresponding meanings are explained to the respondents before he/she was asked to respond. Later on, she submitted them to her two supervisors for appraisal. After making some corrections to the guides and advising the researcher on the importance of probing questions during interviews, they discouraged the researcher from using leading

questions. After this, corrections were done and submitted again to each of them, and they approved the construct, face, and content validity of the instruments.

6.6.1. Pilot Study

Before the administration of the questionnaire and the interviews, a pilot study was conducted to get a sense of the effectiveness of the instruments. The key advantage of pilot testing was that it provided advanced warning regarding potential problems that arise in the main study by indicating whether questionnaire or interview questions were clearly articulated and appropriate for addressing the research questions for the study. During the pilot study, some students filled out the questionnaire and one pilot participant and a few teachers were interviewed. These pilot participants were asked to give feedback on the questionnaire and interview questions to identify any potential problems or ambiguities. Time taken to complete the interview was noted to make sure all questions were addressed within the one-hour time frame. Based on the pilot participants' feedback, all unnecessary or ambiguous interview questions were discarded, reworded, shortened, or revised. The researcher met with her pilot participants for feedback on the questionnaire, who shared the following critiques for improvement:

- The questionnaire was difficult to complete because the questions were too long;
- The questionnaire requires more than 30 minutes to complete as it was. This reduces the completion time to approximately 15 minutes;
- moves questions regarding challenges from the questionnaire to the interview.

The researcher also conducted a run-through of interview questions with the pilot participants. This was to check our recorder, its battery, and all the accessories. The pilot interview also provided the opportunity to sharpen our interviewing skills.

After the pilot test was completed for both the questionnaire and the interview, it was realized that almost all the questions were easily answered by the population. Also, the information needed for the study was elicited. This gave encouragement to proceed in the administration of the questionnaire and the interview guide questions to the sample.

6.6.2. Reliability

Cronbach's coefficient alpha

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma \frac{2}{k}}{\sigma^2}\right)$$

Where:

$\sum \sigma \frac{2}{k}$ is the sum of the variances of the k parts which are the items of the test or instrument.

σ = standard deviation of the test or instrument.

Table 4: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,886	0,836	64

Source: (Researcher, 2023)

Looking at the table above on the reliability test, we realize that the calculated Cronbach Alpha is 0.8 thus implying that the instrument of our study is reliable for the study.

6.7. Administration of the Instruments

In the context of our research, the questionnaire was administered directly. According to Pažur (2022), there are two modes of administration of the questionnaire: *indirect mode and direct mode*. Before administering the first instrument (the questionnaire), the researcher first obtained permission from the authorities of the schools. Initially, she submitted her research attestation from her university to the different principals and the Ministry of secondary education. The students who accepted to participate in the study accepted to fill out the questionnaire at a space convenient for them (in school or at home). This was to ensure there is no bias and all the questionnaires were filled correctly. The researcher later went around collecting the filled

questionnaires on agreed dates. This was done to save time and reduce the risk of the questionnaires getting missing in the hands of other people while in transit especially those in the South West region. After this, the researcher proceeded to administer the interviews. Permission for the interviews was accorded to the researcher as she sought to meet each of the purposefully selected participants. She met most of the participants in their offices. All interviews were face-to-face. A semi-structured interview guide was used for interviews. The interviews lasted less than one hour each. Interviews were digitally recorded and transcribed immediately following each interview by the researcher. Upon completion, transcripts were re-read to ensure the accuracy of the data and then sent to the individual participants for checking to verify if they reflected participants' perspectives and to determine if any modifications, corrections, or clarifications of comments were needed.

6.8. Technique of Data Analysis

Concerning the quantitative data, the appropriate statistical technique used to verify and analyze the hypotheses was the Spearman Correlation and multiple regression analysis. These tests are used when testing the association between two variables.

Spearman Correlation is expressed as:

$$r_s = 1 - \frac{6\Sigma D^2}{n(n^2 - 1)}$$

Where:

D is the difference between the ranks of X and the corresponding ranks of Y

n= the number of paired ranks

Multiple Regression Analysis

A multiple regression analysis was generated to examine the degree the use of ICTs, ICT infrastructure, e-learning, and computer-based direct instructionas predictor variables that predict a criterion variable which is CBA teaching-learning methods. We

also want to assess which of the predictor variables can predict CBA teaching-learning methods the most. Multiple regression is expressed as:

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_p X_p$$

Where the β_s are a set of coefficients in the population whose values are to be determined.

The qualitative data was done following (Creswell, 2022), which is an inductive investigative strategy where the end product is richly descriptive. Here the researcher is the primary source of data collection and does the following: 1) focuses on understanding how participants make sense of the phenomenon under study, in this case of CBA teaching-learning methods, 2) is the instrument of which the construction of meaning is mediated, 3) carries out the inductive strategy, 4) and describes the final outcome.

6.9. Variables of Study

There are two main variables on which this study is based, the independent and dependent variables. The independent variable in this study is the pedagogic ICT integration of secondary schools, which is the presumed cause. When this variable was operationalized, the following research variables came out: the use of ICTs in secondary education, ICT infrastructure, e-learning, and computer-based direct instruction. The dependent variable is CBA teaching-learning methods, which is the presumed effect. Its indicators are basic competency skills, communication skills, adaptability (problem-solving, critical thinking, and creativity), developmental skills, group effectiveness skills, influencing skills, smooth transition from school to work, and shorter duration of the work search. Thirdly, we can talk of the extraneous variables which constitute factors external to secondary schools such as socio-economic background, gender, age, and career aspirations, which might compete with pedagogic ICT integration to explain variations in the dependent variable.

Table 5: Synoptic Table

General Hypothesis	**Specific Hypotheses**	**Independent Variables**	**Indicators**	**Dependent Variables**	**DV Indicators**	**Modalities**	**Research tools**	**Statistical instruments**	Scale
Pedagogic ICT integration influence CBA teaching and learning methods in government secondary schools in Cameroon	The use of ICTs facilitates CBA teaching-learning methods in government secondary schools in Cameroon	IV_1: The use of ICTs	ICT tools, computers, Internet connectivity, Efficacy in instruction, ICT infrastructures, software for instruction, ICT skills	CBA teaching-learning methods	-Basic competency skills (reading writing computation) - Communication skills speaking, listening -Adaptability (problem-solving critical thinking, creativity). - Developmental skills, (self-esteem, motivation goal setting career planning). -Group	High low	Questionnaire Oral interview	Spearman correlation Multiple Regression Analysis	Ordinal Scale
	ICT infrastructure increases CBA teaching-learning methods in government secondary schools in Cameroon	IV_2: ICT infrastructure	Mobile phones, Computers, USB keys, Internet, TV, radio,CD-ROMs, PDAs, projector	CBA teaching-learning methods		High low	Questionnaire Oral interview	Spearman correlation Multiple Regression Analysis	
	E-learning does not foster CBA teaching-learning methods in government	IV_3: E-learning	Self-regulated learning behavior, Web Based Learning,	CBA teaching-learning methods		High low	Questionnaire Oral intervie	Spearman correlation Multiple	

	secondary schools in Cameroon		Computer Based Learning, Virtual classrooms, digital collaboration, WhatsApp, google hangout, e-mails, search engines, Blogging,		effectiveness skills * interpersonal skills * team work * negotiation -Influencing skills *undertaking *organizational *culture *sharing *leadership		w	Regression Analysis	
	Computer-based direct instruction does not enhance CBA teaching-learning methods in government secondary schools in Cameroon	IV_4: Computer-based direct instruction	Information quality, software program, graphical information Interactive Video, videodisc player animations,	CBA teaching-learning methods		High low	Questionnaire Oral interview	Spearman correlation Multiple Regression Analysis	

Source: (Researcher, 2023)

6.10. Ethics and Security

Mugenda (2011) advises the organization of the study, data collecting and analysis, distribution, and use of the results to consider ethical considerations. The researcher made every effort to uphold the confidentiality concept. According to Gatara (2010), the notion of voluntary participation is essential to any research. The participants were willing to participate in the study and were the ones who were aware of the advantages and hazards of doing so. He recommends that participants be informed of the research's goal in order to do this effectively. As a result, the researcher included a brief line on the introduction form outlining who was conducting the research and why.

During data collection, the researcher ensured the confidentiality of the information obtained from the participants by assuring the research participants that the information got was purely for research purposes (Hammersley & Traianou, 2012). To ensure this, the anonymity of the participants was taken care of by asking both the students and faculty members not to indicate their names on the research questionnaire. During data analysis and reporting, pseudonyms were used in order to protect the identities of the participants. It is strongly recommended that researchers need to disassociate names from responses during the coding and recording process (Creswell, 2021). The researcher was honest (Geiger, 2015) during the write-up and only reported what the participants had shared. Intellectual property rights should be respected at all costs (Geiger, 2015). To avoid plagiarism and fraud, the researcher duly acknowledged all the authors of the works that had been cited and any other information that was not the researcher's own (Brooks, Riele, & Maguire, 2014). Finally, the researcher also avoided any incrimination. The participants' privacy was ensured through asking them not to write their names on the questionnaires. Clough and Nutbrown (2002, p. 84) comment as following with regard to ethics in research:

> "In order to understand, researchers must be more than technically competent. They must enter into chattered intimacies; open themselves to their subjects' feeling worlds, whether these worlds are congenial to them or repulsive. They

must confront the duality of represented and experienced selves simultaneously, both conflicted, and both real".

In concert with Clough and Nutbrown's view above, it follows that in planning this research, the researcher had to take into consideration and protect the feelings, welfare, and rights of the participants. In concert with the rules and regulations of the university with regard to conducting research using human subjects, the following ethical considerations were considered during the course of the research. These considerations applied to both the quantitative and qualitative research sections of this study.

The research protocol was developed with a concern for rigor and ethics. Data collection received prior approval from the respondents who participated. All research must be carried out in accordance with ethical principles, yet work on sensitive topics such as the pedagogic ICT integration of the actors involved requires careful attention to avoid hurting or affecting the sensitivity of participants and compensate for the imbalance of power between the researcher and the respondents. Students and teachers are often judged in a pejorative manner and can, in this sense, hide their own point of view to present their experiences in a way it is more acceptable to the researcher. At each level of research, we tried our best to respect all the participants, treat them fairly and protect them, minimize risks, and ensure that the benefits are greater than the risks. The researcher conducted the interviews with previously declared interviews confidential. Before the interview was scheduled, there were clear instructions on informed consent from participants who knew they could withdraw at any time during the study. It is difficult to control confidentiality while transmitting information when a researcher considers that the participant is actually meeting his target. Respect for privacy is important to encourage respondents to speak openly. Confidentiality and pseudonym were ensured throughout the research, during the data collection, analysis, storage of information, and the write-up of the thesis. All participants received clear information about the study. The researcher applied for permission to conduct the research at various schools according to the procedures.

The referencing styles used in this study are the norms from the American Psychological Association (APA). Here the researcher used the most recent edition by Raimo Streefkert, which was introduced in October 2019, and revised in December 2020, making the 7th edition of the APA publication manual and replacing the 6th edition published in 2009. These updated referencing styles are seen in the different citations of this work, most notably in the bibliographic work.

7. CONCEPTUAL FRAMEWORK

At this stage of the work, a definition of certain concepts is necessary for further understanding of the perspectives of the study. There is, however, a further and more elaborate conceptual framework, conceptualizing the concepts involved in the study in chapter two. Pedagogic ICT integration and its relationship with CBA teaching and learning methods are therefore the major concepts developed thematically in this work to build up a solid conceptual framework with a particular and specific focus on secondary schools.

Pedagogic ICT

By strengthening the delivery of public and commercial services, increasing economic productivity through digital economies, and attaining wide socio-economic goals in education, health care, employment, and social development, ICT plays a critical role in the knowledge and information society (UNESCO.U, 2015). By acquiring 21st-century abilities that boost the skilled workforce and social mobility, ICT in education helps people compete in and adapt to the knowledge and information society. ICT in education has a multiplier effect on the entire educational system by improving learning and giving students new skill sets (Balanksat, Blamire & Kefala, 2006); reaching students with limited or no access (UNESCO.U, 2015, Young, 2002), and decreasing the expenses associated with the delivery of traditional instruction; facilitating and improving teacher training (KERIS, 2011); expanding communication opportunities and reinforcing the development of skills of coordination and collaboration between peers (Dede, 2009); and (Gulati, 2008; KERIS, 2012).

Due to its enormous value, ICT has radically taken up a significant position in education and training. According to Brannigan (2010), the term ICT refers to a variety

of hardware (desktop and portable computers, projection technology, calculators, data logging, and digital recording equipment), software (generic software, multimedia resources), and information systems (Intranet, Internet) that are available in educational institutions. Resources for hardware and software are used frequently. Zhao and Cziko (2001) state that there are three prerequisites for teachers introducing ICT into their classrooms: first, teachers must believe that technology is effective; second, teachers must believe that using technology is not causing any disruptions; and third, teachers must believe that they have control over technology. The teaching community has to be aware of the possibilities. ICT is required, according to Soyinka (2021), for the following reasons:

- The use of electronic equipment facilitates the dissemination of information;
- ICT ensures speedy recording, processing, and presenting of information;
- ICT contributes to the quick flow of office work;
- ICT facilitates quality work.

ICT measures communication efficacy and efficiency, and the devices help manage information. It teaches us how to innovate in our interactions with the environment and our competitiveness with other organizations so that we can act wisely when dealing with new organizations (Shahmir, Hamidi & Bagherzadeh, 2011).

There is a sense of completion or wholeness and the need for integration when all crucial components of the teaching and learning process are combined, including technology. The way that technology is employed in the classroom indicates integration. They must go beyond information retrieval to problem-solving to enable new instructional and learning experiences that would not be possible without them; they must encourage in-depth thought processes; increase student engagement with the subject; foster faculty and student enthusiasm for teaching and learning; and, in general, they must free up time for effective classroom interaction (Earle, 2002). The process of integrating ICT is adaptable, dynamic, and versatile. According to established definitions, ICT integration contributes to students' learning-teaching processes with proper ICT and makes it permanent and sustainable (Usluel & Yıldız, 2012).

Competency-Based Approach

The CBA has become more popular recently in the academic community. In fact, it is no longer in style to impart knowledge or apply specialized knowledge through instruction. It is essentially required that students encounter challenging problem scenarios that they must resolve. Through this method, the learners not only gain knowledge but also are able to use it meaningfully in a variety of social, professional, and even personal settings. As a result of this transformation, teaching methods have undergone significant shift as teachers now serve as genuine intermediaries between students and knowledge. Following experience with programs by content and objective, secondary schools in Cameroon made the decision to follow the CBA's path in order to accomplish this competency objectively. This change is significant because it highlights the issue of whether or not teachers have received the necessary training to meet the requirements of the new system.

According to Iskandjanova, (2022), competency-based learning is an approach to education that focuses on the student's demonstration of desired learning outcomes as central to the learning process. It is concerned chiefly with a student's progression through curriculum at their own pace, depth, etc. As competencies are proven, students continue to progress. It is similar to mastery-based learning, with the primary difference being that competency-based learning often focuses on observable skills or 'competencies,' while mastery learning may be academic as likely to focus on concepts as skills (Liu, Ge & Wu, 2022).

Like most education-related phenomena, there is disagreement of what competency-based approach actually means, what its defining traits are, and how it should ideally be used or function. It is traditionally thought of in terms of skills and vocation, but it is entirely 'academic'. A key characteristic of this type of learning is its focus on mastery. In other learning models, students are exposed to content, whether skills or concepts over time, and success is measured summatively. In a competency-based learning system, students are not allowed to continue until they have demonstrated mastery of the identified competencies (the desired learning outcomes to be demonstrated). In this way, the definition of competency-based learning is closely

tied to mastery learning (Vries, Wal-Maris, Hamer & Nijdam, 2022). The concept of competency is a pillar of curriculum development and a driving force behind the process of change. According to Bakirova, (2021, p. 43), it is defined as:

> "The development of complex capacities that enable students to think and act in various fields of activity […]. It consists of achieving knowledge in action, the result of a sound knowledge base that can be put into practice and used to explain what is happening. Competence can be used as an organizing principle of the curriculum".

In a competency-based curriculum, exit profiles specify the classes of situations that learners must be able to handle competently by the end of their education. Depending on the type of education, these classes of situations are identified either on the basis of real-life or work-related situations or on the internal logic of the discipline in question. The competence organizing principle of the curriculum is a way to bring real-life back into the classroom (Bratianu, Hadad & Bejinaru, 2020). It is thus a move away from the idea that curriculum is mainly implemented by having students reproduce theoretical knowledge and memorize facts (the conventional knowledge-based approach).

Teaching and Learning

Teaching is considered an act of imparting instructions to the learners in the classroom situation. According to Tambo (2012), teaching is a process of imparting knowledge, attitudes, skills, and values. It can be carried out in the classroom in many ways, which include telling, discussing, persuading, showing, demonstrating, guiding, directing and many other learning methods. To Robertson (1987), in Youmeyse (2018), teaching is an action undertaken by one person with the intention of bringing about learning in another. For teaching to be effectively implemented in the classroom to bring about intended learning outcomes, a teacher needs to be effective. An effective teacher is one who can bring out intended learning outcomes or results. If a teacher shows good qualities such as kindness, warmness, enthusiasm, steadiness, alertness, and sympathy but is not able to achieve the intended results, he or she cannot be effective. Tambo (2012) outlines four characteristics of an effective teacher, which include:

- Showing command of theoretical knowledge about learning and human behavior;
- Displaying of attitudes that foster learning and good behavior;
- Command of knowledge in the subject matter to be taught;
- Control of technical skills of teaching that facilitates student learning.

Teaching in this study is an action undertaken by the teacher in the classroom using technology and technological tools to make sure that the process shifts from teacher-center. An effective teacher, therefore, is one who can use technological tools such as radios, televisions, overhead projectors, slides, audio tapes, audio visuals, videos, internet services, e-learning, and tele-surveillance to effectively communicate in the classroom to bring about intended learning especially engaging the learners in the process. According to Sequeira, (2012, p. 3):

> "Teaching is a set of events, outside the learners which are designed to support internal process of learning. Teaching (Instruction) is outside the learner. Learning is internal to learners. You cannot motivate others if you are not self-motivated. Motives are not seen, but Behaviors are seen. Learning is both a motive and behavior but only behavior is seen, learning is internal, and performance is external".

Generally, the role of the teacher can be categorized into:

- Traditional Role - Teacher-Centered
- Modern Role - Facilitator (Student-Centered)

There has been a change from the Traditional role to the Modern role in the present context. The learning increases when the teacher builds on the previous experience of the student. However, individual's learning differs and each individual learns at his or her own pace. Identifying the slow learners and individual attention of the teacher may be required. Thus, effective learning is to a great extent based on experiences. Direct experiences are student centered and participate in problem-solving, while, in indirect experience, the contents are carefully designed and organized by the teacher (Levy Nahum, Mamlok-Naaman, Hofstein & Taber, 2010).

Learning is a relatively permanent change in behavior. According to Ngam (2015), learning refers to the ways and means by which learners acquire changes in behavior, improve performance and reorganize thinking. It is a lifelong process that begins at birth and probably even before and continues in one form or the other throughout our lives. It is the process of learning new things and developing new abilities. It is simple to concentrate on formal schooling that occurs in childhood and early adulthood when you think of learning. Learning, however, is a continuous process that happens all throughout life and is not only limited to the classroom.

Due to environmental, historical experiences, emotional, and cognitive aspects, learning is one of the normal daily human activities. Therefore, any change in behavior that is proportionately permanent as a result of experience and effort is defined as learning. It is significant to remember that changes in behavior can be either positive or bad. As a result, there are two types of learning. Learning is an activity, whether it is mental or physical (Bandura, 1969). According to Alqahtani & Rajkhan (2020) different aspects of the learning process include change, actions, engagement, problem solving, and experience. Learning benefits people in many ways, including:

- Conformity - By adopting similar behaviors, ideas, and attitudes, a learner adopts group thinking.
- Discovering one’s passions or hobbies requires learners to attempt new things or take calculated risks.
- Making a difference - A student actively seeks out solutions to difficult problems by tackling them and acquiring knowledge, skills, and concepts out of a desire. The learner stands out because of this circumstance.
- Self-awareness: This is the ability to recognize one's own abilities, passions, strengths, aspirations, personality, and how others see one (Alqahtani & Rajkhan, 2020).

Other purposes of learning include motivation, planning, paying attention, evaluating, and activating prior information. All of these features and capabilities enhance human survival and quality of life.

8. PLAN OF WORK

The introduction consists of context and justification for choice of topic, the research problem, literature review, and statement of the research problem, research question, hypothesis, Objective, the theories used, the methodology, method of data analysis adopted and conceptual framework. Part one entitled ICT pedagogic integration in competency-based approach in Cameroon secondary schools consists of chapters one, two, and three. Here, hypotheses one and two are validated. Chapter one presents ICTs in secondary school curriculum, chapter two the pedagogic use of ICT in Cameroon secondary schools while chapter three presents ICT infrastructures and its influence on the CBA teaching learning method in Cameroon government secondary schools. Part two, on the other hand, is entitled E-learning and competency-based instruction. Here, there are three chapters: chapter four, five, and six. E-learning, competency-based instruction in Cameroon government secondary schools is analysed in chapter four, computer-based direct instruction and CBA teaching-learning methods in chapter five, and the outcome of e-learning on CBA in chapter six.

PART ONE

LEVERAGING ICT TO ENHANCE COMPETENCY-BASED APPROACH IN CAMEROONIAN SECONDARY EDUCATION

CHAPTER ONE
POLICIES, FRAMEWORKS, AND PEDAGOGICAL STRATEGIES FOR ICT IMPLEMENTATION IN CAMEROON'S SECONDARY SCHOOLS

ICT usage in Cameroonian secondary schools is an issue related to the way teachers employ the various ICT tools during the teaching and learning process. Many dimensions were examined in an effort to provide a response. These various facets of ICT's educational use in schools were looked into. It became clear from the responses from the teachers utilizing the interview questions and focus group discussing (FGD) that there are three broad categories of users for the pedagogical tools in these schools. Teachers who recognized the value of these tools in the teaching and learning process took it upon themselves to use ICT tools pedagogically in their classrooms, making them active users. Additionally, some teachers used ICT tools pedagogically in the teaching and learning process by using the tools to prepare their lessons and delegating student research and information-seeking tasks. Further research reveals that some of the teachers were not ICT tool users since they acknowledged that they did not see a necessity for these tools in the teaching and learning process.

The Ministry of Basic Education of Cameroon (2004) identified three key elements of the competence to be taught: subject competence (knowledge), transversal competence (knowledge resulting from all the subjects in a child's learning), and life competence, which is the result of the development of the appropriate attitudes, behaviors, and problem-solving skills for real-life situations. For his part, Arce, Miranda & Ruiz, (2022) describe the CBA's objectives and their nature. To them, goals are divided into precisely defined sub-goals so that teachers and pupils can both see how they are progressing. According to Arce et al. (2022), each approach requires particular teaching resources in order to achieve the goal of its basis. Therefore, for the CBA to be implemented successfully, the instructional materials must be those that can inspire students and convey information in an engaging manner, bringing in real-life scenarios and cultural information, giving students real-world exposure to the target

language, and meeting the learners' needs. The learner-centered strategy, which places emphasis on the learning process, is one that the CBA supports. Some characteristics of a learner-centered approach are highlighted by Field and Drysdale (1991), including the use of customized resources, adaptable learning schedules, and ongoing feedback.

In this context, CBA implementation should make sure that the learning process incorporates all facets of a learner-centered approach. Therefore, the CBA's Learning Environment is focused on helping students enhance their competencies at the conclusion of any study program (Nembaware, Glasser, Priest, Davies, Skelton, Bodzo, & Dandara, 2022). The goal of the CBA is to give students the knowledge, abilities, and attitudes they need to succeed in the workplace and in everyday life. The CBA, according to Nembaware et al. (2022), is based on three main goals: first, it emphasizes the competences that students must possess at the conclusion of each academic year and during their time in compulsory schooling, as opposed to emphasizing what teachers must teach.

To bring their students up to the required level, they should secondly arrange the learning objectives in the best way possible. Thirdly, give the student the responsibility for learning, requiring them to develop their own knowledge using resources made available by the teacher. According to Boutin (2004), the student transforms into a learner who must come up with their own ideas first, have a thirst for knowledge and education, plan assignments utilizing new technology, adopt new teaching strategies, and seek out new data. The new role of the teacher entails encouraging students to learn and giving them some of the responsibility for task preparation. Knowledge acquisition must be facilitated but not mechanically transferred.

According to CBA, a teacher's job should change from that of an expert who imparts knowledge to that of a coach who supports and directs the learning process (Biemans, Nieuwenhuis, Poell, Mulder & Wesselink, 2004). This means that teachers that use this method encourage students to be creative, ensure that events are planned and organized, and offer suggestions without pressuring students to adopt them. Instead of merely delivering information, the teacher must actively promote the learning process. As stated by Zineb, Soumia, Souad, and Karim (2017), the instructor should

employ a didactic strategy based on the support of active learning, including group work, presentations, and self-study, when implementing the CBA. Anane (2013) asserts that CBT or CBA necessitates a different method of instruction, evaluation, and certification. This is so because the CBA differs conceptually from the conventional system. It is founded on clearly stated, business-focused competency standards. The training and education are more geared toward the learner. This indicates that learner-centered learning is prioritized above teacher-centered learning. Anane further emphasizes that a variety of facilitation techniques are used for the CBT programs, including direct instruction, discussion, small group, and problem-solving techniques, and that teachers learn about CBA through seminars, workshops, and research.

ICT changes teaching and learning through its potential as a source of knowledge, a medium to transmit content, a means of interaction and dialogue (Jenkins, Teaching for tomorrow 1999). In this technological age, the eductational institutions need not just impart knowledge to individuals, but enable them to change into lifelong learners as seen in Cameroon educational system. Keeping in view its importance in education, initiatives taken, Legal and Policy development, and difficulties in implementing ICT in Cameroon educational system are therefore examined.

1.1. Initiatives Taken to Integrate ICTs in Schools

Cameroon is among the Sub-saharan African Countries that are making enormous progress in the use of ICTs in various development sectors, including education. This innovation played an important role in ameliorating the Cameroon educational system given that ICT deals with hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information and other related services. Between 1998 and 1999, private efforts were made in private mission schools like College Francois Xavier Vogt to use ICTs in education while it was in 2001 that they were introduced in Public schools of Cameroon. In secondry schools, ICTs were actually introduce in 1998 but only became operational four years later with the setting up of the general inspectorate in charge of Computer Science (Fouda N. et al., 2013). The fact that no specific policy was given to guide the teaching or use of ICT in education, private schools applied their own teaching method or

programme. It is important to note here that before the ministries of education could provide the ICT curricula, several private primary and general and technical schools in major cities of Cameroon had acquired computers and begun providing online ICT courses and with ICTs (Karsenti, T. et al., 2012). It was later in February 2001 that the President of the Republic of Cameroon called for the orientation of education toward the knowledge economy in his address to the Cameoon youths. This therefore led to the official introduction of ICTs in General and Technical Secondary Schools. Since then, many schools have been receiving presidential grants in the form of Multimedia Resource Centres with Internet connection (Mbangwana, 2008).

Government's involvement in the area of ICTs seriously began with the development of the policy document and the general strategy for the integration of ICTs in all sectors. This was done through the National Agency of ICTs (ANTIC) and the setting up of Multimedia Resource Centres in some primary schools like "Ecole des Champions" of the Chantal Biya Foundation and secondary schools such as Lycée Leclerc Yaounde, Government Bilingual High School Yaounde, Joss Douala.

By 2023, official ICT programmes for secondary schools were conceived and ICT syllabuses and National Sequential Schemes of work published in 2008 were made available to Nursery, Primary, and Te acher Training Education (ERNWACA-Cameroon, 2005). Textbooks have also been written and validated by the National Book Commission to facilitate the teaching of ICTs (ERNWACA-Cameroon, 2008). République du Cameroun (2007) also made mention of the draft strategy to implement the national ICT policy in basic education which was applicable from 2007-2015. This strategy was targeted at training teachers and head teachers on the importance and how to use ICTs in teaching and learning as well as in school administration. Based on training objectives, national guidelines were based on six modules for each level including skills, knowledge contrsruction skills, health and safety issues related to ethics and equity (Republique du Cameroon, 2007).

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

2013). In 2007, the field of Computer Science and Educational technologies were established at the Higher Teacher Training College (HTTC) Yaounde to train general secondary school ICT and Computer Science teachers. The following year, a similar field was established at the Higher Teacher Training College Maroua in the Far North Region of Cameroon. In 2009, an information management system was set up at the Higher Teacher Training College Bamenda, so as to train technical secondary school teachers. This led to the institution of Information Technology as a school subject in January 2011, which became effective in February of the same year. Information Technology was therefore introduced as a compulsory subject in all MINESEC official examinations.

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

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

Also, MINESEC in partnering with MTN foundation based on the 2013 partnership agreement (Camerpost, 2013), launched the first competition in 2014 to rewad teachers who integrate ICTs in teaching techniques and methods to improve learning. The competition was aimed at motivating both public and private secondary school teachers nationwide in the use of technology without discrimination, to stimulate

the quest for research in innovative teaching methods and contribute toward achieving quality education (Wong C., 2015). Despite apparent challenges such as connecting more Cameroon schools to a nationwide network and internet, providing schools with technological resources, training more teachers and financing ICT integration projects, there exist success stories like that of schools as "Les Champions" of the Chantal Biya's Foundation, situated in the Centre Region. This school can boast that all students are provided with computers (Karsenti, T., 2012). The setting up of SIGIPES (Système Intégré de Gestion Informatisée du Personnel de L'Etat et de La Solde) that is, Integrated Computerized State Personnel and Payroll Management System, handles personnel and payroll data. It alsso handles online registration system for the competitive entrance examination into the Higher Teacher Training College and the online registration of both old and new students at the University of Yaounde I has been operational since 2011 and 2012 respectively. Multimedia Resource Centres (MRCs) have been setup in Universities and professional schools and in some public secondary schools in Cameroon. Also, the training of monitors who manage the MRCs, the creation of platforms for learning, the interconnection of the eight state Universities and the establishment of training departments in professional schools and Universities and most are now operational. What is most promising is the continuous training of teachers both in the use of ICTs in teaching as a tool and as a discipline in the various Teacher Training Colleges.

Furthermore, there are main bodies in charge of ICT Education in Cameroon. These include MINEDUB, MINESEC, the National ICT Agency (ANTIC), and NEPAD which is a non-Cameroon government organisation. MINEDUB and MINESEC have been carrying out remarkable projects since the introduction of ICTs in schools under their ministries. MINEDUB has been working through PAQUEB (Projet Pilote pour L'Amélioration de la Qualité de l'Education de Base) that is, Pilot Project to improve the quality of Basic Education concerning the implementation of the one laptop per child project in Cameroon. MINESEC, on its part, has been opening multi media centres and it can now boast that, 80 percent of secondary schools have computer rooms and 60 percent have computers (GRID, 2014). ANTIC drafted the first national policy for the development of ICTs in 2007. This National ICT Agency

(ANTIC), is in charge of cyber security, cyber-crime and fraud related issues. It also lays down rules and recommendations for schools and parents to use in preventing children from accessing illegal and immoral contents by setting and blocking undesired websites. The New Partnership for Africa Development (NEPAD), a non-Cameroon government organisation is in charge of the e-schools project in Cameroon. The e-schools initiatives operate in many African countries with the aim of providing primary and secondary school puipils and students with ICT skills and knowledge in order to enable them to be competent in the emerging information society (GRID, 2014). This can be justified by the fact that we are operating in the 21st century or computer age whereby students are supposed to meet up with the technological demands.

1.2. Legal and Regularity Framework

According to World Bank (2011), the project for introducing ICTs in schools was given an impetus by two presidential statements in 2001, which brought ICTs into the realm of education at all levels of schooling. These statements made it clear that imported computers and their accessories were to be duty free for schools. Moreover, the World Bank in its ICT task force policy has raised the concept of cyber education in the global school system to promote the development of computer technology, improve the accessibility of learners to IT, and to encourage digital inclusion in developing countries. Consolidating the presidential statement and the world teaching computer science at all levels to design and develop a project on cyber education in Cameroon, which was implemented in April 2001.

In 2004, key strategies on using ICTs in education were highlighted in the first official draft of the Cameroon National Information and Communication Infrastructure (NICI) policy and plan prepared by the United Nations Development Program (UNDP) and the United Nations Economic Commission for Africa (UNECA) and (NICI, 2004-2015). In this document, the Cameroonian government recognises ICTs as a national priority along with education, health, forestry, and governance. As indicated in the NICI plan document, the government has resolved to achieve the following:

- Modernising the educational system through the introduction of ICTs in schools;
- Introducing ICT application training modules into national universities;
- Preparing a sectoral ICT policy for the educational sector;
- Training teachers in the use of ICTs;
- Equiping all schools with ICT facilities;
- Multiplying pedagogic resource centres for teachers and students;
- Establishing distance training facilities ;
- Providing support for the production of ICT teaching materials.

The plans are implemented in the framework of two projects:
one on cyber education, and another that concerns higher education (universities and professional training schools)- (From The Ministry of Secondary Education). Also in June 2005, the Prime Minister of Cameroon signed a decree creating and organising the national sub-committee for the integration of ICTs in education (Prime Minister's Decree no 087, June 2005).

1.3. Policy Implementation and Development

The implementation phase started in 2001 and since then, the government of Cameroon has signed a number of decrees to pave the way for the introduction of ICTs in education. In 2002, a ministerial decision defining the condition for the creation of MRCs in government secondary schools was published. Then in 2003, a decree introducing ICTs in education was published by the Ministry of National Education (presently, the Ministry of Secondary Education). The decree made it clear that ICTs would become an obligatory discipline beginning in September 2003. The Ministry of Secondary Education was recognised to include a new unit called CAAP, the National Pedagogy Support Unit (Cellule d'Appui à l'Action Pédagogique). CAAP is equipped with a distance training unit called Unité de Fornation à Distance (UFAD) and is expected to ensure the training and capacity-building for teachers, which includes distance learning.

Several factors influenced the implementation process. Some of them include budget availability, week linkages between stakeholders and project management, and

co-ordination. There is no specific board or organ in charge of the co-ordination of the global cyber education project in Cameroon. Stakeholders seem to be evolving independently, thus resulting in some ignoring what others are doing. Regarding the development of ICT policy in Cameroon, it was decided that an all ICT policy would be prepared for the educational sector. Stakeholders are therefore in need of adequate co-ordination and technical support to design and adopt a specific policy.

1.4. Pedagogic ICT implementation in Cameroon Educational System

Today, a characteristic feature of the development of modern society is the growing importance of information, which is becoming a comprehensive and inalienable resource. Work with information has become the main content of almost any type of activity, including in the field of education (Béché, 2014). Intercultural communication and the widespread use of ICT in the educational process should become inalienable conditions in achieving modern professional quality in the training of specialists with high spiritual, cultural, creative search, and social activity (Béché, 2014).

The integration of ICT in education has become an intriguing area of study thanks to social, economic, and technological advancements (Béché, 2017). The World Links Program was designed with the idea that technology might be used as a crucial instrument in improving educational performance and reducing the digital divide between developed and developing countries in an effort to equip young people to enter and participate in the global economy. The World Link Programme, according to Kozma, McGhee, Quellmalz & Zalles, (2004) was first launched in the 1990s with the main goal of assisting schools in the provision of ICT tools and educating teachers in order to promote the integration of ICT into education, particularly in poor countries. This program has significantly increased the pedagogic use of ICT in various African nations, including Zimbabwe, Mauritania, Senegal, Mauritania, South Africa, Ghana, and Mozambique.

Following the launch of the program, a three-year evaluation of the World Link research on the program using a variety of sources was carried out between 1999 and

2000. The results of this study showed that poor countries can make major educational advances when technology infrastructure is created, followed by training programs for teachers on how to use these ICT tools pedagogically in their classrooms. To evaluate a three-year plan for ICT integration in schools, Desai (2010), Nzépa & Keutchankeu, (2012) started a research effort that was also continued by World Links Development. The goal of the world link training methodology employed in this study was to equip instructors with the pedagogical understanding they need to incorporate ICT into their courses and enhance students' learning through cutting-edge technological instructional techniques. Research findings indicated that the implementation of this program provided an effective outcome in the classrooms and school participation (Raviya, Dave & Tiwari, 2020).

Following the completion of the Multimedia Portable for Teachers Pilot (MPTP) project by the University of Nottingham School of Education in 1998, Fisher, Higgins, and Loveless (2012) undertook a study to determine the effects of ICT implementation. Throughout the initiative, instructors received ICT training on how to utilize the computers at their schools and how to effectively use the Internet for teaching and learning. The program's primary goal was to boost teachers' competency and confidence in using ICT in the classroom. After the MPTP project, 98% of teachers who participated in the project made effective use of ICT in the teaching and the learning process (Fisher et al., 2012). Self-confidence and competence increased remarkably as teachers were able to use ICT in their classrooms with little or no problems. Therefore, they noted that the MPTP program was hugely successful as many teachers confirmed the positive changes ICT has made in their profession.

Studies conducted on the effectiveness of teaching practices in the United States, first, about fifty years ago, and then in Europe and France, show that student performance is not unrelated to the practices of teachers, which in a way is reassuring. Indeed, some teaching practices are more effective and equitable than others. In Cameroon, the educational policy has gradually refined its teaching practices. Less than 7 years ago, we were talking about the OBA. Teaching is now organized and favors a convergence of efforts toward the achievement of these objectives. Goal-based teaching

defines precisely what is expected of students. It is based on the Taylorian conception of the world of work of the time (Carrette and Rey, 2010).

Objectives express what the teacher values and the level of cognitive ability expected of learners. Thus, these objectives direct the way in which the learner can accomplish a certain self-assessment as well as develop the ability to set goals for himself or herself, following the example of his or her teachers, which will serve him or her during his or her life-long learning skill. But with the work of Piaget, we realized the limits of the OBA, hence the shift to the CBA. The CBA favors the development of learning based on authentic situations and complex problems. It implies the use of cognitive models of learning skills. It encourages the development of a reflective and intentional professional practice by requiring teachers to provide explicit cognitive guidance and recurrent feedback activities.

With the advent of ICT, education has undergone a major revolution. Hardware and software tools have been developed to help learners better develop their skills in learning a specific subject. Among these tools, we find what we will call courseware. According to the Larousse dictionary, a tutorial is a software program specialized in the teaching of a discipline, a method, or certain knowledge and used in computer-assisted teaching. The goal is for this educational software to complement normal teaching in a classroom situation and not bypass it. With the expansion of technologies, the need to train in the use of this new tool will become more pressing. Pedagogues will therefore focus on this point in order to produce tutorials to help learners to better handle the computer tool.

The study review showed that training and skills improved how teachers performed in ICT and integrated skills in classrooms. However, their perceived efficacy and actual application of knowledge were affected by resistance to change to the new curriculum. The authors recommend strategic leadership as well as effective curriculum design and innovative pedagogies to sustain outcomes.

Another important factor in teachers' roles regarding ICT is to employ it in their classrooms. ICT only has instructional value when teachers actively incorporate it into classroom activities, according to this statement. Therefore, teachers must integrate ICT

into their classes and actively involve students in utilizing ICT in order to shape good student attitudes about technology and help them see it as an engaging and entertaining tool that saves time and effort (Niba, 2022). In Cameroon schools, studies revealed that there are variations in the employment of ICT by teachers in schools. This is due to factors such as the schools' condition. However, it seems that Cameroon teachers are not applying these tools in their classrooms for reasons such as they feel there is no coordination and collaboration in a school setting concerning ICT implementation as well as no administrative support; and even if this support is available, it is not sufficient. Furthermore, they are rarely rewarded for their initiatives (related to ICT). There is no well-defined conception of a teacher that is capable of integrating ICT into a subject domain.

Teachers' reluctance to use ICT tools in classroom activities is explained by a variety of obstacles, including their competence, school digital infrastructure, and access to ICT tools. Hence, teachers lacking ICT skills are enthusiastic about using computers in their teaching practices and integrating supplementary learning, which creates a vicious cycle precluding full-scale ICT integration in education (Lyonga, Moluayonge & Nkeng, 2021).

The teacher's role in attaining this depends on their confidence in using ICT. Pedagogical use of ICT has three main concerns: availability of information and knowledge, the independency of time and place, and collaboration opportunities to work under different conditions. This study employs this principle to investigate these factors and to what extent they can be used to form the study framework by reviewing teachers' views concerning the value of using ICT in teaching, the ICT teachers' competencies, the pedagogical challenges of using ICT in teaching and the future of ICT in pedagogical use. The following section discusses the ICT external factors (Akongoh, 2021).

It is important to remember that the educational process includes the utilization of informal, community-based, lifelong, oral, narrative, collaborative, and non-formal methods. Since it concentrated on providing knowledge, skills, and attitudes for immediate consumption, it responded to societal requirements. Regrettably, educational

innovations over the years seem to disregard their historical roots in much the same way that colonial education policies downplayed and neglected African cultural practices and knowledge that shaped indigenous education (Tambo, 2000). According to Tamanji (2011, p. 320), colonial formal schools were established in Cameroon as a result of the "cooperation between the colonial rulers and the western Christian Missionaries". As a result, Cameroon's formal education is intertwined with the West through trade, evangelization, and colonization. Its development can be followed or explained in terms of the significant turning points in the nation's political history.

Stienen (2007) asserts that ICT can enhance educational quality when teacher-educational materials are completely developed and when ICT is supported and utilized in school operations. Different educational projects covering topics including teacher preparation, the creation of instructional materials, and school administration from the basic to tertiary sectors were carried out in some developing nations to assist this project. Additionally, these countries' ICT educational strategies were developed in collaboration with International Institute for Communication and development (IICD) (Stienen, 2007). Most projects strive to integrate ICT into the educational process in a far more sophisticated way than simply using it to enhance the conventional instructional method. Given that instructors and students were the most active participants and benefited from these activities, data from the IICD-supported projects demonstrated an overwhelming impact on them. It was discovered that students and teachers had a very high score for awareness and empowerment of ICT use four years after the execution of the project. The diverse studies also demonstrated that the numerous ICT integration initiatives implemented in these schools in developing nations have had a favorable effect on the education for all (EFA)'s universal objectives for education access. Zhao and Cziko (2001) also looked at efficient ways to integrate ICT into the classroom, highlighting the critical role that efficient ICT use plays in the teaching process. They claimed that the use of ICT in the classroom wouldn't disrupt or distract from students' ability to learn. Teachers have control over ICT when they develop self-belief in it as a powerful teaching instrument.

The successful professional development of teachers, according to Mishra and Koehler (2006), emphasizes specific classroom applications of general pedagogical ideas, exposes teachers to real-world situations, provides opportunities for group support and collaborative practices, and includes careful evaluation and feedback. According to them, computers must be included in the curriculum as a tool that may support the study of other disciplines if they are to have a substantial impact on the teaching and learning process. To make this transition, pre-service and in-service programs must be skilfully planned so that instructors are given the knowledge and abilities necessary to integrate ICT in their classrooms.

One way in which teachers demonstrate their ideology is through the use of ICT tools (Farmery, 2014; Mohajan, 2017) and so consideration of behaviorism and constructivism is particularly pertinent to this study. Dillon (1998) provides a comparison of the main viewpoints,

Table 6: Behaviorist and Constructivist Viewpoints

Behaviorist	Constructivist
An objective view of knowledge;	A provisional view of knowledge;
Serial structuring of material and program control;	Flexible approaches to interaction with equipment;
Regular review and testing against pre-specified criteria.	Attention to the social context of learning.

Source: (Dillon, 1998)

Although this comparison appears to indicate that either position is compatible with the use of ICT in teaching, often the use of technology reinforces behaviorist pedagogy (Attwell & Hughes, 2010). The use of 'drill and practice' software and the use of technology enhance teacher presentation support behaviorist pedagogy, and so

behaviorist pedagogy is viewed as knowledge instruction and constructivist pedagogy as knowledge construction (Castells, 2010).

Warioba, Machumu, Kulunga & Mtweve (2022) describe greater technology adoption as moving from an industrial to an information society and, while these ideas may be contested, they imply a move from a manufacturing economy to a 'knowledge' or 'information-based economy (Erfan, Sulisyaningsih & Syakur, 2022; Castells, 2010).

Table 7: Expected Changes in Education from Industrial to Information Society

Actor	Education in the Industrial Society	Education in the Information Society
School	Isolated from society Most information on school functioning confidential	Integrated into society Information openly available
Teacher	Initiator of instruction Whole class teaching Evaluates student Places low emphasis on communication skills	Helps students find appropriate instructional path Guides students' independent learning Helps student to evaluate own progress Places high emphasis on communication skills
Student	Mostly passive Learns mostly at school Hardly any teamwork Takes questions from books or teachers Learns answers to questions Low interest in learning	More active Learns at school and outside school Much teamwork Asks questions Finds answers to questions High interest
Parent	Hardly actively involved in the learning process No steering of instruction No life-long learning model	Very active in the learning process Co-steering Parents provide model

Source: (Warioba et al., 2022)

Warioba et al. (2022) view of education in the information society is particularly pertinent to this study. The discussion of pedagogy relating to the use of ICT frequently centers on constructivism and behaviorism (Mohajan, 2017). Anselmus Dami,

Butarbutar & Kusradi (2022) describe these philosophical standpoints as characterizing how teachers and students interact and equating behaviorism with a teacher-centered model of teaching and learning and constructivism as a student-centered model. Constructivism, often described as based on the ideas of Piaget (1977) and Vygotsky (1978), is defined by Duffy & Cunningham (1996, p. 171) as: “Learning is an active process of constructing rather than acquiring knowledge and instruction is a process of supporting that construction rather than communicating knowledge”.

The effective integration of ICT alongside the curriculum is associated with a new pedagogy that changes the role of the teachers and increases students’ control of their learning, self-regulation, and collaboration. This presupposes a shift from traditional lesson formats, based on transmitting information philosophies, towards student-centered approaches that promote active engagement, help them to control their learning, and support collaborative learning and meaningful understanding (Baydas & Goktas, 2017).

According to Almekhlafi and Almeqdadi, (2010); Aydin, (2013); Sipilä, (2014); Choy and Ng, (2015), the effective implementation of ICT in education depends on teachers' positive attitudes toward ICT integration into schools and ICT utilization in their instruction. ICT integration in the classroom, decisions made, and actions taken in classrooms are influenced by teachers' attitudes toward using ICT (Shaibou, 2015).

Even though ICT in Education has the potential to improve education, instructors in Cameroon have not always used it to its full potential (for instance, due to a lack of training or resistance to change). This presumably results from Cameroon’s lack of attention to ICT. For instance, nothing was spoken about the employment of ICT in schools during the 1995 National Forum on Education, which was held in Yaoundé, the capital of the nation, from May 22–27 (Mbangwana, 2008) On the other hand, the Law of Orientation of Basic and Secondary Education (Law No. 98/004 of April 14, 1998), which is largely based on the suggestions of the National Education, acknowledges in general the potential contributions of ICT in education. The education delivered in schools *must consider scientific and technological advances and shall be fitted in terms of content and technique, to national and worldwide economic, scientific, technological,*

social, and cultural trends, according to Section 25 (Part III). The president of Cameroon formally integrated ICTs into the secondary education system in his address to the young in February 2001, urging students to join the knowledge economy (Mbangwana, 2008).

The numerous issues that afflict secondary education in Cameroon have begun to be addressed by this program, including severe shortages of fundamental pedagogical materials and human resource inputs, crammed classrooms, relevance and quality issues, and insufficient access, among others. Some of these issues could be solved by utilizing ICT. ICT, for instance, can increase equity, access to education, and the standard of teacher professional development (Robinson, 2008; Mervyn, 2002). Despite the existence of all these initiatives, there is still no distinct, recognizable national strategic plan for the incorporation of contemporary technology into educational programs and practices. The leadership of the school and the teachers' dynamism and passion are the two main determinants of ICT use in secondary schools in Cameroon.

ICT policies have been adopted by several secondary schools, and implementation is underway. The use of ICT in classrooms has been the subject of extensive educational research in various nations, although the findings were largely context-specific due to population, sampling, or design constraints. In other words, due to the changes in the setting, the results cannot be extended to Cameroon. In addition to the environmental factors, participant differences could prevent certain conclusions from being applicable. Due to the recent introduction of contemporary technology into their classrooms and the varied cultural backgrounds of the teachers, Cameroonian educators have varying experiences with modern technology (Shaibou, 2015). However, there is no research on teachers' use of ICT in secondary schools in Cameroon.

ICT is not a magic bullet for all educational issues, but it is an indispensable instrument for teaching and learning. Teachers require views of the technologies' potential, opportunities to apply them, training, just-in-time assistance, and time to experiment in order to use them effectively and efficiently. Only then can teachers be knowledgeable about and comfortable using new technologies (Murithi & Yoo, 2021).

In the modern age, where knowledge is developing quickly and much of it is accessible to both students and teachers at the same time, teaching is quickly becoming one of the most difficult careers (Bruce & Patala, 2019). Teachers are now required to support learning and make it relevant for each learner rather than just impart knowledge and skills as new notions of learning have emerged. The teaching professions now have more options, but at the same time, there are greater demands on teachers to learn how to integrate this new technology into their lessons (Avdeeva, Zaichkina, Nikulicheva & Khapaeva, 2016). In order to meet these difficulties and keep their employment, teachers must continually retrain and pick up new knowledge and abilities (Bisht, 2013).

Today, a range of ICT makes the learning process itself easier as well as the delivery of education. Additionally, ICT can encourage global networking and collaboration in education and professional growth. A variety of ICT tools, including videoconferencing, multimedia distribution, and websites, can be used to address the issues that teachers currently face. In reality, there is mounting evidence that ICT might be able to give modern teachers more adaptable and efficient means of pursuing lifelong professional development.

The organization, content, and delivery methods of traditional initial teacher education programs as well as in-service continuing education courses are rapidly changing across the globe as a result of the ICT industry's rapid development, particularly the Internet. However, both basic teacher preparation and in-service training institutes find it challenging to integrate new technologies with good pedagogy.

New technologies have an impact on every aspect of our life. This is especially true when it comes to the use of ICT in classroom instruction. Since many tasks have historically been completed without the use of ICT, the question of what value ICT contributes to education emerges. ICT may supplement, assist, and facilitate the entire curriculum, according to Gaboy, Mabalay, Mananghaya, Mercado & Romblon (2020). However, merely introducing ICT into teaching and learning is not sufficient. Teachers should be skilled and knowledgeable in order to appropriately incorporate ICT into their teaching and learning practices (Mercado & Ibarra, 2019).

According to Shulman (2004, p. 201), there are three types of knowledge: "content knowledge, pedagogical knowledge, and pedagogical content knowledge". The term content knowledge describes the standard and arrangement of knowledge in educators' mental processes. To properly teach the subject, teachers must possess the necessary content knowledge (Ball, Thames & Phelps, 2008; Mishra & Koehler, 2006b). Pedagogical knowledge is the ability of teachers to choose effective techniques for imparting content to students.

Ball et al. (2008) say that since displaying is the first step in teaching, visual aids must be used to explain ideas so that students can view the items as they would in the real world. Pedagogical content knowledge, also known as specialized content knowledge, is a blend of topic and pedagogical expertise (Shulman, 2004). When teachers are able to build on students' past knowledge and modify their teaching techniques to effectively impart new material to students, pedagogical content knowledge is obvious (Mishra & Koehler, 2006b).

The aims of teaching-learning pedagogy can be achieved by combining ICTs with forums, services, tools, technologies, information, knowledge, etc. These technologies can also be utilized to improve performance. ICT has benefited the entire cosmos. Access to education, fairness in education, high standards in school, effective instruction, as well as administration and governance. Information, communication, quality, efficiency, effectiveness, reusability, ease of understanding, science, and education are some of the key components of ICT that can be focused on while using it. Today's generation is becoming more and more interested in learning about sciences and technologies, and appropriate practice has progressed from being *technology-driven* to *service-driven*. The entire educational system has evolved into a cutting-edge learning environment. However, it is anticipated that the desired goals will be accomplished after the computer technology, local area networks, and the information management system are built. This is especially true in schools in rural and isolated places. The intended results have not been attained despite having clear and thorough planning, a well-built technical support system, and design.

It is true that the introduction of ICTs in schools has produced important transformations in the level of educational systems. Indeed, the conclusion is that the appropriate use of these technologies in education brings multiple benefits (Munyemana, Nsanganwimana & Gaparayi, 2022). In other words, the successful integration of education can contribute to the improvement of the quality of teaching and quality of teaching and learning, increase the rate of academic success rate, and to strengthening the motivation to learn and perseverance in the efforts made by learners (IICD1, 2007). However, several conditions are required for the success of any ICT in education projects. The integration of ICT in schools requires, first, the installation of technological materials and equipment, as well as full software and educational content (OECD, 2001). In Africa, for example, the main obstacle to the use of ICT in education is the lack of software, computers, electricity, etc. (Karsenti, 2009).

While the availability of ICT materials and equipment, in sufficient quantity and quality, is an essential prerequisite for the successful integration of ICT in education, another very important factor is the professional development in ICT of educational stakeholders, as well as their ability to use ICT effectively in their teaching practice. In other words, the effective integration of ICT in education requires these actors to acquire new technological and pedagogical skills related to the new role and new learning practices. In particular, the acquisition of skills or lack of skills among teachers is the most important factor influencing the success of any pedagogical integration of ICT in any ICT pedagogical integration project (Alwani & Soomro, 2010; Pelgrum & Law, 2004).

ICT Competency for teachers was published in 2011 by UNESCO. This product is the result of collaboration between UNESCO and its partners, CISCO, Intel, ISTE, and Microsoft. The overall objective of this repository is to set standards for the assessment of information and communication technology skills for teachers. It is organized according to three different approaches to teaching and consists of three successive stages of teacher training. The first one is about basic ICT skills, namely the acquisition of digital literacy, as well as sufficient means to enable teachers to make the

best choice and use appropriate software and digital content for learning situations in the classroom, in the multimedia room, or in the computer room.

The acquisition of this first area of competence enables teachers to use ICT in their professional tasks, for example in searching for resources on the Internet to improve their courses. The second approach is to deepen the knowledge of teachers and includes the ability to manage information management and integration of discipline-specific software tools in a student-centered pedagogical approach to enable learners to acquire the skills necessary to solve more problems that are complex. This approach also aims at acquiring skills that enable teachers to work in a network to help students in their collaborative projects and collaborative online projects. The approach concerns knowledge creation and aims at the acquisition by teachers of skills that allow them to design digital learning resources, and help students, using ICT, to acquire the skills necessary to work collaboratively, create new skills, and exercise critical thinking. Teachers must therefore be able to structure and design learning situations in which students apply these skills. As a result, the classroom and therefore the school becomes a learning community based on innovation, training, and the creation of new knowledge.

The importance of technology in education has drawn the attention of educationists since the beginning of motion pictures in the early 20s, but computers were accessible to teachers and students only in the mid-70s when they were introduced in education (Brush cited in Hew &Thomas, 2007). From that time to the present, research has shown that a curriculum that integrates technology has lots of advantages. Some of these advantages include the motivation and improvement of students' learning (Wanji, Amvongo-Adjia, Koudou, Njouendou, Chounna Ndongmo, Kengne-Ouafo... & Bockarie, 2015). This belief in the efficacy of technology in education has led many governments to set up programs to integrate technology into their education systems. It is for the same reasons that Cameroon has also been making attempts to integrate technology into its curriculum since 2001. However, this zeal is yet to be successful due to common barriers that usually affect even developed nations like the United States and other developed countries that are believed to be experts in the use of technology in education (Becker 2000). One such barrier which is a very important aspect of

technology integration into education and common in most Sub-Saharan African countries like Comoros, Congo, Guinea, Lesotho, and Madagascar, and Cameroon in particular, is the absence of a clear vision and planned strategy for ICT integration in Education (Wallet & Beatriz, 2015). Others include the lack of technological resources, the lack of knowledge and skills as well as the attitudes and beliefs of teachers and parents.

1.5. Difficulties in implementing ICTs in Cameroon Educational System

There are so many constraints still facing the integration of ICTs in education in Cameroon despite the legislation establishing ANTIC. These include Institutional challenges, Training and Capacity-building, Sustainablity, and Infrastructure.

Regarding the institutional challenges of ICT integration in Cameroon education sector, it is observed that there are no fewer than eight governmental players claiming authorship or supervision of national ICT policy. The results are power struggles and subsequent appeasements, which has a negative impact on ICT-related educational projects and programmes. This also explains why stakeholders have not been able to reach a consensus on the preparation of a sectoral policy on ICTs in education and on distance learning.

Training and Capacity-building of teachers constitutes another constraint in implementing ICTs in Cameroon educational system. In secondary schools, between 2003 and 2010, there were no qualified teachers except part-timers. These part-timers were either graduate students in Computer Sciences or teachers of other disciplines like Mathematics, Physics, who had little or no knowledge on Computer Science pedagogy. Fouda et al. reveals that since the 2010-2011 academic year, Higher Teacher Training Colleges train 300 Computer Science and ICT teachers to cater for a student population of more than 1,200,000; a ratio of 1 teacher for 400 students (Fouda et al., 2013). More and more teachers are now trained in Computer Science and ICT pedagogy. This will obviously increase the number of Compter Science and ICT secondary school teachers in Cameroon.In addition, princpals, in-service teachers of other disciplines and all other staff in the management of education that could constitute relays to disseminate ICTs in the educational system, have no access to professional Training. Heads of institution

and Computer Science, pedagogic Inspectors of other disciplines such as Mathematics, Physics, do not undergo any form of professional training in the use of ICTs that would enable them to take up their new responsibilities (Fouda et al., 2013).

The situation in primary schools is not so different from that of secondary schools. Availabe research reveals that very little or no training has been carried out for in-service teachers to initiate them in the use of ICTs or to improve their skills and knowledge since its introduction in schools in 2001(Annual Repport, 2009, 2010, 2011). In the little cases where it is conducted, it is done in the form of a pedagogic seminar. The one day seminars are held once in a term giving a total of 3 days per academic year, say 18 hours of effective instruction (Nkwenti, 2015). This is absolutely insignificant given that technologies evolve rapidly. The lack of qualified teaching staff is closely linked to the lack of permanent technical assistance in schools with ICT laboratories. As a result, when systems break down, it takes a longer period to repair them and since many classroom teachers do not have the opportunity to undertake professional development, they usually feel frustrated and discouraged when they meet the least challenges.

Sustainabiity constitutes another constraint facing the integration of ICT into Cameroon educational system. Most ICT integration projects suffer sustainability in Cameroon today because little or no budget is allocated for the purchase of technological equipment. For instance, in his country profile report, Tetang (2007, p. 2) notes that :

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

Furthermore, infrastructural insufficiency equally constitutes another constraint facing the integration of ICTs in education in Cameroon. Fouda et al., (2013) noted in their research that the 2009/2010 school year statistics reveal that out of over 1,000 secondary schools in Cameroon, only 100 have the necessary equipment to teach computer science. They further exemplify thatYaounde, the political capital of Cameroon with a student population of 94,267, has only 1,159 computers giving a percentage of 81 students for 1 desktop. On the basis of a 2009/2010 study, only 3% of all public primary schools have computers and 87% of all ICT teaching is theoretical. In some schools, MRCs are installed in inappropriate buildings some of wich have poor roofing systems. There is also a gap between rural and urban areas. Nearly all service providers are concentrated in urban areas. Due to that fact that many secondary schools are established in zones not yet reached by the electric power, some have started teaching ICTs theoretically. Building educational or learning platforms requires establishing adequate equipment to host and maintain educational Websites and training staff to manage electronic data. This is a serious bottleneck for the various educational initiatives, since the educational institutions in general have weak ICT infrastructure. Some do not have Websites, and the existing ones need to be well maintained to ensure that they are permanently functional.

1.5.1. Psycho-pedagogical Implications of ICTs

Computer sciences applied to education have been causing a real revolution in the teaching and learning process. One modality is to computerize traditional methods. Another is to apprehend the computer as an educational tool with which the learner solves problems related to several areas of knowledge. Considering constructivist approach, no distinction exists between subject matter knowledge and pedagogical knowledge because all knowledge is pedagogical in varying ways. Constructivism implies that “knowing” is created rather than transferred. Two ideas emerge from this conception of learning. Learners are active in contructing their own knowledge and social interactions are important to knowledge construction.

In dialectical constructivism, in reflective classroom situations, students interact with other students and with teachers in ways that stimulate both knowledge

construction and cognitive growth. The main aim of teaching, from a constructivist perspective, is not so much to transmit information but to encourage knowledge formation and metacognitive processes of judging, organizing, and acquiring new information. What becomes important for teachers is to understand how students construct and use their understandings. These constructive processes of knowledge growth occur in a social context as a result of interpersonal interactions. Based on these views ICT and the way it can pedagogically consrain or enable particular activities for teachers, reflection and action are required on the ways they incorporate technology, with gender alertness, into their pedagogy.

1.5.2. Deviate from educational purpose

Although the integration of ICT has brought many merits in education, there is still some uncertainty over the merits of educational use. Firstly, there is a danger that students may be confused with the multiplicity of available information from which to choose (Mikre, 2011). Secondly, the prevalence of undesirable websites poses a real threat (Devadason, 2010) in that it is a critical concern that could affect learning and teaching because the teacher has to spend much time trying to control students from using websites unrelated to the learning content, instead of teaching (Devadason, 2011). Furthemore, learners may spend time surfing websites that show pornographic material as they explore the internet. These challenges bring into question the issue of security, not in terms of physical security but in terms of access to information security. Thirdly, the openness of web put students into an exploratory mode, which often challenges effective learning in time-constrained formal school systems (Devadason, 2010). As a result students tend to misuse the technology for leisure time activities and have less time to learn and study as observed in Government Bilingual High School Yaounde. According to Yousef and Dahmani (2008) in (Mikre, 2011, p. 12), "online gaming, use of facebook, chat rooms and other communication channels are perceived as drawbacks of ICT used in education, because students easily switch to these sites at the expense of their study". It is also possible that the use of ICT may affect students' behaviour. Mike also identifies the following major limitations of ICT use in education as related to students' behaviour. These include:

- Computers limit students ;
- Over-reliance on ICT limits students' critical thinking and analytical skills;
- Students have only a superficial understanding of the information they download;
- Computer-based learning has negative physical side-effects such as vision problems;
- Students may be easily distracted from their learning and may visit unwanted sites;
- Students tend to neglect learning resources other than the computer and the internet;
- Students tend to focus on superficial presentations and copy from the internet;
- Students may have less oppurtunity to use oral skills and handwriting;
- Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

However, in as much as ICTs have inumerable benefits, there are disadvantages or threats that must be equally checked and properly managed in order to ensure its maximum uptake, utilisation and benefits, for both teachers and learners. And if the disadvantages are left unchecked, they many outweight the advantages.

There is no doubt that the integration of ICT in education has leads to educational reforms given a shift from the traditional instruction model of knowledge transmitting towards autonomous, active, and collaborative learning. Cameroon, just like any other African country, has fully embraced this innovation so as to better her educational system. This is seen in the initiatives undertaken, their policy and regulatory framework, and the manner in which this policy has been implemented. Despite the fact that ICT in education ameliorates the teaching and learning process, there are some threats that must be properly checked and managed in order to ensure its maximum use and benefits in education.

The use of ICTs here concerns all laws and government documents of the country that are put in place by the government to create an enabling environment for the right

functioning of secondary schools for the benefit of the entire nation. Teachers' use of ICT in Cameroon has been less than optimal, and in spite of the potential educational benefits of ICT in Education, teachers may not have benefits, for various reasons. Perhaps this is because of the lack of focus on ICT in Cameroon. For example, in 1995, when the National Forum on Education took place in the country's capital, Yaoundé, from the 22nd to the 27th of May nothing was said about the use of ICT in schools. However, the Law of Orientation of Basic and Secondary Education (Law No. 98/004 of April 14, 1998) which is mostly based on the recommendations of the National Education acknowledges in general terms the potential contributions of ICT in education. It states in Section 25 (Part III) that "the education provided in schools shall consider scientific and technological advancement and shall be tailored in terms of content and method, to national and international economic, scientific, technological, social, and cultural trends". ICTs were officially introduced into the Cameroon secondary education system in February 2001 by the president in his message to the youth, in which he called on them to embrace the knowledge economy (Kennah, 2016). As a consequence, computers were introduced into many General Secondary schools, and secondary technical/vocational schools and many schools benefitted from presidential grants for multimedia centers connected to the internet.

Conclusively, the use of ICTs plays a crucial role in the knowledge and information society by increasing economic productivity through digital economies, enhancing the delivery of public and private services, and achieving broad socio-economic goals in education, health care, employment, and social development (UNESCO, 2015). Cameroon just like any other African country fully embraced the implementation of ICTs in the educational sector for quality education.

Therefore, based on our observations, in relation to ICTs, the CBA in Cameroon faces difficulties, just like any innovation. This is seen in the shifts in teaching-learning activity that have been noticed, as teachers must deal with new teaching and learning methods, an increase in the number of students, an influx of students from the North, North West, and South West regions due to the country's political unrest, and, most importantly, a rapid growth in the use of ICTs in teaching. Learners on their part have

limited or no access to ICT resources and frequently abuse the technology for recreational purposes, endangering their ability to learn and study as a result, not competency.

Given their involvement in the use of computers and internet connections for teaching and learning, teachers encounter difficulties. Although instructors' attitudes toward the usage of these technologies are crucial, numerous observations show that teachers lack clarity regarding the extent to which technology might improve learning. Although some teachers may have good attitudes toward technology, they may not use it in the classroom due to low self-efficacy or a propensity to believe they lack the skills necessary to teach using technology.

Education is no longer just thought of as the transmission of knowledge in the modern world. This explains why the OBA style of teaching and learning was replaced by the CBA technique in the Cameroon educational system. That is, the shift from a teacher-centered to a student-centered learning style, which is also encouraged by ICT in education. This transformation is learner-centered since the student must actively engage in the lessons for which he is intended to be the artisan of his own knowledge. As for the instructor, he no longer has the monopoly on information in relation to students who are viewed as passive recipients, but rather serves as a facilitator and guide during the teaching-learning process.

The pedagogical approaches used in today's ICT-based learning are related to Piaget's constructivism paradigm, which has had a significant impact on educational theories and instructional practices and is a central idea in many reform movements. This approach contends that knowledge is socially and individually created through interactive learning, building on the student's prior knowledge. In this situation, the use of ICT in the classroom can spark constructivist creativity, enabling the realization of meaningful authentic, active-reflective, and problem-based learning. This approach encourages students to "learn how to learn," look for solutions to issues in the real world, and utilize ICT to engage their interest and start learning, which then leads to critical and analytical thinking.

ICT in education is a field in which numerous elements are involved. There are specific policies for each of these elements that may have an impact on how ICT is integrated. The interactional result of these elements is ICT integration. It encompasses interactions at both the administrative and instructional levels. The secondary school perspective and individual perspectives can both be used to analyze the ICT integration process. Bidirectional top-down and bottom-up interaction is the key to effective interactive integration. A coordinating unit that is capable of two-way communication is required for an effective and efficient ICT integration process. In this concept of top-down and bottom-up integration, top-down integration primarily refers to the administrative framework and policies, while bottom-up integration, on the other hand, deals with educational difficulties. The objectives and consequences must coincide in order to fully and effectively utilize this paradigm (Altun, Kalayc, & Avci, 2011)

Early in the 20th century, behaviorism emerged as a dominant school of thought, and learning was afterwards a major area of study. Learning is still a key idea in many branches of psychology today, such as cognitive, educational, social, and developmental psychology (Selbing and Olsson 2019). Even if one picks something up quite quickly, learning still involves many steps. A student needs to be exposed to new knowledge, pay attention to it, integrate it with what you already know, memorize it, and put it into practice in order to learn. Performing a hands-on experiment to learn a concept rather than reading about it is an example of interactive, or “active learning,” in this context. However, “passive learning” is still learning and can be successful (Charniak, 2021). Gaining new abilities, information, perspectives, and values is the process of learning. Helping someone or a group of people learn is something that people can accomplish on their own, however, it's usually made easier with education (Ruder, Peters, Swayamdipta & Wolf, 2019).

Learning is accomplished more quickly with the use of educational help. Education is also how we store and distribute all the knowledge and skills we individually acquire. What it means to live in a society instead of in isolation is that we can benefit from education rather than having to develop new abilities and information on our own from beginning. Education and learning convey more than simply

information and skills (Zhuang, Qi, Duan, Xi, Zhu, Zhu & He, 2020). Additionally, they spread the shared beliefs, attitudes, and behaviors that we have chosen to exhibit. Education and learning support the continuity of both human existence (Ruder et al., 2019).

CHAPTER TWO

TOOLS, EVOLUTION, STAKEHOLDER PERSPECTIVES, AND COMPETENCY-BASED APPROACH OF ICTS IN CAMEROON'S SECONDARY SCHOOLS

The following topics will be tackled in this chapter: Historical Evolution of ICT implementation in Schools, Internet and traditional teaching methods, Available and accessible ICT tools in schools, Computer learning skills, ICT as a Subject, Teacher, Student, and administrator Friendly ICTs, Teaching and learning activities with ICTs in Secondary schools, The applicability of computer and internet knowledge, The important of ICT in teaching and learning process

2.1. ICT-Enabled Instructional Strategies

The modern development of world education indicates the fact that the concept of media literacy currently became a necessary constant for the formation of a highly intelligent and highly qualified specialist. The influence of media culture on the formation of the personality, and personal qualities of a person taking into account the educational aspect, according to Béché, (2013), who understands media culture as information and communication tools, as well as material and intellectual values in the aggregate, determines the formation of socio-political consciousness in a developing society. Teachers' use of ICT in Cameroon has been less than optimal, and in spite of the potential educational benefits of ICT in Education, teachers may not have benefits, for various reasons (for example lack of training, and resistance to change, among others). Perhaps this is because of the lack of focus on ICT in Cameroon. For example, in 1995, when the National Forum on Education took place in the country's capital, Yaoundé, from the 22nd to the 27th of May, nothing was said about the use of ICT in schools.

As alleged in Muzaffarovna (2022, p.19), ICT is "one of the fundamental competencies necessary for any professional to function effectively in the so-called information environment". In our opinion, media literacy is the process of preparing a

media literate person with information competence, conditioned by an understanding of the sociocultural, socio-political, and intercultural context of media culture functioning in the modern world, code and representative systems, or, in other words, the ability to see only explicitly. In addition, worth pointing out is the implicit information embedded in the media (Khotimah & Reza, 2022). In recent years, the terms IT and ICT have been widely used, showing modern functions and computer technology, and telecommunications. Various concepts define three main uses of ICT in education, namely:

- organization and management of the educational process;
- training in the broadest sense of the word - training under the guidance of a teacher (stationary and remote) to use computer technology for self-training;
- study of specific disciplines.

In practice, the use of ICTs in teaching the mother tongue, beginning in the mid-80s of the last century, began to use various applications - text editors, spell checking, electronic dictionaries, as well as spreadsheets, desktop publishing, encyclopedias, games, and other programs (Erfan, Sulisyaningsih & Syakur, 2022). The second stage of the use of ICT in teaching the native language, which began in the 90s, is associated with a qualitative change in the technical capabilities of computers and the spread of ICT in the learning process. The beginning of the 21st century is the development of ICT training using virtual reality (León Gil & Henao Villegas, 2022). In the virtual class - laboratories, students have the opportunity to work in conditions of modeling a variety of speech situations; it undoubtedly expands the ability to improve speech and cognitive skills, and creates optimal conditions for the formation of communicative and socio-cultural competence (Erfan et al, 2022).

Education (Law No. 98/004 of April 14, 1998) which is mostly based on the recommendations of the National Education acknowledges in general terms the potential contributions of ICT in education. It states in Section 25 (Part III) that “the education provided in schools shall take into account scientific and technological advancement and shall be tailored in terms of content and method, to national and international economic, scientific, technological, social and cultural trends”. ICTs were

officially introduced into the Cameroon secondary education system in February 2001 by the president in his message to the youth, in which he called on them to embrace the knowledge economy (Wirba, 2022). Consequently, computers were introduced into many General Secondary schools, and secondary technical/vocational schools and many schools benefitted from presidential grants for multimedia centers connected to the internet.

This initiative has started to address the many problems that plague secondary education in Cameroon, among them acute shortages of basic pedagogic material and human resource inputs, overcrowded classrooms, problems of relevance, and quality, and inadequate access, among others. The use of ICT has the potential to address some of these problems. For example, ICT can improve access to education, equity, and the quality of teachers' professional development (Nsolly & Charlotte, 2016). With all these initiatives in place, there is no clear, recognizable national strategic plan for the integration of modern technology within the school curricula and pedagogical activities. The use of ICT in Cameroon secondary schools mostly depends more on the school leadership and the dynamism and enthusiasm of teachers.

Many Secondary Schools have adopted ICT policies and are in the process of implementation. Although significant educational research has been carried out in other countries on the use of ICT in schools, the results were mostly context-specific due to population, sampling, and/or design limitations. In other words, the findings cannot be applied to Cameroon because of contextual differences. Apart from the contextual factors, findings may not apply because of potential differences among participants. That is, Cameroonian teachers have differing experiences with modern technology due to the recent presence of modern technology in their schools and their distinct cultural backgrounds (Shaibou, 2015). However, there is no study on ICT integration by teachers in Cameroon secondary schools. Hence, it is important to investigate teachers' perceptions of ICT access, ICT training, ICT competencies, leadership support, and ICT integration. Research findings from teachers' perceptions and ICT usage may have important implications for administrators, departments, students, and employers and may enhance educational delivery to students' learning experience in secondary school, and students' application of knowledge and skills in the real world of work. Therefore,

we reason that it is necessary to investigate teachers' perceptions and ICT usage in education.

Given that data and the analysis of constant evaluation and research enable the improvement of ICT use in education (Nsolly & Charlotte, 2016), the main purpose of this work is to first of all review major initiatives that have been carried out in the country to integrate ICTs into primary and secondary schools. Secondly, it analyses the current situation and the barriers identified from the analysis, and lastly, it proposes some useful strategies that can help to remedy the situation. The opening section briefly describes Cameroon's education system. Faha & Vaumi, (2015) identified several driving factors, which affect the implementation of new forms of ICT in education.

Table 8: Driving Factors

Driving Factors
The increasing capacity, flexibility, and suitability of ICT for educational applications;
The continuing decrease in the cost of hardware;
The growth of knowledge, with its attendant consequence of the obsolescence of much of what was previously learned, places ever-increasing pressure on the conventional models of education;
The realization that the quality of the learning experience can be enhanced by applying ICT
The demand from isolated learners for more equitable access and service;
The perception of many institutions that the application of ICT would enable them to increase their market share in an environment that is increasingly competitive;
The need to be seen to be 'keeping up with the competition;
The expectation of policymakers and administrators is that the development of virtual delivery models would reduce costs, increase productivity, and enable expansion without cost increases.

Source: (Faha & Vaumi, 2015)

Cameroon Education System

Cameroon's education system is a legacy of the British and French colonial administrations. Thus, the education system is divided into two sub-systems which are the French-speaking sub-system and the English-speaking sub-system respectively.

There are eight State-run universities and a good number of private universities: two Anglo-Saxon-style universities and six others run on the francophone model.

Table 9: The structure of primary and secondary education in the two sub-systems

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

Source: (Nsolly & Charlotte, 2016)

The structure of the primary and secondary education of the two sub-systems presents some salient similarities and differences. The duration of nursery education post-primary education is 2-3 years and 2 years respectively and at the end of post-primary artisan training in sub-systems, students obtain a testimonial. Primary education in both sub-systems takes 6 years. The technical secondary education in both sub-systems runs on the francophone model. While secondary education in the French sub-system lasts for 4 years and 3 years for its 1st and 2nd cycles respectively, the English sub-system takes 5 years and 2 years in the 1st and 2nd cycles respectively. Even though the two systems exist separately and maintain different evaluation methods

as well as certification, primary education nationwide is compulsory through the age of fourteen. However, this right to free education is not yet available, accessible, and adaptable but is largely acceptable when it is available (Djoyou, 2011).

In the twenty-first century, the incorporation of ICT into educational systems is a pressing subject. ICTs were first used in classrooms in industrialized nations in the 1980s. However, teachers still do not see how they might be used for instructional reasons; therefore, this has become the focus of numerous studies (Yap & Brooks, 2022; Bauer & Kenton, 2005). This review of the literature will pay particular attention to studies on the teaching of ICT to 21st-century learners, various perspectives on what hinders effective ICT integration into the curriculum, and related material.

Computer use in the teaching and learning process might be considered the simplest definition of ICT integration in schools. This perspective would obviously underestimate how complicated the integration process is in and of itself. By integrating, we mean joining various components so that they function as a whole. The school environment in which integration is to occur, the technologies offered, the technical support offered for the installation, maintenance, and upgrading of hardware and software, the pedagogical preferences and skills of teachers, the accessibility of suitable electronic resources, and finally the abilities and motivation of students are the parts to be combined.

ICT Integration is seen as a whole configuration of events, activities, contents, and interpersonal processes taking place in the context in which ICT is used. However, the right conditions need to be in place before the educational benefits of ICT can be fully harnessed, and a systematic approach is required when integrating ICTs into the education system. This fact is often overlooked, and in their eagerness to jump onto the technology bandwagon, many education systems end up with technologies that are either unsuitable for their needs or cannot be used optimally, due to the lack of adequately trained personnel (Akanni, 2022).

2.2. Historical Evolution of ICT implementation in Schools

This section seeks to outline the various periods and ideologies that have shaped Cameroon's educational system, as well as the institutions that prepare teachers and, most crucially, the pedagogical resources that have developed over time. Tools and circumstances that may teach on their own or help a live teacher to teach successfully are referred to as pedagogic resources. The creation of models, techniques, and teaching and learning methodologies in the field of education has been affected by these technologies. Simple media, advanced media, and information and communication technologies were all represented ICTs. Simple media does not require electricity, whereas advanced media requires it.

It is noteworthy that the Cameroonian educational system has undergone continual evolution in terms of its policies, strategies, techniques, and practices, which have been influenced by the country's political development and needs. However, it is essential to review its history in order to analyze the concepts and advancements that have molded educational practices in order to construct the first professional training in Cameroon's schools. The history of education in Cameroon is extensive.

Before the advent of western-style education, indigenous African communities like Cameroon had their own systems of instruction and training for children through storytelling, games, riddles, songs, and dances. This was aimed at ensuring that the young develop a sense of loyalty to their communities. Because it was an integral part of the community, this sort of education was known as indigenous education. There were no written records of these African customs. Because it lacked supporting evidence, the West labeled that type of schooling as primitive education (Kennah, 2016). Indigenous or African education was therefore a method by which society could instruct its youth in the social mores necessary for them to exist within the confines of their culture. The main goal of this type of education was to prepare and integrate Cameroonian youth into the workforce.

According to Fonkeng (2007), African education consisted of exercises designed to help children develop their motor or physical skills needed for building, farming, pottery, weaving, hunting, and carving, as well as character and moral education,

intellectual skills, vocational development, and the development of a sense of belonging and cultural heritage. In his subsequent argument, he says that "traditional African education addressed issues of modern education specifically, with reference to the transmission of the cultural heritage in view of continuity and expansion for the management of life in the society" (Fonkeng, 2007, p. 32). Falola (2000) emphasizes that learning was a cultural activity, a group activity that involved the duty of socializing, and a collective affair.From 1844 until the present, formal education in Cameroon can be categorized into the following five cultural eras:

Cameroon's Pre-Colonial Period (1844-1884)

The Baptist Missionary Society (BMS) established formal education in Cameroon as Shu (2000) and Ihims (2003) indicated. The first primary school in Bimbia was established in 1844 by the Reverend Joseph Merrick of the Jamaican-supported London Baptist Missionary Society, according to Rudin (1968) and Tamanji (2011). At the time, there were 62 students enrolled. Since that time, the Cameroonian educational system has steadily expanded into a complex network that is overseen by the government, churches, and private citizens. Alfred Saker came after Merrick (Fonkeng, 2007). Alfred Saker began erecting churches and schools in Douala in 1845, a year after the Reverend Joseph Merrick. According to Tamanji (2011), the Bethel formal school in Douala, which was established in 1845 along with a Mission Station by the Reverend Alfred Saker, was the second formal school in Cameroon. Only Victoria (Limbe) and Douala had schools during that time period, which were both seaside regions. In primary education, the missionaries concentrated on basic practical and useful skills likely to maintain the pupils' interest to practice learning in a school atmosphere. It was therefore not thought to include secondary schooling. Drawing, singing, reading, writing, arithmetic, and the study of the Bible were all highly emphasized in the curriculum. They understood the value of resources like the Bible in instruction, as seen by their curriculum. Unfortunately, the natives were not given access to these Bibles (Ardener, 1968). Teaching was done in the vernacular. The primary goal of education was evangelization. Without giving any thought to the needs and interests of the populace or considering what had already existed, the educational techniques, structures, and

curricula were developed to fulfill the evangelical mission. The missionaries' only goal was to win souls for Christ.

German education in Cameroon during this period (1884-1914)

The colonial era in Cameroon began in the year 1884. According to Ardener (1968), the Basel Mission, a German-speaking missionary organization, continued the work that the London-based BMS had started in 1886. However, on July 12, 1884, the Germans surpassed the British in the race to acquire Cameroon (Tamanji, 2011; Ihims, 2003). Ngoh (1996, p. 74) notes that the Germans employed the "divide and rule" strategy. He goes on to say that the Germans divided the Chiefs in order to instill German culture in Cameroon. The master race idea claimed that the German masters were superior as well. The London-based Baptist Missionary Society was forced to turn over its schools to the Germans after Cameroon was annexed. Technical and vocational education made up the majority of the new forms of education. This form of education suggests that instruments were used in the classroom to assist students in the development of skills. This implies that using educational resources to learn is not a brand-new occurrence in Cameroon. Germanic studies were prioritized in the curriculum that resulted. After Cameroon was annexed, however, education was not given the attention it deserved for more than ten years. The German Baptist Mission, the American Presbyterian Mission, and the Pallotine Mission were in addition to the Basel Mission. It is important to highlight that the Mission has remained more active in the area of education than the Government. German authorities established a system of financial aid awards for mission schools that used the official mandated curriculum and taught in German (Ihims, 2003).

The Basel Mission replaced the English-speaking Baptist Missionary Society during this time because it spoke German. Education no longer belonged to just one organization. More religious bodies entered. The government started to participate in the provision of education. Schools started to be established further inland as a result of German exploration and demarcation of the nation. These are just a few of the major changes that occurred in education during this time, German was used as the primary teaching language instead of English, notably in the upper grades of elementary school;

the government assumed ultimate responsibility for the management of education; Mission schools started using government-designed curricula, and there was limited teacher and vocational training. However, the years between 1914 and 1922 saw the end of the First World War and the establishment of peace in Cameroon. After the war, Cameroon was divided between the French and the British after the Germans were defeated. The gloomy years in Cameroon's educational growth can be characterized by this period.

In the British-occupied territory, it was difficult to transfer from German to English, while in the French-occupied area, it was difficult to switch from German to French. Education either came to a complete halt or was merely reorganized by the new government and missionary authority.

French and British mandates during the Twin Epoch (1922-1946)

During this time, the League of Nations oversaw the governance of the British and the French in their respective regions of Cameroon. Within its colonial empire known as French Equatorial Africa, France governed French Cameroon as an independent nation. British Southern Cameroon was governed by Britain when it was a part of Nigeria. From 1916 to 1954, British Cameroon and Eastern Nigeria were governed as a single entity (By 1916, Britain already had a colony, Nigeria). When German Kamerun was divided in 1916, the British received one-fifth (1/5), and the French received four-fifths (4/5) (Fonkeng, 2007).

Education in French Cameroon during the Mandate Period

According to Tamanji (2011), the French, like the British and the Germans, were focused on international colonization plans that would boost their colonial economies. He goes on to say that assimilation, which aimed to replace African culture, language, and civilization with French culture, language, and civilization as well as other French colonial education practices from French Gabon, was the main tenet of the French educational policy for its African colonies, including Cameroon (Tamanji, 2011). The French saw their culture as being superior to all others. Additionally, they believed that their language was superior and that it was their duty to bring civilization to the rest of the world. They held that African languages were extremely underdeveloped and

incapable of assisting people in handling certain logical concepts. The educational system was designed to identify individuals who had learned French culture, or those who had “evolved” from their basic civilization. This was accomplished by introducing the French educational system into their territories (Orosz, 2008). The colonies followed the same schedules, texts, and programs like the French schools.

It is noteworthy that the French were overly involved in managing education, including the establishment of schools and the supply of teachers. The higher primary school in Yaoundé was where local professionals were trained in the early years of the French rule, according to Fonkeng (2007). Between 1921 and 1938, this institution was the only one offering post-primary education in Cameroon. According to Fonkeng (2007), this school's primary goal was to prepare instructors for elementary schools. One of the provisions of the Government Order of 1920 was that the government would only recognize and provide financial assistance to schools that taught only in French and adhered to the government's established curriculum. Schools were divided into five groups by the Order of 1921, which governed public schools (Ihims, 2003). The village, regional, upper primary, domestic science, and vocational schools are included in this. While the secondary school system prepared students for the Baccalaureate (Advanced Level) exams that were introduced at the University of Bordeaux in France, the primary school system culminated with the CEPE (the First School Leaving Certificate). On his part, Ngoh (1996, p. 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 American Adventist Mission".

Education in British Cameroon during the Mandate Period

During this time, British Cameroon’s system of education got off to a slower start than the one run by the French. Compared to French Missionary Societies, which arrived extremely early, the British Missionary Societies arrived relatively late; unlike French Cameroon, whose educational policy was started in Yaoundé, British Cameroon's strategy was started in Lagos, Nigeria, not in Buea. As a result, British Cameroon was considered a colony within a colony. Ngoh (1996, p. 168) claims that the British pursued a strategy of “indirect dominance,” employing the chiefs to instill

French culture in Cameroon. They believed that the regional languages were unsuitable for education or learning and, as a result, were not effective tools for fostering intellectual growth. Government schools (placed at divisional headquarters), Native Authority (NA) schools, Assisted Mission Schools, Unassisted Mission Schools, and Post-Primary Schools are some of the educational institutions that have sprung up in British Cameroon. According to Ngoh (1996), government rules made education consistent and gave newborns free schooling in 1924.

Furthermore, according to Tamanji (2011), there are only six public schools that are used as models, including Government Schools in Buea, Mamfe, Kumba, Bamenda, and Victoria. The British government established a policy known as the "indirect rule" that stated they would not actively participate in schooling. According to Fonkeng (2007), indirect rule refers to a type of colonial governance in which native people were governed by the use of their tribal structures and natural or traditional leaders. At the divisional headquarters, Native Authority Schools served as feeder schools for the public schools. They might be contrasted with the Village schools of the French administration. The mission schools with assistance were those that adhered to government norms. Mission schools that were not supported by the government failed to meet the requirements. The majority of the schools in the educational system were primary schools prior to the start of World War II.

According to Tamanji (2011) and Ihims (2003), the government established an elementary teacher training center at Kake toward the end of the mandate period (1932), which was followed by the establishment of the government teacher training center at Kumba in 1946. These centers were used to train teachers for grades II and III, respectively. In 1944, the Basel Mission established a Teacher Training College in Nyassoso (Tamanji, 2011). In 1944, the Catholic Mission established two teacher training institutions, one in Baseng and the other in Njinikom. In 1950, the Baptists established a teacher training facility in Great Soppo (Ihims, 2003; Tamanji, 2011).

Additionally, the secondary school level was added to the educational system during this time. In 1939, the Catholic Mission opened St. Joseph College SASSE, the first secondary grammar school. Ten (10) years later, in 1949, Cameroon Protestant

College (CPC) Bali was established. The SASSE and CPC Bali curricula were heavily focused on the Cambridge School diploma tests (Tamanji, 2011). The language of instruction was English. According to Tamanji (2011), the Catholic, Presbyterian, and Baptist Missions ran the majority of the schools during this time. The majority of the Dutch and Cameroonian Grade II teachers who taught the lower courses at St. Joseph College SASSE were MilHil Fathers. French was required in CPC Bali while Latin was required at St. Joseph College SASSE. At Okoyong in Mamfe, the first girls' school, Queen of the Rosary College, was inaugurated in 1956. Both the West African school certificate examination syllabus and the University of Cambridge School Certificate Examination syllabus were accepted by these secondary institutions.

Students chose their courses from four fundamental categories for the exam: language, math, social studies, and science. It was a group certificate exam. You had to pass a number of subjects chosen from each of the four categories in order to receive the certificate. Based on the final score, the pass mark was determined. Your classification as a Grade II or III teacher was determined by your overall score. Up until 1955, this system was in use. The University of London General Certificate Examination replaced the Cambridge and West African School Examinations after the country gained its independence.

In sum, the British sought to lay the foundation for higher education by educating Cameroonians to be responsible citizens. First, the British brought their educational system to Cameroon and turned it over to the Mission. It is ironic because missions solely cared about operating schools for evangelization purposes.

Trusteeships between France and Britain (1946–1961)

The League of Nations was replaced by the United Nations Organization (UNO) at the end of the Second World War (1939–1945) (Ihims, 2003). One of the six UNO entities designated to oversee the old League of Nations declared territory is the trusteeship. In both the Cameroonian regions that were under French and British administration at the time, a focus was placed on post-primary and professional education. British Southern Cameroon was given autonomy beginning in 1954 as part of the new Nigerian governmental structures brought forth by the McPherson

constitution. In Buea, a self-governing educational board was established for Southern Cameroon. Similar to French Cameroon, primary enrollment increased, although secondary and professional education received some attention. Giving school graduates the abilities to manage the affairs of the nation was the key goal. In order to train middle- and upper-level manpower, there was hence intense demand for educational institutions to grow and for higher education institutions to be established. The University of Yaoundé, Cameroon's first University was founded in 1962 because scholarships were expensive. Additionally, with the establishment of the Advanced Teacher Training College in Yaoundé in 1961 and an annex in Bambili in 1967, the situation for general secondary schools changed.

The Post Independent Period (1961 to Present)

The independence and unification of French Cameroon and British Southern Cameroon between 1960 and 1961 marked the beginning of the actual Cameroon education. While the districts under British rule achieved independence in 1961 and joined with Francophone Cameroon, French Cameroon earned independence from the French in 1960. (Ngoh, 2006; Fonkeng, 2007). Due to the dual colonial origins of the nation, French and English have been designated as the two official languages with equal status (The Constitution of the Republic of Cameroon, 1996). As a result, bilingual primary, secondary, higher education, and teacher preparation institutions have emerged in the nation. It's important to remember that the post-independence era was divided into three distinct time periods, commencing with the Federal period from 1961 to 1972, followed by the Unitary period from 1972 to 1982, and finally the Republic from 1982 to the present. Ahmadou Ahidjo served as president of Cameroon from 1961 to 1982 (Ngoh, 2006).

In 1982, President Ahidjo was succeeded by President Paul Biya (Ngoh, 2006). The programs of Harmonization, Ruralization, and Bilingualism were among the key educational initiatives throughout the Federal era. In the 1970s and 1980s, Cameroon had one of the most effective education systems in Africa, according to a World Bank Report (2012) (the unitary period). Similar to the economy, education development had ups and downs as a result of the fall in national revenue. According to this data, the

primary completion rate rose from 59 to 72 percent in 2008 and the repetition rate dropped from 22 to roughly 18 percent, respectively.

Furthermore, since its unification in 1961, Cameroon has maintained its stability. The pedagogical tools used in education during the colonial era were created with colonial interests in mind. It had to be focused on addressing the demands of national independence and development in all spheres of national life in the years that followed the victory of independence. Since the country's independence, its educational strategy has placed a strong emphasis on providing all citizens with access to education, fostering national cohesion, and developing the human resources necessary to meet the nation's economic, social, and political needs. During this time, the government started to get more involved in education. The Ministry of Education played a supervisory role as primary and secondary schools grew, ensuring that there was a unified, high-quality curriculum as seen by the various curriculum policies that were put into place.

Additionally, institutes of higher learning that did not exist during the colonial era were emerging. In 1961, the Higher Teacher Training College Yaoundé became the first institution of higher teacher education. Government and nonprofit organizations worked together more frequently. Through the Parent-Teacher Association (PTA), parents started to take an active part in education. Since 1995, two new laws outlining higher education policy, Law No. 005 of April 16, 2001, and Law No. 98/004 of April 14, 1998, have been passed. Cameroon has put a lot of work into adhering to these laws in order to meet the demands of globalization, information and communication technology, and the requirement for quality.

2.3. History of ICT

The goal of this section objective is to investigate the historical evolution of educational technology up to its current state. ICT history has generally been shaped by four revolutions (Liquigan, 2022; Kaino, 2008). Each period is discussed in the section after that.

First Stage

With the invention of the printing press by Johannes Gutenberg in 1440, technology was first incorporated into the media (The Great Idea Finder, 2007). Printing quickly replaced other forms of communication as the primary means of spreading knowledge and achieving both upper-class and later mass education. The electronic revolution began in the 16th and 17th centuries, when technological advances made it possible to communicate ideas and stories in a more dynamic and engaging way (Sullins, 2012), even though the original tools were somewhat primitive by today's standards, such as Huygens' Magic Lantern from 1659 (Verme, 2005). In the end, the Lumière Brothers' innovation of film, which they created in 1899, supplanted the Magic Lantern (Manley, 2011). In addition to this, Heinrich Hertzin created the radio in 1886, the television in the 1920s, and later recording devices like cassettes and VHS players (Ledo, 2009).

Second Stage

The so-called communications revolution gave the mathematical field access to microcomputers and telecommunications, and in the 1960s, computers started being employed in schools (Kovarik, 2011). The devices were small and reasonably priced by the 1970s, and some of the early models were produced around 1977 by Apple, Tandy, and Commodore computers (White, 2008). The TCP/IP protocol was created in 1974 by Vinton Cerf and Bob Kahn to facilitate rapid file transfers and the public posting of information. The early stages of the internet were also established in the 1970s (Spira, 2003).

Third Stage

The 1990s saw the integration of these technologies into all facets of computing, which is known as information technology (IT) (Sullins, 2012). At this point, the phrase *computers* were replaced with the term IT, signifying a shift in emphasis from computing technology to the capacity to gather and extract information (Pelgrum and Law, 2003).

Fourth Stage

This happened in 1992 when the word IT was changed to Information and Communication Technology (ICT), suggesting that technical improvements not only assist but also mediate communication. ICT began in mathematics and has since spread

to almost every area of human endeavor, including the field of education, opening up fresh possibilities for the latter. Additionally, ICT has accompanied globalization in ways that improve interconnection, eliminate economic borders, and boost global interchange and transitory engagement, which unites individuals from all over the world into a single global community (Kaino, 2008).

The worldwide web (WWW), which had tremendous growth in the 1990s and 2000s and now permeates not just businesses and schools but even families, is a key element of the ICT idea. Many educational institutions, ranging from basic schools to universities, established online presences for themselves in the 1990s using text-based websites and other ICT tools for instruction and learning (Garcia, 2004).

Table 10: Computer Evolution

Era	Year	Invention
Pre-microcomputer Era	1910	Silent Film entered education
	1927	Broadcast radio was in schools
	1936	BBC began regular television broadcasts
	1950	First computer used for instruction
	Early 1970s	Computer-assisted instruction (CAI) movement emerges
	Early 1970s	CAI movement declines and Computer literacy movement begins
Microcomputer Era	1977	First microcomputers in schools The Apple corporation is founded
	1981	The IBM corporation begins
	1982	The Personal Computer was introduced
	1990	The mobile phone becomes more than just for the government
	1991	The first interactive white board, but it was 10 more years before they became part of education
The World Wide Web	1994	The advent of the World Wide Web The Netscape navigator released
	1995	Microsoft released Windows 95
	1997	Internet Explorer version 4 released
	1998	The Search Engine Google is founded
	1990	Bluetooth was announced
	2000	Microsoft released Windows 2000 Apple introduces the iPod
	2001	Wikipedia, a Wiki free content encyclopaedia goes online

Era	2004	The advent of Web 2.0
	2007	The first iPhone is released beginning the development of "smartphones"
	2010 UP TO 2022	The first generation iPad hits the market beginning the development of tablet computing
		A dramatic development in the telecommunications sector, especially the new generations of smartphones, computers, tablets as well as social media

Source: Adopted from (Roblyer and Doering, 2010; Timetoast, 2011: Report Linker, 2016).

Due to the internet's recent rapid expansion and influence, about 3.2 billion individuals (out of 7.2 billion) were reported to be utilizing it globally in December 2015 (InternetWorld Stats, 2015). However, three eras are distinguished in the development of ICT (Timetoast, 2011; Roblyer and Doering, 2010).

2.4. Trends of ICTs in Sub-Saharan Africa

Developing countries have recognized the fact that successful knowledge economies will require additional skills to productively transform knowledge and information into innovative products and services. This aligns with the global trend, observed in a World Bank report highlighting the focus of governments around the world, on strategies to increase access to and improve the quality of education (World Economic Forum, 2002). Relevant education is more important today than ever before because today's networked world demands a workforce that understands how to use technology as a tool to increase productivity and creativity.

Developing countries have, therefore, recently witnessed a considerable commitment and huge investments by national governments and their partners to improve access, retention, and the quality of education. Despite this, the present state of education in most developing countries presents a rather bleak picture. Recent studies have indicated that up to as many as 72 million children worldwide have never been inside a classroom, half of them living in Sub-Saharan Africa (United Nations, 2009).

This clearly suggests a major concern for developing nations in Sub-Saharan Africa, to provide access to education for all. From this report, access to education,

however, is only part of the solution, as school systems are chronically underfinanced and under-resourced, and often fail to deliver high-quality education. As a result, millions of children start school but eventually drop out. These out-of-school children in developing countries are especially vulnerable to poverty, abuse, violence, hunger, and diseases, as not being in school contributes to future generations of people with limited life choices.

Providing greater access to basic education and ensuring quality education are two paradigms imposed on developing nations seeking to subscribe to the concept of knowledge-based societies. Improving the quality of education and training is a critical issue, particularly at a time of educational expansion (Tinio, 2003). Tinio further states that for developing countries, ICTs have the potential for increasing access to and improving the relevance and quality of education. It thus represents a potentially equalizing strategy for developing countries. ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, facilitating the acquisition of basic skills, and by enhancing teacher training.

Also, ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies, scattered and rural populations, groups traditionally excluded from education. Due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enrol on a campus (Tinio, 2003). The potential of ICT use in education, however, opens up major concerns to developing nations, as outlined by a World Bank report (World Bank, 1998) that ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for businesses and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, is their sense of isolation. The new communications technologies promise to reduce that sense of isolation and open access to knowledge in ways unimaginable not long ago (World Bank, 1998).

It is important to note that the goal of this study is to demonstrate the value of pedagogic ICT integration in the teaching and learning process and how it can significantly aid in the achievement of a CBA style of instruction. The majority of secondary schools on the African continent as a whole still have a long way to go because of the persistence of an outdated teacher-centered paradigm in schools as opposed to more contemporary strategies that place a greater emphasis on student-centered principles. This is true even though there have been some innovations in pedagogical strategy, including notable successes with ICTs.

2.5. Teacher, Student, and administrator Friendly ICTs

Schools are required to implement problem-based instructional initiatives that consistently entice students to gravitate toward important questions and challenges that are crucial to humanity. Schools progress far beyond the actual buildings to the nerves centers with permeable and transparent partitions that give everyone access to the wealth of knowledge that exists on the planet and enable a platform for the stakeholders to communicate with one another from all over the world. Thus, the shift from a teacher-centered educational, textbook-, chalk-, and blackboard-driven system to a wholly student-centered learning system is significant. The teacher's primary role as a knowledge dispenser is currently being replaced by that of a facilitator of learning, assisting students in turning knowledge into learning and data into information (Subashini, Udayanga, De Silva, Edirisinghe & Nafla, 2022). A 21st-century student, according to Hover & Wise (2022), is one who studies or collaborates with classmates and other peers from around the world in a global classroom as opposed to, in the past, when students were thought of as individuals who attended school, spent a certain amount of time taking the prescribed courses, received passing grades, and eventually graduated (Subashini et al., 2022).

The existence of globalization cannot be avoided as a global process; all parts of the world appear to be one, transparent and interdependent on global life. Globalization is marked by the rapid development of information and communication technology and affects everyone in aspects of national life, such as ideology, politics, economy, socio-culture, as well as national security. Globalization brings universal values

(individualism) which undermines national values (cooperation, tolerance, and politeness) and society, especially students (Gillan, 2020). The actual state of deviant behavior among young people is now widespread, where the atmosphere of globalization has an impact on young people who tend to be less interested in activities related to patriotism and nationalism (Moskos & Burk, 2019). On the other hand, young people are more interested in lifestyles that come from western culture, both in diet and clothing (Wahdani & Abi Aufa, 2021). Fights among students, drug abuse, and the proliferation of free sex activities show that the value of national understanding, especially among students, begins to disappear, which is very ironic for a country that used to have good values (Goh & Kananatu, 2020). What this seems to show is that technology plays a very prominent role in supporting reform efforts.

The government and society have recognized that the function and role of technology are indispensable in the world of education. The impact of technology on modern society is forcing it to begin with an educational climate so that learning activities must be balanced and in harmony with the needs, aspirations, and norms of society. Technology has an important role in educational activities, especially during difficult times, as during a pandemic which has a tremendous impact on the scope of education. The estuary of globalization, which is synonymous with modernization, shows changes in all aspects of life. The change follows the rapid advancement of technology, where technology is one of the most attractive propositions for everyone today and is a renewal process that covers all aspects of life by using technology as the main vehicle (Wu, 2021). As the main media, technology plays an important role in all developments, including in the field of education. The implementation of education is designed so that humans can thrive according to their abilities when learners must be able to understand the reality of their opportunities and ideals and educators must know how to bring about the desired changes. So education has an important role in the progress of the nations, in both developed and developing countries. The development and progress of a country are seen by how education is able to form quality human resources (Shaturaev, 2020).

When science and technology are developing very rapidly, the learning process is no longer monopolized by the presence of educators in the classroom. Students learn anywhere and anytime to access knowledge. A learning designer is required to be able to design learning by utilizing various types of media and appropriate learning resources so that the learning process takes place in a fun, effective, and efficient manner as a form and effort in the pattern of educational resilience (Chen & Wu, 2020). In the current era of globalization, students are more familiar with technology, especially smartphones and, on the other hand, a fair attitude from both educators and society, in general, is needed, which shows the identity and character of educators as professionals and educative members of society (Nicolaou, 2021). The learning process becomes more familiar when students use smartphones using search engines (Google Chrome, Mozilla, Opera, and other web browsers) or use Android-based learning applications that are easily available through the Play Store and App Store. This technology allows students to be happier and more knowledgeable about learning through online learning applications than learning in a regular classroom (Tekinner, Acar, Uluagac, Kirda & Selcuk, 2021). This is relevant for the present study in its bid to probe the above phenomenon to see whether there is a big influence in the world of education with the existence of technology that is developing massively.

Descriptive Statistics on the Use of ICTs

Table 11: Information on the Use of ICTs

Item	Statement		SA	A	Un	DA	SDA	Mean
1	I learn best using internet rather than traditional teaching methods	f_1	305	480	154	72	98	3,74
		%	27,5	43,3	13,9	6,5	8,8	
2	The computer teacheralways providesinteresting learning skills	f_1	206	516	248	68	72	3,64
		%	18,6	46,5	22,4	6,1	6,4	
3	In my school, projectors and computers are in good condition	f_1	341	514	91	93	70	3,86
		%	30,7	46,4	8,2	8,4	6,3	
4	The computer rooms are spacious enough	f_1	299	298	313	126	73	3,56
		%	26,9	26,9	28,2	11,4	6,6	

5	My classroom is set up in advance to use educational technology devices	f_1	206	524	170	122	87	3,57
		%	18,6	47,3	15,3	11,0	7,8	
6	There are enough computers in the computer lab for our lessons	f_1	421	364	104	122	98	3,80
		%	38,0	32,8	9,4	11,0	7,8	
7	ICTs devices and applications need maintenance	f_1	361	370	132	119	127	3,64
		%	32,5	33,4	11,9	10,7	11,7	
8	We apply what we have learned using computer and internet	f_1	589	368	152	---	---	4,39
		%	53,1	33,2	13,7	---	---	
9	I pay more attention to the ICT subject	f_1	436	340	63	170	100	3,75
		%	39,3	30,7	5,7	15,3	9,0	
10	ICTas a subject helped me to learn more about computers	f_1	539	390	---	180	---	4,16
		%	48,6	35,2	---	16,2	---	
11	The ICT subject provides new information/skills	f_1	386	430	112	92	89	3,84
		%	34,8	38,8	10,1	8,3	8,0	
12	I already knew most of the computer skills before being taught	f_1	621	364	90	34	---	4,41
		%	56.0	32,8	8,1	3,1	---	
13	I use a phone to interact with teachers and classmates for studies	f_1	597	434	---	78	---	4,39
		%	54,0	39,0	---	7,0	---	
14	ICT plays an important part in my learning process	f_1	478	342	151	99	39	4,01
		%	43,1	30,8	13,6	9,0	3,5	
15	I think the use of ICTs to learn is helpful after school	f_1	438	277	128	114	152	3,66
		%	39,5	25,0	11,5	10,3	13,7	

Source: Field statistics

Table 11 and the charts that follow present the information respondents gave on the use of ICTs tools on teaching/learning method in Government Secondary Schools in Cameroon.

Item one is on whether they learn best using internet rather than traditional teaching methods .27.5% (305) and 43.3% (480) support the statement while 13.9% (154) are uncertain and 6.5% (72) and 8.8% (98) completely are not using ICT during learning. The mean (3.74) falls in the acceptance region, meaning most of the

respondents accepted the statement. Even so, some 13.9% of the respondents were unaware of about the use of ICT to study. This implies that ICTs is observed elsewhere in secondary. It has touched and influenced the life of students. It has imposed its presence into the daily life of students so much so that the latter cannot function without them.

Item two shows the distribution of respondents according to whether computer teacher always provides interesting learning skills. 18.6% (206) and 46.5% (516) strongly agreed and agreed with this statement respectively while 22.4% (248) were uncertain. 6.1% (68) were however not in agreement. The mean (3.64) falls within the accepted area, implying that the computer teachers are implementing new ICT skills even though 22.4% were uncertain.In this precise domain, ICTs play a very important role as they ease the teachers' duty (typing, calculators, content multiplication, automatic examinations, marking and corrections, research and others). ICT in Cameroonian secondary school system is still at a low stage. Much effort is being done.

Item three is the distribution of respondents according to whether in their school, projectors and computers are in good condition. 30.7% (341) and 46.4% (514) of the respondents think it is very important, thereby strongly agreeing and agreeing respectively. 8.2% (91) were uncertain while 8.4 % (93) and 6.3 (70) did not think that these devices are in good condition and high quality thereby disagreeing and strongly disagreeing respectively. The mean of 3.86, falls in the accepted region, implying that most of the respondents agree with the statement. Today ICT literacy is the prerequisite for the 21st century's appropriate knowledge and skills. This is due to the fact that through ICT, one can explore useful information to be able to overcome the modern life's obstacles. Integrating ICT in education system does not mean that computer is able to replace the teacher completely, but it means using computer tools, equipment, and applications as an enabler to help the teacher to improve student's learning and better pedagogical practices.

Item four presents the distributions of the respondents according to whether computer rooms are spacious enough. 299 respondents (26,9%) and 298 respondents (26.9%) agreed to their school have enough space. 313 (28.2%) claimed to be uncertain

while 126 respondents (11.4%), and 73 (6.6%) disagreed with the statement. Yet the mean 3.56 still falls with the acceptance region. This implies that if modern technologies are integrated with the conventional methods, it then results in a robust and effective outcome for teaching and learning process.

Item five presents the distribution of the respondents according to whether the classroom is set up in advance to use educational technology devices. 18.6% (206) and 47.3% (524) responded in favor of the statement while 15.3% (170) claimed to be uncertain. 11.0% (122) and 7.8% (87), did not agree with the fact that a classroom has to be set up in advance to use educational technology devices. Even so, the mean 3.57 still falls within the accepted region, meaning most of the respondents accepted the statement. Promoting new technologies and innovative changes to power national competiveness is a growing challenge to secondary school in Cameroon.

Item six is the distribution of the respondents according to whether there are enough computers in the computer lab for their lessons. 38.0% (421) and 32.8% (364) agreed that, there are enough computers in the computer lab for lessons, 9.4% (104) respondents claimed to be uncertain while 11.0% (122) and 7.8% (98) disagreed with the statement. The mean of 3.80 also falls within the region of acceptance. This implies that most of the respondents accepted that there are many computers in their school. A good and practical computer lab makes students interesting and enthusiastic about technology and science. Computer lab invests students' free time of learning programming, and automation and improving basic computer skills.

Item seven shows the distribution of respondents according to whether ICT devices and applications need maintenance. 32.5% (361) and 33.4% (370) agreed with the statement while 11.9% (132) were uncertain. 10.7% (119) and 11.7% (127) disagreed. The mean of 3.64 is however found at the acceptance level. So, the majority of the respondents supported the statement. Even though the number disagreeing is relatively high, there is an indication ICT devices and applications need development. One of the common applications of computers in education today involves the ongoing use of educational software and programs that facilitate personalized online instruction for students.

Item eight presents the distribution of respondents according to whether they apply what they have learned using computer and internet. 53.1% (589) and 33.2% (368) both strongly agreed with the statement. 13.7% (152) were completely uncertain while none disagreed and strongly disagreed respectively. The mean 4.39 also falls in the acceptance level, meaning that most of the respondents agreed with the statement. Even so, some 13.7% % of the respondents claimed to be uncertain about this. This implies that basic computer skills and education are the roots that are born and expanded in schools. Providing more engaging lessons and individualized education to students is two big reasons why there are more computers in the classrooms than ever before. One of the reasons why many respondents agreed with the statement is because computers are one of the most valuable resources in a classroom because they serve so many useful functions. With computers and the internet, students today have wealth of information at their fingertips that help them develop the research and communication skills while preparing them for a future career in a workforce that is increasingly reliant on computer technology.

Item nine shows the distribution of the respondents according to whether they pay more attention to the ICT subject. 39.3% (436) strongly agreed and 30.7 (340) agreed with this statement while 5.7% (63) were unaware. 15.3% (170) and 9.0 (100) disagreed and strongly disagreed with this statement respectively. The mean, 3.75 however falls within the acceptance region meaning that most of the respondents agree with this statement even though so many of them were uncertain.

Item ten presents the distribution of respondents according to whether ICT as a subject helped me to learn more about computers. 48.6% of the respondents strongly agreed, 35.2% agreed, 16.2% were uncertain while none disagreed and none strongly disagreed. Based on the data, the mean is 3.83 and is found at the acceptance level. This implies that most of the respondents supported the statement. Yet quite a good number of the respondents think that the ICT subjects helped them to learn more about computers. Students are fascinated with technology and it encourages and motivates them to learn in the classroom. ICT in education improves engagement and knowledge

retention. When ICT is integrated into lessons, students become more engaged in their studies.

Item eleven is the distribution of the respondents according to whether ICT subject provides new information/skills. 34.8% (386) and 38.8% (430) strongly agreed with the statement while 10.1% (112) were uncertain about the statement and 8.3% (92) and 8.0% (89) disagreed. Again, based on the data, the mean is 3.84 which is at the acceptance level. This means equally that the majority of the respondents were in agreement with this statement. ICT enhances subject learning. It is well known these days that the use of ICT in education adds a lot of value to key learning areas.

Item twelve shows the distribution of respondents according to whether they already knew most of the computer skills before being taught. Based on the data on this item, the mean of 4.41 is found within the acceptance level, meaning that most of the respondents agreed with this. Even so.it was noticed that quite a great number of respondents, (90) were uncertain about this. Also quite a large number of students disagreed (34) and none strongly disagreed. This means that these computer skills make the economy vital to have the ability to produce and use information effectively. That is why ICT will continue to be a significant part of the future as it connects itself to more and more parts of our lives. **One of the students said, *we like to use it for personal growth, creativity and joy, consumption, and wealth*.**

Item fifteen is the distribution of the respondents according to whether they use phones to interact with teachers and classmates for studies 54.0% (597) and 39.0% (434) strongly agreed and agreed with this statement. 227 (43.7%) no one was uncertain while 7.0% (8) strongly disagreed and disagreed with the statement. However, the mean of the data stands at 4.39 falling at the level of acceptance and meaning an acceptable number of the respondents' were in support of the statement.

Item sixteen is the distribution of the respondents according to whether ICT plays an important part in the learning process. Based on the data, the mean is 4.01which is found at the level of acceptance. This means that most of the respondents supported this statement. Technology-based teaching and learning makes changes in school that requires proper planning and policy making. ICT integration in education generally is

technology-based teaching and learning process that closely relates to the utilization of learning technologies in Cameroon secondary schools.

Item eighteen is the distribution of respondents according to whether they think the use of ICTs to learn is helpful after school. Based on the statistics, the mean stands at 3.66. This also falls within the zone of acceptance even though a great part of the respondents do not seem to agree.

Hypothesis one

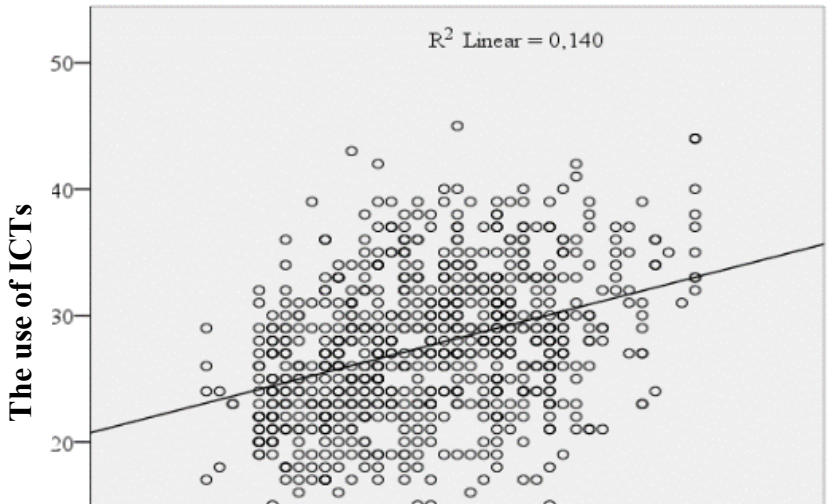
Ha$_1$: There is a relationship between the use of ICTs and CBA teaching-learning methods in government secondary schools in Cameroon

Ho$_1$: There is no relationship between the use of ICTs and CBA teaching-learning methods in government secondary schools in Cameroon

Table 12: Correlations of the use of ICTs and CBA teaching-learning methods

	the use of ICTs	CBA teaching-learning methods		
Spearman's rho	The use of ICTs	Correlation Coefficient	1,000	,367**
		Sig. (2-tailed)	.	,000
		N	1109	1109
	CBA teaching-learning methods	Correlation Coefficient	,367**	1,000
		Sig. (2-tailed)	,000	.
		N	1109	1109
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: (Researcher, 2023)



The correlation table 12 above reveals that the relationship between the use of ICTs and CBA teaching-learning methods is positively significant. This is based on the fact that the level of significance is 0.00 thus lesser than 0.05 which is the alpha, that is, the standard error margin. Alternatively; the correlation coefficient (0. 367) is a positive value and is situated within the normal range. It is high and close to 1, indicating that there is a strong link between variables under investigation. The results reveal that we have no chance of making an error if we accept that the association between the variables exists. We can therefore conclude that the use of ICTs significantly influences CBA teaching-learning methods in government secondary school in Cameroon.

ICT usage in Cameroonian secondary schools is broadly seen how teachers employ the various ICT tools during the teaching and learning process. Many dimensions were examined in an effort to provide a response. These various facets of ICT educational use in schools were looked into. It became clear from the responses from the teachers utilizing the interview questions and focus group discussing (FGD) that there are three broad categories of users for the pedagogical tools in these schools. Teachers who recognized the value of these tools in the teaching and learning process took it upon themselves to use ICT tools pedagogically in their classrooms, making them active users. Additionally, some teachers used ICT tools pedagogically in the teaching and learning process by using the tools to prepare their lessons and delegating student research and information-seeking tasks. Further research reveals that some of the teachers were not ICT tool users since they acknowledged that they did not see a necessity for these tools in the teaching and learning process.

Table 13: Pedagogic ICT Integration and CBA Teaching and Learning Methods

ICT Tools	Active Use	Passive Use

Projectors	PowerPoint presentation, picture display,	
Laptop, desktop,	video lessons, showing animated videos, lesson presentation,	Research, searching information, finding out better presentation method, lesson preparation,
Google, Google Scholar	Teaching students to find academic materials on the Web.	Searching information, assigning students to search information
Virtual lab software	Showing practical scientific videos	
Phones, Ipad and other mobile devices	Reference in the classroom, showing real images to students	searching information, SMS teaching, research practices
Radio/TV	Teaching through music	

Source: (Almås & Krumsvik, 2007)

Many instances were given on how instructors use ICT tools in their classrooms, starting with those who were thought of as active users of ICT tools in the teaching and learning process. It was clear that the majority of them began their courses by using the conventional teaching style to explain the topics in their various subjects. They later took the students to the school's multimedia center to demonstrate the notion to them using ICT tools. While some teachers utilized the resources offered by the school (by bringing the students to the school's multimedia center), others took the effort to include ICT resources in their lesson plans.

It was vital to ask teachers and administrators about how ICT affects pedagogy in order to acquire a complete picture of the use of ICT in general. Finding the teaching and learning outcomes ICT has brought to schools was the main goal of this question. Teachers readily acknowledged the importance of ICT in education and how its practical application may enhance both the teaching and learning process.

The study revealed that the attitude of teachers is not impeding ICT integration since the majority of teachers have a positive attitude towards the integration of ICT in teaching and learning. Findings from the interview from participant P1 showed that all teachers had positive attitude towards the use of ICT in teaching and learning. Participant P5 commented:

> *ICTs are a very important tool for education in today society. I love using ICT in my teaching work. They make my work very easy and I do not think that I can do my work without ICT* (Interview, November 9, 2022).

The emergence of a knowledge-based economy has increased competitiveness in all sectors of society more than ever before. This proves that teachers like using ICT and they find them effective. Governments in all parts of the world are striving to achieve access and good quality education for their citizens (UNESCO, 2013). In the FGD, the participants point out that ICT in education increases access to education, particularly for the rural population, and to make teaching and learning pleasurable *(*FGD, November 12, 2022). The use of ICT in education is an enabler in the process of teaching and learning by assisting the learners to grasp concepts that would otherwise have remained abstract. Participant P1's response made this clear:

> *For instance, in my class, typically, before I bring them here at the school multimedia center, I teach them in theory the various concepts in the subject area, then later bring them here so they can see for themselves the concepts I taught using displayed image on the computer* (Interview, November 8, 2022).

Participant P12 who took the initiative to integrate ICT into his classroom said,

> *As you can see in my backpack, my laptop, I frequently use films on lab experiments when I teach my subject. Due to their inability to visualize the process, I begin by describing the concept to the students before starting to play videos on my laptop* (Interview, November 5, 2022).

Projectors were mentioned by many of the teachers who actively utilize ICT; participant P6 explains that: *Sometimes I prepare my lessons using PowerPoint, putting*

it into slides and present to my students using overhead projectors (Interview, November 4, 2022). Another subject participant (P13) commented:

> *Basically, after doing the standard traditional instructional teaching in the classroom, I take my laptop to the ICT labs, using the projector to project images, I stand behind the class allowing the students to watch video lesson for some time then, and I pause from time to time to explain* (Interview, November 9, 2022).

Projectors serve as a tool that can be easily used to assist numerous children at once, according to the professors, who went on to comment on the context and student-teacher ratio in the school. Participant P11 gave a succinct explanation for this, saying,

> *The tools are limited around our schools so we use what is available. We have a projector, to project the visuals so that it may reach a broad audience as is the case here* (Interview, November 5, 2022).

Participant P9 described a new method he had just developed in light of the enormous class size, in which he paired quick and slow learners to work cooperatively. He said:

> *I typically pair three or sometimes four students with one computer in my lesson to accommodate the large class size. While other students (slow learners) see what they do and follow the instructions, I let the pupils who are proficient computer users sit directly at the computer* (Interview, November 5, 2022).

Participant P9 describes how he uses his personal laptop in the classroom;

> *I use my laptop computer in the classroom, as I have software and scientific videos which I demonstrate to the students when teaching. I have programs in my portable computer like virtual lab and 4 stroke engine animations* (Interview, November 5, 2022).

P4 acknowledged showing their students real-world photographs on their phones and IPads while teaching and using them as a reference tool;

As you can see, I have an Apple IPad with me. When I discuss concepts like folding and faulting or volcanicity in class, I use real images from my tablet to demonstrate them. I make every effort to improvise and align my instruction with reality (Interview, November 2, 2022).

Participant P1 said: *When I am teaching, I keep my Tablet beside me to verify what I'm teaching and to check from other sources online* (Interview, November 8, 2022). Furthermore, participant P3 stated, *I use my phone too. When a student has a hard question in class or I need to apply what I'm learning to a real-world scenario, I might just use my phone to browse through resources relating to the topic I'm teaching* (Interview, November 2, 2022).

The investigation revealed that the other group of teachers admitted to using the tools indirectly to ensure effective teaching rather than directly in the teaching and learning process. They noted that pedagogic use of ICT may include passive (indirect) uses of the tools that support the teaching and learning process in addition to direct (passive) uses of the tools in the classroom. All of the teachers also acknowledged possessing personal computers, but when asked how they used them, they gave varying answers. The majority of them replied that they use computers for social purposes, research, communication with coworkers and students, lesson preparation, and other things. Participant P18 commended that;

Whenever I am at home, I typically search online for and store PDF versions of advanced mathematics-related articles. I typically review these materials at home to aid in my improvement as a mathematician. I therefore use my computer at home to study most of the time. Additionally, I prepare evaluation exams using it (Interview, November 8, 2022).

Participant P15 said;

So basically, I use the ICT tools just for research purposes to complement my lesson notes. In case I found new materials, I try to add to my lesson notes so that the student and myself are abreast with the information that are changing (Interview, November 8, 2022).

To continue, it was evident that during the FGD, teachers are actively making use of some mobile applications as a collaborative tool with their students as he explains: *I use recent mobile applications like Viber and WhatsApp to communicate with the students giving them academic directives in my subject area* (FGD, November 12, 2022). The reason these teachers are using these mobile applications as a pedagogical tool was also questioned, given that it was evident from the observation that students are not allowed to use mobile devices in class. One replied from the FGD:

> *CT in the teaching and learning process is a vital issue that must be taken seriously because we have gone past the age where teaching must be done in a classroom, or under a tree. We are now in an age where technology rules, so at least we should try as much as possible in our Cameroonian schools to incorporate ICT in the teaching and learning process* (FGD, November 12, 2022).

Participant P16 discussed how he teaches his students to obtain quality academic materials online and said that some teachers assigned students to find information on the internet in their subject area.

> *I give them advice on how to conduct research on the internet. For instance, when I am teaching a topic like science, I typically give them homework after class, instructing them to type the url google.com into the Google search box when they are browsing the internet at home* (Interview, November 4, 2022).

Inasmuch as the majority of the teachers were considered both active and passive users of the ICT tools in the teaching and learning process, few teachers admitted not using the ICT tools pedagogically. Their views, they asserted that ICT in education is still a new concept so it will take time for teachers to start making use of the tools in the teaching and learning process. It was evident that pedagogic use of ICT still remains a difficult challenge amongst teachers as some of the teachers were more comfortable with the traditional instructional method of teaching. They explain that ICT was inappropriate in their subject area. Appraising the traditional instructional method of chalk and chalkboard, they explained that they saw no need of using ICT in teaching some practical lessons as it demands step by step processes which are more suitable or

better understood when the chalk and chalkboard are used. Participant P15 and P13 in their responses said:

> *It has been a good experience so far given that we are using our traditional method of teaching. We live in a country where ICT is still developing, and so I prefer to use the traditional method, the board and chalk and it has been fine* (Interview, November 8, 2022).

> *I think physics is more of a practical subject that needs demonstration in certain aspects and is not enough to use ICT tools to teach the subject. In physics you actually have to demonstrate aspects such as solving equations using the chalkboard so students can clearly see the steps. But using ICT tools like projector will not be effective in such lessons* (Interview, November 9, 2022).

From a general point of view, the pedagogic use of ICT in both schools can be considered as very low. The majority of teachers were passive users and only two teachers created innovative classroom practice with ICT in which they gave the students active role in participating in their learning. In as much as many of the teachers considered the tool vital in the teaching and learning process, it seems the interest in incorporating ICT in pedagogy is still in a surface stage in these schools.

The teachers' replies indicate that using the ICT tools has enhanced their material and pedagogical skills because they are now able to present their classes without many challenges as before. Some of the teachers acknowledged that their function as guides instead of instructors has changed as a result of adopting ICT, making their work easier than it formerly was. Additionally, some educators actively engage in project-based and collaborative learning. ICT is a collaborative tool that teachers utilize with their pupils to help them understand more. ICT's diverse effects led to teachers developing their lesson plans *knowledge, pedagogical knowledge, technological knowledge* and students' achievement.

2.6. Discussion on the use of ICT tools and CBA in Cameroon Secondary Schools

Data collected on this was tested using the Spearman rank correlation and multiple regression analyses. Concerning this first hypothesis, it was discovered that

the use of ICTs significantly facilitates CBA teaching-learning methods. Statistically, the Spearman rank correlation index was 0. 367. This coefficient is positive and thus reveals that the relationship between the use of ICTs and CBA teaching-learning methods is high and positive. Alternatively, looking at the level of significance of 0.00, we can conclude that we have no chance of making an error if we admit that the use of ICTs positively facilitates CBA teaching-learning methods.

From the statistics we got from the field, most of the respondents confirmed this hypothesis. 305 of them strongly confirmed, while 480 confirmed that they learn best using ICT rather than traditional teaching methods. Eventhough many of them (154) seemed to be unaware. ICT is observed elsewhere in secondary schools. It has touched and influenced the lives of students.It has imposed its presence into the daily life of students so much so that the latter cannot function without them. Also, most of our respondents (206, strongly agreed while 516 agreed) said that a computer teacher is keen to provide new learning skills in ICT. Computer teachers are implementing new ICT skills even. ICTs play a very important role as they ease the teachers' duties (typing, calculators, content multiplication, automatic examinations, marking and corrections, research, and others). ICT in the Cameroonian secondary school system is still at a low stage. Much effort is being done. On the contrary, the fact that 388 out of 1109 of our respondents were actually uncertain whether a teacher is keen to provide new learning skills in ICT, the use of ICT in the classroom has been shown to boost students' motivation, enthusiasm, and involvement in the subjects they are studying. ICT makes it possible to use cutting-edge educational materials and modernize teaching techniques, fostering greater student engagement and the concurrent learning of technology skills. ICTs also greatly aid in the development of judgment. Some of the most noticeable abilities that students acquire as a result of using ICT are the ability to compare and contrast multiple sources and organize knowledge.

Worthy of note from our statistics was also the fact that most students seemed unaware that ICT devices are in good condition and high quality. That may be why most of them (91) strongly disagreed with the question that the ICT devices are in good condition and of high quality. From our responses, 124 disagreed and 110 strongly

disagreed that ICT improves knowledge. ICTs also greatly aid in the development of judgment. Some of the most noticeable abilities that students acquire as a result of using ICT are the ability to compare and contrast multiple sources and organize knowledge. The statistics show that 438 agreed and 277 strongly agreed that the use of ICTs to learn is very important for a career after school. They foster creativity. ICT tools encourage the growth of the imagination and the initiative of every student in the class. Digital environments enable real-time updating of all resources and information, allowing for personalization and up-to-date material. Additionally, the tools and materials can be modified to reflect regional and surrounding reality. More informal and spontaneous close communication between students and teachers is promoted through a variety of methods. The use of ICT in the classroom encourages students to take an active and participatory role in their education and to see themselves as the main character. The use of various digital tools obviously improves collaboration among students. They can work together, develop team projects, and share knowledge much more easily.

Our literature review corroborates the fact that the use of ICTs has been making a great impact in secondary schools in Cameroon. The pedagogic use of ICT in the teaching and the learning process from a qualitative perspective, regarding the context of Cameroon closely linked with the theoretical framework and relevant studies emerging from the literature review. The efficient integration of ICT into teaching and learning processes is one of the goals of 21st-century education, and instructors are expected to acquire the necessary skills and knowledge through pre-service or in-service training programs. Therefore, it is essential for every teacher to effectively integrate ICT technologies into their instructional practices. It became clear from the analysis that the pedagogic use of ICT was not being utilized to its full potential in these schools after examining the pedagogic use of ICT through observations and teacher interviews in an effort to address the first research question, which focuses on the pedagogic use of ICT. Unfortunately, ICT has not significantly altered the school's approach to teaching. Both institutions' teachers used well-established and conventional teaching techniques to create their classroom learning environments. During the FGD, it was discussed that:

It is a given that most teachers still have not fully utilized ICT's creative potential by having pupils participate more actively in the creation of information. It was clear that ICT was underutilized because most teachers and students were just obliviously using it after interviewing the teachers and observing the different ways they used it in the classrooms (FGD, November 12, 2022).

As passive users, they focused more on using ICT for class preparation, evaluation procedures, and online resource discovery. Some ICT newbie teachers made sporadic attempts to develop a learning environment where students actively engaged in knowledge creation. Even while the delegation in charge of secondary education vigorously implemented in-service ICT training in the schools, interviews with teachers and observations clearly demonstrate that this was the main strategy for supplying teachers with ICT.

Few teachers are considered active users of ICT. This alone was not enough to guarantee the effective integration of ICT in the teaching and learning process. Merely equipping schools and teachers with ICT tools are inadequate (FGD, November 12, 2022). According to the teachers' responses to research question number two, teachers were confident that, if new technology is used effectively, it will not only improve students' learning processes but also make teaching easier and more efficient, raising the level of education at the national level. However, given the inadequate ICT infrastructure and resources available, teachers expressed uncertainty and concern about whether the new technology can improve the current academic performance of our children.

The results show that the majority of participants have positive views towards integrating ICT in education confirming that, for example, the FGD reported that *ICT* makes the work easier, teaching more enjoyable, changes the daily routine, enhances student achievement, and, saves time and a great deal of effort for teachers as well as students (FGD, November 12, 2022). This is supported by participant P4 when he stressed the pressing need for ICT in education, and the positive influence that ICT tools can have on learning and the teaching process for both teachers and students. He thus commented: *ICT has become an urgent necessity in education these days, and it can*

make a huge difference for both students and teachers. This is a technological era; I mean nobody can deny the importance of using ICT in teaching (Interview, November 2, 2022).

The results revealed that both principals and teachers agree that students should not be deprived of learning through technology and that they should be supported to become more involved in ICT. This is well illustrated by participant P12, *we must not deprive students of learning through technology; in fact, we should ensure that they are involved in this area. The use of educational technology has become a reality that cannot be ignored, especially at the present time* (Interview, November 5, 2022). Participant P1 affirmed how the presence and use of ICT is simply everyday normality in daily life, and education should be part of this, saying, "*Nowadays educational technology is everywhere, in schools, at home, the market, and even on planes. Modern education is based on the use of ICT tools* (Interview, November 8, 2022). Participant P4 emphasized that *I find ICT in my school interesting. I learn best when my teachers use ICT tools rather than traditional teaching. I think ICT tools play an important part in the learning process* (Interview, November 2, 2022).

The use of ICT in the classroom by teachers is also highly respected. Students especially admire teachers who are competent in ICT skills and particularly those who are able to employ them effectively in the classroom. One of the students summarized these points of view succinctly,

> *I respect teachers who use ICT tools in their lessons, and I feel they do their job well because they are keen to make our lessons more interesting. I am very concerned about teachers who are not able to use educational technologies and so neglect them; to be honest, I don't respect them, and unfortunately, there are many such teachers in my school* (Interview, November 9, 2022).

ICT integration into the classroom has significantly improved the way technical courses are taught, especially ones like chemistry that require more hands-on instruction. The effective use of ICT in these fields, including mathematics, is seen as a breakthrough in the accessibility of crucial data, materials, examples, and media via websites like YouTube and its films, which reduce the need for a physical lab. To

demonstrate this, participant P16 explained, *Teachers are now able to clarify and explain these experiments through ICT tools, for example, by watching documentary films on YouTube, without having to take risks and carry out dangerous experiments in the lab* (Interview, November 9, 2022).

The literature discussed the process of successfully implementing ICT in schools as intricate and varied, and it also depends on factors like teachers' skill levels, curriculum reform, school readiness, long-term funding, and the caliber of the ICT, among others. Recently, the Cameroon government has achieved outstanding strides through the Ministry of secondary education, demonstrating its dedication to integrating ICT to enhance the nation's educational system and the creation of the national curriculum. ICT subject at all levels in Saudi schools is still deficient and needs development. It is not compatible with modern technology. It is just about basic computer skills in most of its content and this does not accommodate young learners who are interested in various technology fields.

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

Computer science was born out of a concern to automate tasks that were sometimes redundant or difficult for humans. A new science and therefore still in gestation, it appears as an indispensable means for the development of third-world states and an undeniable force for powerful states. Beyond the field of technology, computer science has found its place in education by giving birth to ICT. ICT has become one of the fundamental elements of modern society. Many countries now consider the mastery of basic skills and concepts of ICT as an essential part of their concepts as an essential part of education.

To this end, several new models of education are evolving in response to the new opportunities that are now available through the integration of ICT and web-based

technologies in particular, in the teaching and learning environment. The effective integration of these demands, however, depends to a large extent on the socio-economic context of the states. The teachers need to know exactly how to integrate ICT as a teaching and learning tool for their learning tool, for their own purposes and to help students use it.

Putting technology at the center of learning to improve learner performance is UNESCO's current focus. Indeed, this institution has quickly understood the limits of traditional education in terms of access to information, among others, but also in terms of the quality of teaching. In one of its articles, UNESCO, (2021) stated: *Technology has brought its share of benefits including access to good information, sharing of resources between geographically distant individuals, enabling self-learning, and many others*. But to fully realize this, we must first train teachers in the use of digital technology.

To support education in Africa, governments have been considering various strategies. In a common way, they agreed on the integration of ICT in education such as the Ministerial Forum on the Integration of ICT in Education in Africa, which is a regional mechanism for policy dialogue created by the Association for the Development of Education in Africa (ADEA), the African Development Bank (AfDB) Group, the United Nations Educational, Scientific and Cultural Organization (UNESCO) and their partners, were born (Elouardani, 2016). This symposium was aimed at enhancing education in Africa through the effective use of technology in education. The goal was to find a way to support governments that are struggling to integrate this important aspect of state life into their national routine, At the end of the forum, some conclusions were taken among which were to :

- promote the sharing of experience between African States in the implementation of educational policies,

-better understand the role of education and ICTs in the construction of building a state at all levels, the signing of conventions and partnerships between states and NGOs in the service of education or technological development.

Faced with the trend of redesigning education in the world, Cameroon has not remained insensitive. Since 2001, Cameroon has officially integrated ICTs into the educational system through the creation of several Multimedia Resource Centers (Marcelline Djeumeni Tchamabe, 2013). This took effect in accordance with the Law of Orientation of Education n° 98/004 of April 14, 1998 in its article 25 April 14, 1998, states that "teaching in schools should take into account the evolution of science and technology and also that the education system must train Cameroonians rooted in their cultures and open to the world. It is therefore clear that ICT is a solid foundation on which education should be based. These CRMs are each made up of about forty computers interconnected with each other while connected to the Internet network and various equipment (photocopiers, printers, video projectors...). They are open to teachers and students under certain conditions of use. The goal is that teachers can use the equipment at their disposal to enrich their course content, find learning activities, and much more...

But it was clear that the actors of education did not have a real mastery of the digital tool. This is why, in 2003, the Ministry of Secondary Education established computer science as a subject in its own right in the school curriculumm, with the objective of enabling learners to integrate more easily into the workplace in a world drowning in digital technology. Aware that the training of students depends on quality education, it is essential to train upstream those who will be in charge of transmitting the knowledge to in turn the learners. Hence, the creation of educational technology courses in teacher training colleges since 2007.

A high level of satisfaction indicates a successful ICT implementation and vice versa. However, the study found a very low level of satisfaction, with 100% of the participants feeling that there is still a clear gap between the current situation (the reality) and their expectations. The participants identified several issues that they are dissatisfied with. Regarding satisfaction with the availability and use of ICT tools in school, for example, participant P9 explained, *we give our school titles such as 'School of the Future' or 'Smart School,' yet they don't have even the minimum basic conditions*

required to use ICT tools. Frankly, the current situation is frustrating (Interview, November 5, 2022).

> *Most teachers don't like attending training programs, I've already discussed this issue with my colleagues; they question the benefits we get from these kinds of programs; whether we attend or not, the way we are treated and our salary remain the same* (FGD, November 12, 2022).

Most teachers see their duty as facilitators as a necessity to guarantee that the ministry of secondary education upholds the use of ICT tools in most disciplines. This leads to the construction of an enjoyable and stimulating learning environment as well as the availability of ICT resources in the school and the reinforcement of the ICT-related learning processes. The ways in which teachers supported ICT also varied from one teacher to the next, with some citing providing training, disseminating announcements, and overseeing and maintaining learning centers as major factors in this position. Participant P1 reported that:

> *I make sure that the teachers who are proficient in the use of ICT train the teachers who need training. I try to make the Learning Resource Centre a place of thinking and research. I always ask the teachers to involve students in using ICT tools in lessons, because this will help them to prepare for the next stage in their lives. I also monitor teachers' work and constantly encourage them to use technology in their lessons* (Interview, November 8, 2022).

However, some students believe that some headmasters are unhelpful in promoting the use of ICT in the classroom, claiming that the way in which headmasters interact with them when they use the internet and mobile devices neither inspires nor builds up their confidence. Participant P7 stated, *the problem is that the teachers deal with students like irresponsible people or teenagers* (Interview, November 9, 2022). When asked to clarify this resentment, participant P12 responded that:

> *We're at a critical stage with what's happening in the world around us. For example, terrorism has led me to ban completely the use of the internet and mobile phones in my school. I know they continue to be used in secret, but I have*

tried my best to take control of this matter, and I think the internet should be banned in all secondary schools, because of the seriousness of this age and the impact of suspicious ideas on students (Interview, November 5, 2022).

Collaboration was realized at various levels, both internally, with students and teachers, and externally, with the ministry of secondary education and parents. Commenting on how they ensure effective collaboration with teachers and students, participant P3 reported that, *I take note of the complaints from students and teachers about what they're actually faced with and what they need in terms of ICT tools, and work extremely hard to resolve such issues* (Interview, November 2, 2022). Teachers and students perceived that this collaboration was ineffectual, and they describe themselves as sometimes caught in between. This was highly evident when tools broke down or students needed access to ICT. Integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties.

Implementing ICT tools in teaching and learning in the classroom among school teachers is very important. Furthermore, it examines the challenges of using ICT tools in teaching and learning in the classroom among school teachers and recognizes the effectiveness of the extent of ICT tools in supporting classroom teaching and learning. Based on the study, the findings indicate that the average level of the perceptions in implementing ICT tools in teaching and learning in the classroom among school teachers, high level of challenges of using ICT tools in teaching and learning in the classroom among school teachers, and recognizing the effectiveness of the extent of ICT tools in supporting teaching and learning in the classroom. Participant P6 said:

I really respect a teacher who uses ICT and feel such a teacher has integrity, because he's keen to make the lessons more interesting, but I'm really bothered by the fact that some teachers are unable to use educational technologies or even deliberately ignore them. To be honest, I don't respect them at all (Interview, November 4, 2022)

With the advent of ICT in education, teachers form their own beliefs about the role of ICT as a teaching tool, the value of ICT for student learning outcomes, and their own personal confidence and competency (Shambare, Simuja & Theodorio, 2022).

Barriers exist to integrating ICT into teaching and learning (Nidup, 2022). The barriers are extrinsic to the teacher and include a lack of resources, time, access, and technical support. The findings of this research suggest that teachers were still giving comments on the barriers to implementing ICT tools at school in teaching and learning. Our research showed that the rate of ICT use among teachers in schools is average. However, the finding shows that more teachers used computers with teaching software in the classroom to present or demonstrate examples to students. They also like to use the computer to access students' results and keep track of their progress.

This study has shown that the primary and secondary levels of the Cameroonian educational system still use ICTs at a very low level. Contrary to public schools where there are too many pupils, private schools make a lot of effort to maintain an acceptable number of students per classroom. The primary causes of this predicament have been identified as low equipment, teachers who lack training, and a poor working environment. Projectors and interactive whiteboards are the least used tools in schools, while computers, phones, and calculators are the most frequently used. Additionally, it has been noted that ICTs are utilized for preparing lessons (typing, printing,) multiplication, research, delivering lessons, conducting exams, and grading papers. In order for ICTs to be used effectively in Cameroonian schools, emphasis should be placed on teacher training and recycling, school equipment, improving teaching conditions, and implementing awards to recognize outstanding teachers and students. By doing this, they will be more likely to invest in this cause. It should be noted that since this study was conducted in an urban area, it is possible that rural areas may experience harsher conditions. Future studies in that area will produce a wealth of information.

From the discussions, we therefore conclude that there is no doubt that the use of ICTs positively influences CBA teaching and learning methods. A good policy can be marred at the level of implementation, especially when concrete implementation strategies are not conceived and carried out so that implementation results trickle down to all stakeholders, especially to students. Some teachers use the school computer to prepare lessons and they find this helpful as they are able to make notes for their learners who do not have textbooks. They also use computers to record learners' marks. Some

teachers use computers to research for their lessons but they do not use those in the school premises.

CHAPTER THREE

EXPLOITING ICT INFRASTRUCTURE TO ENABLE COMPETENCY-BASED APPROACH IN EDUCATION

ICT infrastructure in this work is treated in terms of a central role in transforming teaching, learning, and assessment practices for teachers and students, in a high-quality 21st-century education system. Teachers and schools are constantly engaged in enhancing how they teach, how their students learn, and how learning is assessed. It is essential to embed ICT infrastructure in the education system at all levels (Lowder & Regmi, 2020). Learners need more open-ended learning experiences that develop the learners' higher-order thinking, creativity, independence, collaboration, and ownership of learning. When the ICT infrastructure is used effectively, it can provide opportunities

for all teachers, students, and parents/guardians to develop these Key Skills. ICT infrastructure has often taken the place of older technologies, such as books or whiteboards, and the role of the teacher and the learner remains unchanged. The setbacks recognized included rethinking the role of teachers and scaling teaching innovations. The adoption of ICT infrastructure in secondary schools is one key initiative that makes it possible for the education system all over the world to meet the challenges of the 21st century (Bariu, 2020).

3.1. Modern Technologies on Learning Environment

Noe & Kodwani (2018) claim that the internet is mostly to blame for our current revolution in education. Electronic networks that integrate phone, video, and data connections between students, instructors, and experts have been made possible because of internet technology. Halimi & Hristoskova (2001) claim that the learning environment has been significantly impacted by the Internet. They contend that teachers need to learn a new skill to help pupils understand how to learn in light of the abundance of knowledge available on the Web. However, according to Glickman (1985), research on the performance of schools demonstrates that most of them merely do not significantly alter the lives of their pupils. Additionally, he makes the claim that *successful schools have faculties with a clear, common purpose toward which they strive*.

Bezuidenhout (2009) further notes that it is frequently difficult to make efficient use of both students' and lecturers' time when teaching large classes in a traditional setting, which reduces the educationally advantageous informal interaction between students and professors. According to Sun, Shirley, and Liu (2004), traditional classrooms taught students to rely on their tutors for their motivation, guidance, goal-setting, progress tracking, self-evaluation, and success. But because of technology, learning has evolved into a highly dynamic process. According to Palloff and Pratt (1999), interaction in all of its forms between and among learners, between learners and educators, between learners and content is a crucial part of the learning process. The capacity for new and improved methods of knowledge exchange and teamwork is thus increased by the usage of new technology.

In order to become the innovators of tomorrow, students must today acquire 21st-century abilities (Kibinkiri, 2014). To advance up the knowledge chain, they must employ those skills. Additionally, it lays the foundation for lifelong learning. In addition, Béché (2017) draws the conclusion that the integration of ICT has had a motivating effect on students based on the responses he received from principals, students, teachers, and parents in a survey of eight secondary schools in Cameroon to better understand how the nature of the conditions in the integration of African countries, favors the successful integration of ICT in the school system and ensures quality education. The principals mentioned the flood of kids during use hours and other times, for instance. The students' enthusiasm for computers and increased interest in school were also emphasized; evidence of this interest included the students' attendance at cybercafés and afternoon computer classes. Additionally, as a result of the students' apparent enthusiasm, there was a decrease in absenteeism, which showed the positive impact of the integration of ICT. Furthermore, 71 percent of the students—boys (38%) and girls (33%)—said that ICT significantly makes it easier to do coursework. Additionally, according to 80% of the professors, using a computer helps children concentrate better on their academic work (Tchombe & Karsenti, 2008).

However, Mbangwana (2008) conducted a study on the instructional use of ICT by students and faculty at Cameroon State University. The study revealed that students used computers and Internet-based learning materials more frequently than teachers for instruction: Z-calculated (9.78) and Z-critical (1.645). Additionally, Z - calculated (0.775) and Z - crucial indicate that students are more assured and competent about the use of computers and the Internet for instruction than their teachers (1.645) (Mbangwana, 2008).

Additionally, a survey of Makerere University's conventional distance learning students reveals that both electronic and non-electronic media were effective for fostering learner-learner and learner-lecturer communication (Muyinda, Lubega & Lynch (2009). Electronic communication made use of discussion boards, cell phones, and e-mail. 52 percent of the students admitted that they had spoken with their course directors during residential sessions to get updates on the IT II course. Prior to the start

of the IT II online course, 88 percent of students had an email address. Sixty-four percent (64%) of students sent at least one email to a classmate, and 62% sent one to a professor. 42 percent of students used the discussion board to discuss hot topics presented in the BBLMS by the lecturer or other students, while 38% of students used their mobile phones for learner-to-learner communication. Constructivist learning existed. According to Muyinda et al., (2009), 81 percent of students agreed that the in-person training and the page-by-page instructions on how to use the Blackboard Learning Management System (BBLMS) were sufficient to enable them to take part in online learning.

Reverting to our original research question, we can see that the aforementioned literature fell short of a thorough examination of the behavioral shift in teaching-learning activities brought on by the adoption of ICT in Government Secondary Schools in Yaoundé V, which is the main subject of our study. Therefore, we will explore the ICT tools that are available, how they are used and the significance and effects of incorporating ICT into the curricula of the aforementioned institutions.

3.2. Status of ICT infrastuctures

The use of computers in instruction and learning has become standard due to their role in the national improvement in education and the growth of student enrollment in schools today. This is because if educators adopt it, a better method for delivering teaching will be created. Effective classroom management, collaborative learning, self-study, course/subject organization, and improved peer, teacher, and student-teacher communication are all concerns that ICT will help with. Unlike in the past when a teacher would stand in front of a class and lecture pupils without involving them in the subject or issue, students participate actively and aggressively in the process nowadays (Al-Mamary, 2022).

ICT infrastructure includes network connectivity, software, and hardware. ICT is used in this context to facilitate learning with ICT and learning through ICT, in addition to learning about ICT. Sub-dimensions are identified in relation to ICT infrastructure in education, such as the producer versus the consumer dimension, which determines whether the digital materials are created by the students and teachers

themselves or if they are created by others and accessed by the students and teachers; the stand-alone versus the distributed dimension, which determines whether the software is only locally available (CD-ROM) or accessible only from remote locations (Web-based); the degree to which a pre-determined learning path is designed into materials (tutorials and some simulations) against their use as exploratory settings, or as hyperlinked encyclopedias of resource materials, is referred to as "the structured versus the learner-controlled" dimension.

At this point, concerns about the type and quantity of hardware, the required price of the equipment and its specifications, the essential components and handling of the ICT infrastructure and maintenance best practices should be addressed. From a software standpoint, the argument focuses on the advantages and disadvantages of utilizing Free Software (FS) and solutions in comparison to proprietary solutions. The FS solution wins out economically, despite claims to the contrary from companies who sell proprietary software that their Total Cost of Ownership (TCO) is lower (Damnoen, Phumphongkhochasorn, Pornpitchanarong & Nanposri, 2022).

According to Damnoen et al., (2022) and Goodyear (2022), the various ICT tools used during the delivery of instruction and learning in schools and colleges include audio sets, TV, personal computers (PCs) projectors, Optical fiber cables, Telephones, Mobile devices, Handhold devices, Fax machines, Internet, Intranet, CD-ROM, PPT slides, electronic board, digital multi-media, video/ video compact disc (VCD), and DVD machines. It gives the impression that some of these technological advancements are not properly incorporated into post-primary instruction in Cameroonian government schools (Tanyi 2022).

According to Ndongfack (2015), using these resources effectively necessitates a variety of strategies, including computer-based operation/systems, video and audio conferencing, local area networks, the internet, and computer-assisted instruction (CAI). It should be highlighted that the viability of these various ICT teaching and learning methodologies depends largely on the availability of these resources and the teachers' proficiency in using them. The ability to use a PC effectively has now become an essential component of every student’s academic life. Science, technology,

engineering, and administrative support are increasingly included in specialized computerized programs like word processors, spreadsheets, Corel Draw, and databases. Other disciplines include accounting, business management, clerical support, and science (Kadjie, Hikouatcha, Njamen Kengdo & Nchofoung, 2022). The need for computer and ICT literacy is constantly increasing as workers realize that staying current with new technology is the best way to secure their jobs as it gives them the greatest amount of job security. Even among experts, the teaching and learning of these abilities is currently a hot topic. Applications of ICT in education have been beneficial in empowering the teaching and learning process in Cameroonian public schools and improving the quality of education for the pupils. In order for a country to develop effective human capital, education must be improved (Kadjie et al., 2022).

As technology advances, educational capacity equally steadily grows. Teachers and instructional technologies now have better tools to work with thanks to the advancement of modest PC innovation and mass storage media like an optical disc, cloud, and other similar ones. Nowadays, a PC’s memory is measured in terabytes and can hold a large amount of data and information. According to Ndongfack (2015), the effective use of ICT in the classroom strongly depends on the teachers' access to these tools and their proficiency with their use. According to research, the schools in Cameroon lack efficient ICT facilities, which makes it difficult for the teachers to use them. Other problems include insufficiently qualified teachers, inconsistent power supplies, instability, and a lack of funding.

It is thought that the accessibility, aptitude, and attitude of instructors regarding the employment of cutting-edge innovation in instructing and learning play a significant role in the efficient integration of ICT in the educational system. Idoko and Ademu (2010) discovered that one of the biggest barriers to technology adoption and integration in teaching and learning is frequently the lack of ICT availability. They showed that more ICT facilities are constantly needed if a country intends to successfully integrate ICT into secondary schools. PCs are arranged and connected to the internet to make up a system. They continued by saying that because there are so few of these vehicles, most village institutions have not yet benefited from this task. Fakeye (2010) also found that

many of the schools examined lacked PCs and were therefore not connected to the internet (intranet). It is noted that those who own computers only use them for managerial tasks rather than for learning.

Abdul-Salaam (2012) noted that students from the institutions he studied were unable to quickly access computer resources. The report also shows that the vast majority of secondary schools are not connected to the internet. Those who own PCs typically lack the essential instructional programming that their children need. Additionally, due to the large number of students enrolled in the impacted institutions, the PCs available at these schools are unable to meet their needs. A few institutions that had internet connectivity were also unplugged because they are not able to afford the access cost. These results are consistent with the findings of Fakeye (2010) and Oyejola (2007) that the majority of secondary schools are not adequately equipped to use ICT. It is also important to realize that the likelihood of using ICTs in teaching and learning activities is significantly influenced by their accessibility in educational settings. In a study that examined the variables that affect ICT use in schools in Sub-Saharan Africa, according to Erdogdu & Erdogdu (2022), the accessibility and availability of resources in schools are extremely important for the integration of technology into education.

3.3. ICTs for classroom teaching

It is the ability to apply learning in novel situations that makes for a successful student and, eventually, a successful member of the 21st -century workforce. Research has suggested that students learn more when engaged in meaningful, relevant, and intellectually stimulating work and that using technology increases the frequency of this type of learning (Lambert & Cuper, 2008). Teaching that integrates ICT ensures that students are actively engaged and allowed to practice their learning in novel situations by relating, experiencing, applying, cooperating, and transferring (Dyer, Reed & Berry, 2006). The start of the new millennium was marked by a ground-breaking digital innovation. We currently live in a complicated, globally connected, and increasingly diversified media-saturated culture. Martinez (2022) asserts that this revolutionary transition has a greater impact on society than the shift from an oral to a written civilization. Due to this advancement in technology, students now need to actively

participate in the generation and use of information, as well as be able to communicate effectively and function both locally and globally. Learning technology for the digital era is just one of the changes brought about by this technological innovation in our daily lives. Today's learners must continually deal with a variety of computer and social networking applications, like those offered by web 2.0 tools. The learner's behaviors and requirements are changing as a result of the new technology, but so are the theories and principles underlying learning processes, instructional design, and application development. Once more, Uştuk (2022) emphasized that the learning group is portrayed in the Connectivism model as a hub that is constantly a part of a larger system.

A study carried out by Martinez (2022), stated that "the three r's of education (reading, writing, and arithmetic) have been replaced with rigor, relevance, and real-world skills for the 21st-century learner". It is therefore imperative that teachers alter their instruction to focus on what their students need. To Martinez (2022), it is not enough to simply teach in the same manner in which we were taught because the skills necessary for success in society have changed. In order for students to be competitive in the workforce, they must possess 21st -century skills such as global awareness, scientific literacy, the ability to collaborate, and leadership abilities, where technology literacy is the foundation of all of these skills. He equally states that cultural awareness and social responsibility are key components of the skills a student must possess given that much of their work constitutes communication on a global scale (Vallera & Harvey, 2022). According to their study on how teachers used technology resources, Lei found that social communication technology use had a significant positive association with student development and a moderate positive association with student achievement. It was even found that entertainment-exploration use of technology improved student learning habits (Lei, 2010). Research has also suggested education that integrated technology had a positive effect on student achievement. According to Dyer et al., (2006) a study, in particular, sought to determine if students involved in an illustration and design technology course would perform better on the mathematics Standards of Learning (SOL) test, which is Virginia's standardized test. In this study, it was found that those students who participated in the illustration and design technology course had

a statistically significant higher passing rate on the SOL than those students who did not participate in the technology course (p. 9).

Another study also suggested that merely using technology as a learning tool on a regular basis does not automatically result in higher student achievement; rather, it is through high-quality and purposeful utilization of technology that students will perform better. Lei found out that when time spent using technology was the only factor analyzed, there were no significant differences in student achievement. When general technology use was examined, as a factor, only technology proficiency increased while subject-specific technology use impeded technology proficiency (Lei, 2010). Social communication technology use, or ICT, had a significant positive association with student development and a moderately significant positive effect on student achievement. It is as well observed that students who learn in a technology-enhanced environment not only increase their motivation and achievement but also improve their self-efficacy levels (Hsieh, Cho, Liu & Schallert, 2008), Studies have also shown that students with higher perceived self-efficacy are more persistent, motivated, and experience greater achievement (Bandura, Freeman & Lightsey, 1999). The greatest catalyst for increasing self-efficacy in students is the self-directed learning that takes place when a student is using technology as a learning tool. Bandura and Schunk found that when students pursued self-directed learning with proximal sub-goals they achieved substantial mastery of mathematical operations and developed a strong sense of mathematical efficacy (Bandura & Schunk, 1981).

On the other hand, not all studies have found ICT as a catalyst for improved student achievement. Merrill for example, found no difference in student achievement for students taught using technology when compared with those students who were taught using traditional methods (Merrill, 2001). Other researchers have even suggested it is debatable that technology-infused teaching can enrich student learning and cautioned educators to plan purposefully and not assume student achievement is inevitable simply because technology is being used (Mathiasen, 2004). Schofield warned that the shift from a teacher-centered to a student-centered learning environment may have unanticipated consequences (Schofield, 1995). In their work, Garthwait and

Weller (2005, p. 11) outlined the technical problems that arose in their study when the teacher (Susan) used technology in the lesson.

> *One of the first laptop activities Susan planned was for students to practice scientific note-taking and upload their work to the school server. She saw this as an effective way to assess students' ability to select key points and paraphrase. Much to her distress, only half of the students had been taught how to access the server, so Susan had to rededicate time to teaching the others … this inefficiency was frustrating.*

An increasingly complex society and a rapidly changing technology-based economy have posed new and demanding challenges to schools and communities alike. School systems worldwide are being asked to develop frameworks emphasizing developing the skills, knowledge, and attitudes necessary for success in the 21st Century. In Cameroon, for example, policymakers have argued that Cameroon's high schools are not producing the twenty-first-century graduates needed to compete and succeed after high school in an increasingly complex and interconnected world (Achieve, 2010). There is ample evidence that too many young people in our American education system graduate from high school poorly prepared for university, careers (Achieve, 2016).

Conceptualizing 21st-century teaching is a mode of education through which learners collaborate, construct interdisciplinary knowledge, take responsibility for their own learning, solves real-world problems, and innovate (Wood and Sithamparam, 2021, p. Ix.) The authors argued that teachers need to engage in action research to make sure that their students achieve such outcomes. That contemporary role of educators makes them adopt the critical role as the agents of change *(*Watson, 2014) and makes them participate in various practitioner inquiries such as lesson and/or learning studies. The authors of this book discuss that "the soul of lesson study" (2021, p. 26) is to present professional learning opportunities for teachers so that they can be empowered to make decisions regarding their own classroom practices. This way, they can raise an understanding of their learners' needs and critical aspects of (the objects of) learning. Crucially, the authors oppose the conventional top-down approaches to teacher

professional development in which experts present certain *best practices* and tell teachers what they should teach and how they should teach it.

3.3.1. The Influence of ICT Infrastructure in Teaching/Learning

A study done by Nchake & Shuaibu (2022) on the investment in ICT Infrastructure and Inclusive Growth in Africa revealed that teachers who had computers in their classes were more likely to use them in instruction than teachers who did not; more than 50% of teachers who had computers in their schools used them for research and activities related to lesson preparation. A total of 78% of teachers surveyed cited limited access to computers as a barrier to effectively using computers in their classes. Therefore, efficient and effective use of technology depends on the availability of hardware and software and the equity of access to resources, by teachers, students, and administrative staff.

A study by Văidean & Achim (2022) to assess the preparedness and extent of use of ICT in public schools in Cameroon, concentrated on the current status of ICT infrastructure; extent of use of ICT equipment in teaching, and learning, attitudes of principals towards ICT use and integration. Schools owned computers, printers, and LCD projectors whose availability was scored at 41.9%, 39.5%, and 2.3% consecutively and perceived to be expensive by principals. The study revealed the low availability of some ICT equipment that an ordinary school should reasonably afford. These include Radio 32.65, Television 16.3%, Video Tape 4.7%, and DVD and VCD players.

The study also found that 33.7% of students do not use any ICT equipment at all in learning and 39.5% of teachers do not use ICT equipment for instruction. The study does not specify the challenges which rise from principals' management roles as suggested in this study. A very high proportion of principals, 81.8%, suggested that government should provide more support for ICT and qualified personnel, 72.8%. However, there is other ICT equipment such as TVs, radio, and DVD players which most schools can afford and yet they are not available or they are under-utilized. Even schools that have computers registered only 60.0% of teachers and 58.0% of students who accessed them and students' performance is still low.

3.3.2. Students' and Teachers' Perceptions on the use of ICTs

Students form the largest part of any academic community and their viewpoint has to be respected. Considering the role they play in any activity that takes place in the school setting, psychologists argue that students should be seen as dynamic and integral members of the learning community not just as aloof beneficiaries or even mere consumers. According to Oyewale (2022), ICT eliminates problems with time and location because it allows students to communicate with their teachers and share information at anytime, anywhere. Students typically have access to a global pool of knowledge since ICT makes serving and sharing information easier. The students can independently and/or collaboratively create notes and presentations, enlist their progress, and utilize it for exams. As a result, they are also equipped for future assistance in international research and correspondence. Partners in the field of instructional technology concurred once more that the use of ICT in the classroom boosts students' cognitive abilities through higher order thinking, critical reasoning, improved relational skills, and a thorough understanding of the teaching tools and concepts encouraging a solid, intuitive, educational and learning environment by increasing learning correspondence and providing students, especially those with exceptional needs with learning tools, using computer-produced design to illustrate connections of many kinds, especially those that do not involve human presentation (Oyewale, 2022). According to Erdogdu & Erdogdu (2022), educators are aware of their ability to create both autonomous and group learning environments where students understand concepts more clearly. In reality, according to the results of a study by Yunus, Salehi, and John (2013), teachers believe that the usage of visual aids stimulates students' enthusiasm for studying.

Regarding the difficulties in integrating ICTs into the teaching-learning process, educators and school administrators are skeptical. These include inadequate telephone services, improper maintenance of the damaged equipment and facilities, a lack of ICT facilities, poor electric power supply, a lack of knowledgeable ICT support personnel, inadequately trained ICT teachers, a lack of funding, the high cost of ICT equipment, materials, and accessories, and government payments to support the implementation of

ICT policies. If the government upholds its expectations in the execution of the ICT policy, teachers and students in Cameroon certainly have a large number of learning tools at their disposal (Ndongfack, 2016). Accessibility is hampered for instructional growth due to the low availability level of ICT resources in secondary schools in Cameroon. This supports the finding made by Ndongfack (2015) that there were no ICT resources in primary and secondary schools.

3.3.3. Students' Attitudes towards ICTs

A study was done by Westhuizen, Nel & Barry (2012) in South Africa on an Analysis of Students' Academic Performance When Integrating DVD Technology in Geography Teaching and Learning. The study used a descriptive survey design. The instruments used in the study were questionnaires and an interview guide. The target population was geography students. The study revealed that more than 70% of the students of all three groups reported that the DVD has the potential for more effective use of academic time. All the students (100%) in 2004 and 2005 and 93% in 2006 agreed that the DVD method called for more self-discipline and time management. Furthermore, given that the students are aware of the fact that they live in a developing country (South Africa) 84% in 2004 and as high as 92% in 2005 and 2006 felt that the DVD is a good alternative to the computer. In 2005, 89% of the students and 93% in 2006 were satisfied with the balance between the independent learning required by the DVD and the seminars.

Kimitei (2008) conducted a study that investigates the effects of computer technology on students in secondary schools in Nairobi, Kenya which used mixed methods to collect the required data. The study found out that most students preferred to use computers than to read or write and enjoy and concentrate more while using computers. Students feel that ICT provides a better learning experience and they would perform better if their teachers use ICT in teaching since they concentrate more. Furthermore, the researcher found out that though the effects of teaching and learning with ICT on students' cognitive, affective and behavioral outcomes have high positive effects, they have some negative effects on students like being tempted to watch pornographic materials and playing games while teaching is going on. The study noted

that ICT if used positively enhances learning processes and outcomes. Findings assert that both the learning environment and curriculum pedagogy and content are central to the effective use of ICT. However, teachers and students need to be confident in their subject knowledge as well as in basic ICT literacy so that they can effectively integrate ICT into teaching and learning programs. The study suggested means to help administrators, teachers, and students develop positive attitudes towards ICT.

The results of the study by Nasser (2014) in Qatar noted that teachers and students are not frequently using ICT in activities associated with students' assessment consistently. However, the highest frequencies of ICT use by teachers and students correspond to the most basic and conventional activities, such as preparing general classes and organizing teacher's work (educational management-related activities); searching for information and developing teaching activities; making presentations and work as a group at the same pace (learning activities).

Furthermore, the same study revealed that students' access to ICT resources, 85% of students reported having free access to computers, 50% to projection systems, and only 35% to systems. Moreover, less than 10% of them reported free access to interactive whiteboards and digital cameras. The frequency of use of ICT was influenced by access to ICT resources. The most commonly used ICT resources were computers followed by TVs, while digital cameras and scanners were hardly used due to their inaccessibility when needed and the cost of buying them. About 64.5% used the TVs daily, but for entertainment, not for teaching, and 42.9% did not use TVs due to lack of time.

The research also stated that the use of a variety of teaching-learning resources has the potential of making students understand the subject matter easier as they get different perspectives; however, proper use of such resources is what brings the impact. Such tasks tend to be more fruitful when they are clear, teacher-guided, and students have the necessary technical skills, otherwise, students tend to immerse themselves in searching for unnecessary information. Since ICT availability is one of the most important obstacles to technology adoption and integration in learning, secondary schools should make an effort towards increasing the availability and accessibility of

ICT resources to students in order to enhance students' academic performance. Furthermore, ICT equipment such as smart boards should be available so as to achieve qualitative learning. Based on these recommendations, this study suggested how the accessibility to ICT for students can help improve the performance of students in secondary schools.

3.3.4. Teachers' Attitudes towards ICTs

A number of studies have revealed that one of the important determinants of the adoption of new technologies is teachers' attitudes to ICT use in learning. A survey of teachers showed that teachers' positivity about the possible contributions of ICT was moderated as they became rather more uncertain and sometimes doubtful about specific, current advantages (Backhouse, 2013). If teachers' attitudes are positive towards the use of educational technology, then they can easily influence their students'attitudes and motivate them in their performance. Positive attitudes often encourage less technologically capable teachers to learn the skills necessary for the implementation of technology-based activities in the classroom. Therefore, if teachers want to successfully use technology in their classes, they need to possess a positive attitude toward the use of technology. Such attitude is developed when teachers are sufficiently comfortable with technology and are knowledgeable about its use. For the students' attitudes, the behavioral change would likely occur for learners who learn the material presented in the training and desire to apply that new knowledge or skills to work activities (Moluayonge & Innwoo, 2017).

Wikan and Molster (2011) stated that ICT confidence and ICT competence are both necessary factors in order for the teacher to be willing to explore the possibilities of ICT for improved teaching and learning. The authors found out that the 10 teachers of the Norwegian secondary school who were given ICT training and support in the classroom developed a positive attitude towards the use of ICT. They used ICT in a more learner-centered way and often asked students to use ICT for producing presentations and submitting homework. They found that this is motivational for many learners, especially for some slow learners. Furthermore, the study revealed that 80% of the teachers integrate ICT in timetable preparation; 52.2% use ICT in preparing

schemes of work; 54.1% integrate ICT in preparation of instructional materials; 54.8% integrate ICT in preparing students' progress reports; 84.4% integrate ICT for students' instruction class; 80.0% integrate ICT in library management;79.3% integrate ICT in preparing students 'records; 78.5% integrate ICT for collaborating with peers, and 85.2% integrate ICT in class attendance management.

The study observed that the integration of ICT in teaching in public secondary schools is rather significant. It further revealed that much of ICT is also integrated into the preparation of professional documents, for examples, the schemes of work and the students' progress reports.

The study indicated that the implementation of ICT in teaching failed due to the negative attitudes of teachers. Most teachers in these schools found the integration of ICT in their teaching as time-consuming, which indicates that they had negative attitudes. The study highlighted the importance and effective use of ICT in enhancing learning and improving performance to help teachers and students embrace positive attitudes. It is the skill and attitude of the students and teachers that determine the effectiveness of technology integration into the curriculum (Haji, 2015). Once teachers and students developed skills, they could begin to find ways to integrate technology into the teaching and learning process and demonstrate its use to others. Moluayonge & Innwoo (2017) noted that teachers failed to exploit ICT due to a lack of skills and their negative attitudes toward them. The above studies did not suggest ways to help teachers develop positive attitudes towards ICT. Therefore, this study recommends different ways to help teachers develop positive attitudes like giving them required training on ICT and encouraging in-service programs.

Descriptive Statistics on ICT infrastructures

Table 14: Information on ICT Infrastructures

Item	Statement		SA	A	Un	DA	SDA	Mean
1	I visit the computer room during my free period for research	f_1	354	305	163	139	148	5,52
		%	32,0	27,5	14,7	12,5	13,3	
2	I have a password in the computer lab that leads to my lessons	f_1	359	334	180	171	65	3,67
		%	32,4	30,1	16,2	15,4	5,9	

3	My computer teacher pays keen attention to everybody	f_1	290	371	327	36	85	3,67
		%	26,1	33,5	29,5	3,2	7,7	
4	The computer teacher gives us instructions on how to use the computer	f_1	469	374	25	109	132	3,84
		%	42,3	33,7	2,3	9.8	11,9	
5	I receive encouragement from my computer teacher for my progression	f_1	296	437	109	145	122	3,58
		%	26,7	39,4	9,8	13,1	11,0	
6	The computer teacher allows us to use the internet	f_1	359	399	---	199	152	3,55
		%	32,4	35,9	---	18,0	13,7	
7	I love all ICT equipment for studies	f_1	632	381	---	96	---	4,39
		%	56,9	34,4	---	8,7	---	
8	There is a multimedia hall for teaching and learning	f_1	345	426	118	102	118	3,70
		%	31,2	38,4	10,6	9,2	10,6	
9	Cyber café improves my research skills	f_1	288	364	231	116	110	3,54
		%	25,9	32,8	20,8	10,5	10,0	
10	My school makes use of digitalized teaching	f_1	290	160	---	532	127	2,95
		%	26,1	14,4	---	48,0	11.5	
11	Video presentations make learning interesting	f_1	537	209	100	154	109	3,82
		%	48,4	18,8	9,0	14,0	9,8	
12	My teachers sometimes use smart/digital devices such as phones and laptops in class	f_1	201	359	139	188	222	3,02
		%	18,1	32,4	12,5	17,0	20,0	
13	My school uses photocopy machines, Scanner, and Printers	f_1	528	498	83	---	---	4,40
		%	47,6	44,9	7,5	---	---	
14	I use whatsapp group for academic exchange	f_1	397	314	147	167	84	3,69
		%	35,8	20,3	13,3	15,0	7,6	
15	At times, teachers use projector during a lesson	f_1	396	233	103	223	154	3,44
		%	35,7	21,0	9,3	20,1	13,9	
16	Sometimes, I use Microsoft word to do class assignments	f_1	213	360	56	280	200	3,09
		%	19,2	15,6	14,2	28,0	18,0	
17	I receive and exchange audio records from teachers in the whatsapp platform	f_1	250	173	157	311	218	2,93
		%	22,5	15,6	14,2	28,0	19,7	

Source: Field statistics

Item one on table 14 is the distribution of respondents according to whether they visit the computer room during their free period for research. 32.0% (354) 27.5% (305) agreed with this statement while 14.7% (163) remained uncertain. 12.5% (139) and

13.3% (148) did not agree with this statement. This gave us a mean of 5.52 which falls within the region of acceptance. Computers have several benefits in learning. Smartphones and computers help students to have access to their learning material on the internet which is very productive for their studies. Looking at the majority who responded to this statement, it means that students use their school learning system management system with a computer or smartphone.

Item two presents the distribution of respondents according to whether they have a password in the computer lab that leads to their lessons. 32.4% (359) and 30.1% (334) accepted. 16.5% (180) were uncertain while 15.5% (171) and 5.9% (65) did not know whether their computer teacher is qualified. The mean, 3.67 falls in the acceptance zone. Computer teachers prepare students for careers. This is because technology encompasses a range of subjects, from learning how to computer hardware to software programming. One of the reasons why these students feel that their computer teacher is qualified is because of the results of the classes they have with them. Education makes human life into a civilized and complete life. Education includes all the values teachers demonstrated to students which continue till the end of life. When a computer teacher is competent, it empowers the lives of the students with everyday changing environment. It enhances the skills of the students and develops their personality. A good education system is one which updates itself with the day to day changes in the world. This is possible only if the computer teachers who are imparting knowledge remain updated according to the changes in the field of education. Computer teachers have the professional responsibility to transform themselves by developing their competencies.

Item three presents the distribution of respondents according to whether the computer teacher pays keen attention to everybody. 26.1% (290) and 33.5% (371), understood. 29.5% (327) were uncertain, while 3.2% (36) and 7.7% (85) of the respondents disagreed and strongly disagreed with the statement respectively. Based on the data, we got a mean of 3.67, which falls within the region of acceptance. This means that most of the respondents agreed with the statement.

Item four is the distribution of respondents according whether the computer teacher gives us instructions on how to use the computer. 42.3% (469) and 33.7% (374) agreed with this but 2.3% (25) were uncertain while 9.8% (109) and 11.9% (132) did not agree. The mean was 3.84 accepting the statement. This is indicative of the fact that work related skills are supposed to be embedded into secondary school curricula so that students acquire skills that help them transition smoothly to work and help them grow their employability.

Item five shows the distribution of respondents according whether they receive encouragement from their computer teacher for their progression. Based on the data, the mean is 3.58 which is found at the acceptance level. Most of the respondents accepted. Even so, a great number of the respondents were uncertain (109) while 145 and 122 disagreed and strongly disagreed. This means that there remains a call and need for adding extra-curricular activities into the curricula of secondary school that encourages students so as to prepare them for the knowledge economy after school.

Item six is the distribution according whether the computer teacher allows them to use the internet. Based on the data, the mean is 3.55, found at the acceptance level. This means that most of the respondents supported the statement. The internet represents the greatest collection of human knowledge. With the internet access in education, a widely range of ideas, teaching and learning resources, techniques and innovations have their shares.

Item seven is the distribution of respondents according whether they love all ICT equipment for studies. The data gives us a mean of 4.39, found in the acceptance zone. Even so, 96 disagreed and none strongly disagreed with this statement. This could mean that in the 21st century, there has a concerted push for ICT integration in education.

Item eight presents the distribution of respondents according whether there is a multimedia hall for teaching and learning. The data leads to a mean of 3.70 which is accepted. Yet 118 respondents were not sure while 102 and 118 disagreed and strongly disagreed. This implies that even though an accepted number of respondents agreed with the statement, a lot of work still needs to be done on the integration of ICT in teaching and learning.

Item nine presents the distribution of respondents according whether cyber café improves my research skills. The statistics produced an accepted mean of 3.54. But a large portion of the respondents still remained uncertain (231) with some disagreeing (116) and strongly disagreeing (110). This may be implying that even though the mean is accepted, secondary school must revise and continue to revise contents to reflect market needs so as to help their students to transition from school to work more smoothly through the improvement of ICT skills in their research. Educational growth and competiveness rest significantly on application of ICT, driven by a well-planned vibrant research skills acquisition system which integrates the research prowess of secondary schools in Cameroon.

Item ten distributes respondents according to whether their school makes use of digitalized teaching. 26.1% and 14.4% of respondents supported this statement. 48.0% and 11.5% disagreed and strongly disagreed. Again we see here that even though the mean of 2.95 falls within the acceptance region, audio presentation sustains learning.

Item eleven distributes respondents according to whether video presentations make learning interesting. From the data, the mean is 3.82 which fall at the level of acceptance. Even so, a very large number of respondents (154 plus 109) disagreed and strongly disagreed. This indicates that video representations do not enhance learning.

Item twelve is the distribution of respondents according whether their teachers sometimes use smart/digital devices such as phones and laptops in class. Based on data, the mean is 3.02 and is found at the acceptance level. Most respondents accepted the statement. Yet 139 were uncertain while 188 disagreed and 222 strongly disagreed. Even though the mean is accepted, there are strong indications that the use of Smart/Digital devices such as phones, laptops, and I-Pad in the class is sometimes not allowed.

Item thirteen distributes respondents according to whether the school uses photocopy machines, scanner, and printers. The data gives us a mean of 4.40, which is found at the level of acceptance. Curiously, no respondents disagreed with this fact. Only 83 were uncertain.

Item fourteen distributes respondents according whether they use whatsapp group for academic exchange. The data gives us a mean of 3.69 which falls within the acceptance range. This implies that most of the respondents agreed with the use of email to send and receive messages from teachers.

Item fifteen is the distribution of respondents according to whether at times, teachers use projector during a lesson. Based on the data, the mean is 3.44 found in the acceptance zone. This leads to the conclusion that most of the respondents supported this statement, especially because no respondents disagreed. Only 103 of them claimed to be uncertain. Projectors are inclusive tools in the classroom, enabling the teacher to draw on multiple sources during a lesson, and to engage students in more agile way. The value of learning is dependent on the creativity of the teacher, the way in which they are set up to share tools, and the content which is created for the lesson. The digitalization of lessons is a vital element in preparing students for future workforce, where technology is increasingly at the forefront of productivity.

Item sixteen distributes the respondents according to whether sometimes they use Microsoft word to do class assignments. According to the data, the mean is 3.09 which is also found at the level of acceptance. This means that the majority of the respondents supported this statement. 280 plus 200 of the respondents disagreed in anyway. Only 56 of them were uncertain.

Finally item seventeen presents the distribution of respondents according to whether they receive and exchange audio records from teachers in the whatsapp platform. Based on the data, the mean is 2.93, falling within the region of acceptance. Therefore most of the respondents supported this statement.

Hypothesis two

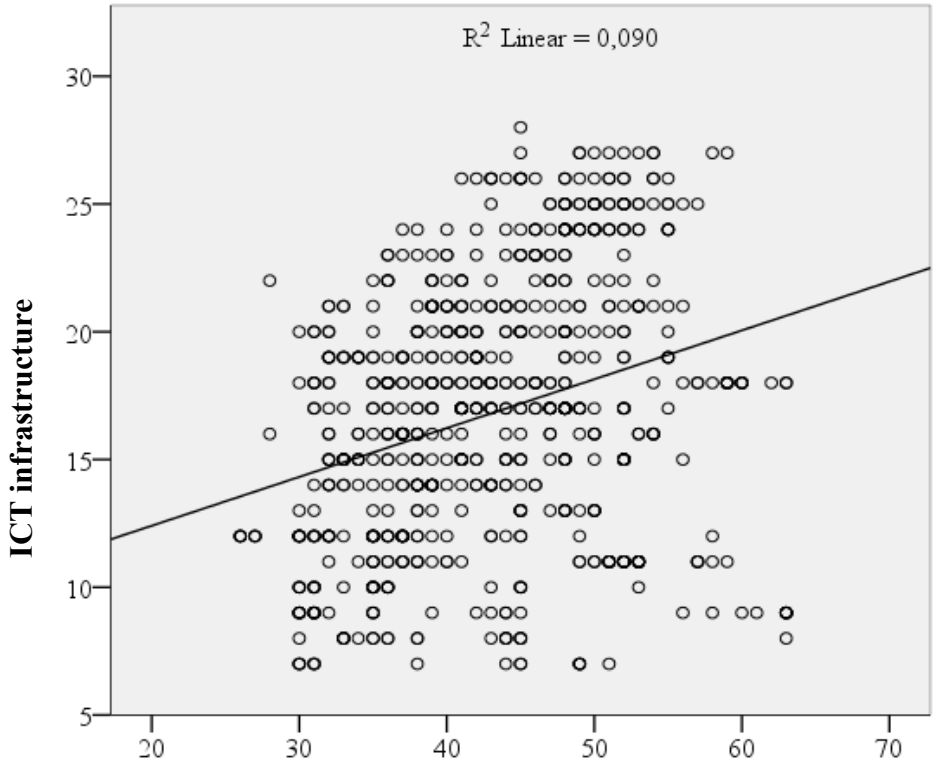
Ha_2: There is a relationship between ICT infrastructure increases - CBA teaching-learning methods in government secondary schools in Cameroon

Ho_2: There is no relationship between ICT infrastructure increases - CBA teaching-learning methods in government secondary schools in Cameroon.

Table 15: Correlations of ICT infrastructure and CBA teaching-learning methods

			ICT infrastructure	CBA teaching-learning methods
Spearman's rho	ICT infrastructure	Correlation Coefficient	1,000	,319**
		Sig. (2-tailed)	.	,000
		N	1109	1109
	CBA teaching-learning methods	Correlation Coefficient	,319**	1,000
		Sig. (2-tailed)	,000	.
		N	1109	1109
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: (Researcher, 2023)



The correlation table above presents the correlation between ICT infrastructure and CBA teaching-learning methods. The correlation coefficient is 0,319 while the level of significance is 0.000. The level of significance is less than 0.05 which is the alpha and the standard error margin. The results reveal that ICT infrastructure significantly influences CBA teaching-learning methods in government secondary schools in Cameroon.

Evidently, access and the infrastructure that is available continue to be the key determinants of how ICT is used pedagogically in schools. Both schools did not lack this. All of the comments made it clear that the teachers had brought up the issue of access. While some instructors had access to the school's multimedia center and ICT resources, others complained that they did not have the same level of access. Given that computer science is included in the curriculum, teachers in this field have access to the school's multi-media center, although other subject teachers have acknowledged that they do not. Many of the teachers who were interviewed also lamented the absence of ICT resources in the classrooms. Others mentioned how it is challenging to educate utilizing ICT tools because the classrooms are not adequately prepared with these resources. The following are a few of the arguments the teachers made like participant P11;

> *In larger classes where I am supposed to use a projector at all times to ensure effective teaching, it's quite frustrating for me because there's only one projector which is sometimes being used by another teacher in another hall. So, in such cases, I'm forced to use the regular traditional method of teaching* (Interview, November 2, 2022).

Participant 14 said:

> *Considering the fact that our school has computer labs, the labs are just names because the equipment is not worthy; and we have mostly second-hand equipment that is usually difficult to use. Schools like our own are supposed to have internet connection throughout, but we have a problem, we can go for a term without internet network, so it makes it difficult to use ICT to be able to teach* (Interview, November 5, 2022).

A participant 16 who teaches mathematics started using ICT in his classroom explains that:

> *I have found out that mathematics is well taught with the use of ICT tools because mathematics is a most challenging subject to most African children, by making*

it visual, helps them to understand faster and it also makes the teaching process easier (Interview, November 4, 2022).

The few participants who were using tools in the teaching and learning process made mention of the fact that their use of ICT has enabled them to cover their lessons faster than before; some of them explained:

> *Take for example I have a printer at home which has helped me so much in my profession. With the limited ICT tools available in school, I have derived a method where I now type my lecture notes, print them and photocopy many copies to share with my students. Now much of my lesson time is allocated to discussions instead of the past years where I had to copy the notes in the chalkboard for the students to copy in their books which usually makes my teaching challenging and time-consuming* (Interview, November 8, 2022).

Another teacher said:

> *Using ICT tools facilitates my lessons, for example, a lesson that I used to teach for one hour, now is possible for me to use just 30 minutes. Usually, practical mathematics lesson which involves plotting a graph or drawing tables, a teacher has to come to the classroom and use so much time in drawing and plotting the various points using a chalkboard. What I do in such cases now is that I usually prepare that kind of lessons well ahead of time using Microsoft Excel which is easier, practical and time-saving* (Interview, November 2, 2022).

A contrary view was given by one teacher who had incorporated ICT but still faces difficulties as a result of insufficient knowledge of the use of the tool in the teaching and learning process as he explains:

> *There was a time I try to use my laptop in the class, but I discovered that it was not easy because finally, I could not even finish the work I programmed for that day. I was not familiar with the tools because I have never received any formal training in teaching my subject using these ICT tools* (Interview, November 9, 2022).

Furthermore, some teachers highlighted ICT does not only help them to transmit knowledge to students or to get diverse information in their subject areas but also use ICT actively as a learning tool to develop themselves:

> *Through my quest for professional development with the help of ICT, I had the possibility to take free online courses through MOOC (Massive Open Online Courses) in my subject domain. I usually log in and watch free video lectures on some important topics in geology* (Interview, November 8, 2022).

Responses from the teachers clearly demonstrate that ICT was helpful in one way or another in their teaching profession. While some of the teachers were using the ICT to prepare their lessons, others admitted that ICT had changed their method of lesson delivery.

From the various responses, repeatedly, teachers explained the high level of autocracy in using the school multi-media centre which also features as a difficulty in using ICT in the schools. Participant P17 clearly explains from his experience the problem he usually faced in using the ICT room, as his response;

> *Only ICT teachers are allowed to use the school labs. For a subject teacher like me, to come here with my students, I need to start first by taking permission from my head of the department in charge of my subject area. The head of the department then asks for permission from the school discipline masters, who make a request to the ICT monitor in charge of the school multi-media centre. You can see the level of bureaucracy in this process* (Interview, November 8, 2022).

Also, though many of the teachers use their personal initiative in bringing ICT tools such as their laptop computer, phones and Ipad in classrooms to show display images and play videos in their lessons, they complained of a shortage of electrical adaptors in the class to support their devices while teaching. Amongst the interviewees, all the teachers were not satisfied with the classroom structure. From observation of the classes, both schools have an average of 60 students per class. Concerning this factor, it was hard to incorporate ICT in such a large class size as participant 12 said:

I have to teach tomorrow from 9.00am till 4.00pm, but my laptop battery can only last for a maximum of five hours. So, since there's no electricity supply in the classrooms, I'll not be able to go through my lessons for the day as planned (Interview, November 5, 2022).

Participant 16 bitterly said:

Poor connections, infrequent electricity supply bring a lot of puddles, the number of students in classrooms, having almost a hundred plus with almost no space for circulation. All of that you know compact the difficulties that go with using ICT usage in the classroom (Interview, November 4, 2022).

Repeated responses from many of the teachers of unequipped ICT classrooms reveal their loss of interest to incorporate ICT in their classrooms. On the other hand, teachers who had the interest in integrating ICT could not effectively use ICT tools because of poor network and lack of electricity in the classrooms. It can therefore be concluded that integrating ICT in these schools will demand significant classroom arrangements to suit the ICT tools teachers intend to use.

3.4. Discussion on ICT Infrastructuresand CBA in Cameroon Secondary Schools

Hypothesis Two (Ha_2) ICT infrastructures promotes the CBA teaching-learning method in Cameroon government secondary schools

Data collected on this hypothesis was tested using the Spearman rank correlation and multiple regression. The results confirm that ICT infrastructure can influence CBA teaching-learning methods. Statistically, the Spearman rank correlation index stood at 0, 931. This positive coefficient reveals that the relationship between ICT infrastructure and CBA teaching-learning methods is significantly high. In other words, looking at the level of significance of 0.00, we can conclusively say that there is no error in admitting that ICT infrastructure affects CBA teaching-learning methods.

From our field statistics, most respondents (354, strongly agreed, and 305 agreed) that they like to use a computer and a smartphone to study, yet the majority (163) are uncertain about computers or smartphones to study (139) totally disagreed. This shows that the orientation given to students on how to use these technologies is not

properly done. Nevertheless, computers and smartphones have become the most frequently used technological devices and they are now widely regarded as necessities in the lives of these students. With multiple functions due to different social media and technology being combined into one device, smartphones and computers have brought convenience and efficiency to many students. The integration of computer technology into the learning experience extends students' access to various resources and information and allows them to learn and develop skills independently via computer. This was corroborated by the 469 and 374 respondents who agreed and strongly agreed respectively to the question on whether the computer teacher gives instructions on how to use the computer. It is also important to note that extensive use of these technologies can have negative impacts on students such as poorer sleep, shorter sleep duration, worse sleep quality, and excessive daytime sleepiness.

This is substantiated by the 188 and 222 respondents who disagreed and strongly disagreed respectively to the question of whether the use of Smart/digital devices such as phones, laptops, and I-Pad in the class is sometimes allowed. Psychologically, more time spent on smartphones and computers is associated with lower psychological well-being and less emotional stability. Students who use smartphones and computers excessively have a higher likelihood of showing symptoms of anxiety and depression (Ng, Wu, Lam, Lam, Nip, Ng and Leung, 2020), which may be the consequence of physical inactivity and poor posture. For students who use a computer for more than 2h per day, the associated head and lower back pain may cause moderate or severe inconvenience in their everyday lives. Additionally, students' cognitive control, executive function, and productivity may all suffer as a result of heavy smartphone and computer use, which negatively impacts their academic achievement (Twenge & Campbell, 2018). Students' increased difficulties making friends and receiving care have also been linked to their increased use of smartphones and computers (Twenge & Campbell, 2018). The quality of a study life is seen if using a phone or computer replaces social activities, which causes social withdrawal and a loss of well-being.

Also, on the question of whether they use email to send and receive messages from teachers, some respondents (167 and 84) disagreed and strongly disagreed

respectively. For a teacher to be certain that the lesson that has been taught has been clear to the student is a priority. Communication is not always verbal; in fact, non-verbal communication is equally important in a classroom. It can be asked in both the classroom as well as on the online platform (WhatsApp, email) if a lesson is understood. But what the online platform lacks is the ability for the teacher to comprehend facial expressions and body language, which can say a lot of things. This becomes highly essential when the students refuse to interact or respond, which is why it is a drawback in the online mode of teaching, as not all students respond when the teacher inquires if they have any queries, adding to the difficulties and, at times, lack of interest for teaching for the teachers. With experience, it is also known that students cannot always keep their cameras on, as it creates a load on the software/app that is being used, causing malfunctions such as lagging or network issues. So, even students are not visible in the online mode. Usually, students keep their microphone off as their background noise can cause disturbance not only for the teachers but also for other classmates. A participant identified three categories of students, thereby further clarifying their roles in ICT infrastructure, P 13 puts it:

> *The first category is the enthusiastic group, and there are unfortunately very few of these, they look out for these tools and are keen to be provided with all the latest devices. The second group isn't at all interested and unfortunately, there are many of these in my school, they even fight against the idea of using ICT in their lessons, they don't even try to use it. The final category would really like to use ICT tools in their lessons because they're aware of their benefits, but they don't, because they don't have any idea how to use them* (Interview, November 9, 2022)

In a high-quality 21st-century educational system, ICT infrastructure can play a key role in changing instructors' and students'methods for teaching, learning, and evaluation. The ways in which educators educate, students learn, and learning is evaluated are all continually being improved. ICT infrastructure must be integrated into the educational system at all levels (Lowder & Regmi, 2020).

The findings of this study indicate that most of the teachers in secondary schools are more likely to use ICT applications and resources for educational purposes, such as the Internet, multimedia computer, projector system, PowerPoint presentation, or word processor programs during the teaching and learning process. At the same time, the advanced usage of ICT like building a learning website or creating learning software such as educational games appear to be rarely used in the teaching and learning process or even preparation for educational purposes.

Nevertheless, teachers are one of the important factors in students' high achievement. The teachers' beliefs will influence them to integrate ICT in their teaching practice. The knowledge and skills about ICT that teachers are equipped with will encourage teachers to integrate ICT into the teaching and learning process that will increase student learning outcomes. Besides ICT skill and knowledge, the teachers' attitudes are also another key factor that plays a role in ICT integration in education. Teachers' attitudes and skills will influence their perception on education and will determine their teaching style.

The role of ICTs in the development of Africa in general, including the ICT infrastructure currently available, is addressed. The importance of ICTs for educational provision is discussed and the issues, achievements, and kinds of projects being implemented in primary and secondary education, tertiary education, adult or basic education, and teacher training are also reviewed. Finally, financial considerations when implementing an ICT-based educational strategy in the African context are discussed.

This new trend, particularly pervasive in Cameroonian educational debates but now finding its way into several educational discourses, has been to use 'distance education' and 'educational technology' interchangeably or even as a single, composite term. The most obvious problem with this is that it is simply an illogical inference. Educational technologies are used regularly in contact educational environments, whether they be 'old' technologies like print or whiteboards or 'new' technologies like data projectors or personal computers.

The adaptive nature of ICTs means that technology can be used to support traditional teaching patterns as much as it can be used to support moves to resourced-based and open learning. Haddad and Draxler (2002) note that one of the myths of ICT and education is that 'merely providing ICTs to schools transforms the learning process and merely connecting to the Internet changes the learner's world'. The introduction of ICT into education at all levels cannot be seen as independent of educational reform more generally, nor of the context within which this takes place. It is thus important to note that:

> *No miracles derive from the mere presence of ICT in a school; it does not, except in unusual circumstances, act as a catalyst for wider-scale improvements. Instead, ICT can be a powerful lever for change when new directions are carefully planned, staff and support systems are prepared, and resources for implementation and maintenance are provided* (Venezky, 2004, p. 20).

Technologies have a crucial role to play in supporting the educational provider itself, particularly in its day-to-day management and administration. Regretfully, however, this important use is often neglected, both in policy statements and in the deliberations of people planning the use of technologies to support education and training.

Provision of course materials is an important part of the teaching and learning processes in all education and training, whether face-to-face or at a distance. In addition, however, there are many technologies that might support other teaching and learning processes. Some of these can be used generally in any education and training program, such as whiteboards or overhead projectors, while others might be referred to as specialist technologies, such as woodwork equipment or language laboratories. Again, the technologies covered by this group ranges from the very simple, such as pen and paper, to the very sophisticated, such as computerized simulators.

Responses from the teachers with respect to answers to research question two indicated that teachers were optimistic that the new technology, if properly used, will enhance development not only by improving the students learning process but will at the same time ease and streamline the teaching practice, thereby uplifting the national

standard of education. But on the other hand teachers expressed doubt and fear about whether the new technology can add value to the present academic performance of our students considering the poor ICT facilities and resources on the ground. On the issue of teachers' competencies, the teachers displayed various levels of confidence in using the facilities available to them because one can only have access to what is available. It was seen from the result that most of the teachers can work with computers, printers, and photocopying machine and sometimes use programs such as MS word, MS excel, and MS access for academic purposes. Regarding the policy implementations and interventions from private and non-governmental organizations, the findings show that teachers are aware of the federal government policy on integrating ICT in education which was considered by many as a failure. In terms of intervention, it was testified by both the teachers and students that virtually all the efforts were done by state governments which were believed that cannot cater for all the schools due to their limited budget.

From the number of respondents (377) who said they were never exposed to using a projector during a lesson, it is worthy noting that the majority of projectors lack interactive features, which restricts how much the teacher and students may engage with the lesson material. Yet, the good news is that modern projectors are considerably more sophisticated than those of the past and can contribute significantly more to education than they ever could. Their influence today goes far beyond the lecture hall or classroom. They are incredibly high-quality, dependable, and cost-effective. More so than the biggest TV on the market, they enable teachers to have the biggest effect. With the aid of projectors, teachers may concentrate more on visually appealing projects that help pupils pay attention longer and effectively retain more knowledge. Lessons need to be entertaining at all times since social media and the internet are affecting children's capacity to focus and pay attention. Projectors and cameras can be utilized to enhance learning. Additionally, teachers and students can annotate images taken by the cameras and record courses as videos to be utilized later. These enable professors to share passages of text, intricate schematics, and 3D objects with the entire class. The advancement in technology means that students no longer have to crowd around a shared desktop PC or shuffle their chairs nearer to a TV monitor to view any multimedia

presentations. A single projector has the power to engage students and keep their attention for longer periods of time.

To the question of whether the use of PowerPoint to present assignments in class was ideal, 213 and 360 agreed and strongly agreed respectively to that statement. When effectively planned and used, PowerPoint enhances instruction. People are divided on the effectiveness of this ubiquitous presentation; assignment with PowerPoint is wonderful. It does offer effective ways to enhance instruction when used and designed appropriately and it can be an effective tool to present material in the classroom and encourage student learning. Participant P5 said:

> *PowerPoint is especially useful when providing course material online. Consider student technology compatibility with PowerPoint material put on the web; ensure images and graphics have been compressed for access by computers using a dial-up connection* (Interview, November 9, 2022).

Educational systems worldwide aim to develop the digital competency of students; learning how to find, assess, save, produce, present, and exchange information using technology has been incorporated into the curricula created by educational institutions. ICT has gained popularity as a study subject as well as a teaching tool (Kinge, Wiysahnyuy, Awah & Nkuo-Akenji, 2021). Many educational systems have sought to increase the availability of computers and internet connections in classrooms. This equipment is an efficient tool for study, a valuable source of information, and interesting support for teaching (Arkorful, Barfi & Aboagye, 2021). Students benefit from using software packages that are made for editing texts, making graphs, organizing data, and performing computations. Access to information and materials on platforms intended for educational purposes is enabled with an internet connection. The availability of software that makes it easier to deliver content, carry out various tasks, provide students feedback, and allow for interaction between students and teachers has also opened up chances to supplement in-person instruction with virtual instruction.

ICT use by teachers can be divided into two levels: The first level involves relatively ineffective use, such as basic support for teachers, which most often involves use in class preparation. The second level is effective to use, which involves the use of

ICT as an educational resource in the teacher's daily work with students. In this connection, introducing ICT into educational centers occurs in three phases (Aminu & Samah (2019). The first (emerging) phase involves amassing infrastructure. In the second (application) phase, teachers apply technology in the same teaching-learning processes that they have always used. In the third (infusion phase), teachers start to use technology in different ways in innovative pedagogies.

Regarding ICT integration into the curriculum, most countries have a curriculum framework that specifies general guidelines for ICT. There has been considerable evolution in the computing equipment provided for teaching and learning activities in Cameroon secondary schools. Greater or less amounts of ICT infrastructure in schools are not generally related to the frequency of classroom use.

Learners need more open-ended learning experiences that develop higher-order thinking, creativity, independence, collaboration, and ownership of learning. When the ICT infrastructure is used effectively, it can provide opportunities for all teachers, students, and parents/guardians to develop these key skills (Fanso & Ngwa, 2022). Embedding ICT in teaching, learning, and assessment is a complex endeavor and the mere presence of ICT in a school does not equate to its effective use.

ICT infrastructure has often taken the place of older technologies, such as books or whiteboards, and the role of the teacher and the learner remains unchanged (Bariu, 2020). The setbacks recognized included rethinking the role of teachers and scaling teaching innovations. This study has unanimously confirmed the potential role of the ICT infrastructure in helping to transform teaching, learning, and assessment practices in a very positive way in the long run as the transformation will serve to enhance student learning and prepare our young people to live, learn, and work in a modern globalized society (Kopcha, 2012).

The adoption of ICT infrastructure in secondary schools is one key initiative that makes it possible for the education system all over the world to meet the challenges of the 21st century. The implementation of the ICT strategy serves to enhance continuous applications and improvement of education. Similarly, in the recent past, there has been an achievement in various curricula reforms taking account of the key role ICT can play

in helping transform the education system so that the learners are equipped with the knowledge and skills required for the challenges posed by a rapidly changing world.

ICT infrastructure supports more powerful and complete knowledge-building experiences for learners if there are integrated well-designed technologies. ICT infrastructure provides a learning environment that allows students to learn by solving problems, thinking for themselves, and collaborating with others. They create a learner-centered environment by motivating learners through combining text, sound, color, and moving images that enhance content for easier learning and facilitate the acquisition of basic skills through practice (UNESCO, 2008).

ICT also provides teachers with improved educational content and more effective teaching methods that improve the quality of education. They facilitate access to information and increased interest in teaching where teachers create more time to engage with students leading to greater productivity in the learning process. To implement the use of the ICT infrastructure in secondary schools' teaching and learning, different countries attempted to craft national policies to guide and direct ICT integration into education and social programs.

Computer programs and software when well-developed can aid teaching in an established education rate that connects schools to internet services at affordable prices. ICT infrastructure use in education is still in its early phases in Africa, and the bulk of the nations run the risk of falling behind in technology development because of their slow pace of integrating ICT into their educational systems (Lloyd, 2020). Unfortunately, most developing countries including Sub-Saharan Africa, for example, Uganda, Ghana, Liberia, Kenya, Zambia, Sudan, and Cameroon have limited application and use of ICT in Education in spite of elaborate ICT policies in Education being in place. Their policies are not responsive to the specific needs of the education sector with an emphasis on the utilization of ICT for economic returns outside schools (Achimugu, Oluwagbemi, & Oluwaranti, 2010). As a result, there is a delay in the adoption of digital technology due to their financial difficulties, lack of emphasis on education, narrow investment horizons, and culturally negative views toward the digital world.

To maximize teaching and learning, the policy seeks to promote e-learning growth and development at all educational levels by supporting the use of ICT infrastructure (Dillon, Rickinson & Teamey, 2016). Further, the application of ICT in instructions includes the use of computers, CD ROMS, interactive media, modems, satellites, teleconferencing, and other technological means to support learning. The application of ICT in instruction could have several aspects which include: the process of designing instructions, selection of materials and tools to design and implement a design, evaluations of designs, the effectiveness of teamwork, and use of technology in support of the development and delivery of instructions (Tondeur, Krug, Bill, Smulders, & Zhu, 2015). Participant P 13 explained that:

> *I can describe the way I use ICT as acceptable to some extent. I like using educational technologies, and if I could, I'd use them much more, but there aren't enough devices, and in some classrooms, there's not enough space to use them, because the number of students is greater than the capacity of the classroom. We have classrooms of 45 students, and the distance between the first row and the board can be less than a meter; the situation is difficult, but we do have projectors in some of the classrooms, so these are the only ones that I can teach in when using technology devices. Furthermore, there's not enough room even to put a computer desk in the classroom* (Interview, November 9, 2022).

Computers, the internet, multimedia, educational software, and even online education during times of need should be part of the teaching and learning process. Together, computers and communication technology have advanced enough in recent years to potentially raise educational standards (Bailey & Cotlar, 1994). The FGD indicated that:

> *The ministry of secondary education provides the school with most of the ICT tools we need, but the implementation is still weak because some teachers have no idea how to use these tools, and we have problems with training, so they're not qualified. Some aren't even aware of how these tools can make teaching more enjoyable, and some still think that traditional teaching is more effective. In general, some schoolteachers lack the skills required to implement ICT tools,*

especially the new generation of these tools, such as interactive projectors (FGD, November 12, 2022).

ICT infrastructure has been an impediment to the adoption and integration of ICT in teaching and learning. Even though these infrastructures are important, yet, during the FGD, it was highlighted that, few teachers use ICT tools in my school, most still just use pens and a board, and sometimes no pens, so our teachers teach us without any learning tools (FGD, November 12, 2022). Furthermore, participant P 11 referred to the poor employment of ICT in students' homework, indicating that:

> *I use my computer at home for different tasks, but not for learning purposes, because none of my teachers help us to link what we learn at school with what we have to do at home (by browsing the web). We do not have the research skills or advanced skills in computers, the only thing we've all learned is the basic skills, which even the students in primary school know, the vast majority of teachers do not use ICT tools* (Interview, November 12, 2022).

It is clear that not all teachers are able to use ICT tools that only some encourage the students to use them, while others do not use them at all. This will be explored further under the sub-theme of ICT skills. Evaluation of the use of the ICT infrastructure in teaching and learning in secondary schools is lacking and hence impacts negatively the provision of relevant and quality education. Relevant data on the use of the ICT infrastructure in teaching and learning in secondary schools and more so in Cameroon is not provided, hence the policy of ICT infrastructure provision has not been based on the needs of secondary schools. This necessitated the need to carry out research on the ICT infrastructure and its use in teaching and learning in secondary schools in Cameroon.

The ICT infrastructure in education increases access, maintains the quality of education, and evaluates information from different sources so as to enhance teaching and learning. If schools provide access to ICT, the quality of education will improve and productivity will be enhanced. This in turn will develop highly skilled manpower who can adequately respond to the economic, political, and social challenges of the 21st century. The FGD pointed out ICT infrastructures that are needed in schools:

These are: hardware such as computers, scanners, photocopiers, mobile phones, printers, projectors, and broadcasting technologies which include radio and TV as well as essential software that enhances teaching and learning. ICT infrastructure must be connected through computer networks and internet connectivity in order to allow for sharing and distribution of data and information among teachers and students (FGD, November 12, 2022)

ICT infrastructure must be simple for everyone to use and access, according to researchers (Özer& Yilmaz, 2011). Schools should use multimedia tools more frequently to enhance instruction and give pupils engaging tasks (Neyland, 2011). In addition to having a physical network, a school that is networked may also use resources from networks outside of the school when doing so is advantageous (Bielefeldt, 2012). ICT infrastructure, like the ICT curriculum, has a direct impact on the outputs and results of ICT use in teaching and learning. Some teachers do not like these new technologies. Participant P 8 is interesting as he outlined the fact that colleagues are not interested to be trained to use ICTs:

I discussed training issues with some of my colleagues. One of them, who teaches the subject of religion, told me, I don't like going to training sessions, it's just a waste of time, and to be honest, I don't have any motivation to use ICT in my teaching. Look at my mobile, it's just a normal mobile, I don't like the new generation of mobiles. I don't even have a computer at home. He added, "One of them told me, 'Why do I have to go for training? I teach the Arabic language subject, and I really don't think I need to use these tools in Arabic classes, I prefer the traditional methods, and I think I'm all the more professional for it (Interview, November 3, 2022).

Abstention from ICT training programs, as well as a lack of provision and quality, was evident in participants' views. Participant P6 commented that about 90% of my teachers aren't qualified in ICT (skills), and most of them don't even like training...which in turn makes the implementation of ICT poor (Interview, November 4, 2022). Discussing the reasons for the low level of teacher engagement in ICT training

programs, as well as the weakness of their desire to develop their ICT skills will be discussed in detail in the section on challenges.

Before using the ICT infrastructure in classrooms and schools, a thorough justification must be developed. In general, as computer hardware becomes more widely available, it is crucial that teachers avoid getting distracted by the technology and instead concentrate on their fundamental responsibilities as educators. Teachers must use their imaginations to the fullest while realizing that as computer technology advances, they will be able to accomplish more of their objectives (Papaioannou & Charalambous, 2011). ICT infrastructure has the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change.

Teaching has always been emphasizing on content. For many years course work has been revolving around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favoring curriculum which promotes competency and performance. Curriculums have started emphasizing on capabilities and are concerned more with how the information will be used than with what the information is. Contemporary ICT is able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curriculum that makes sound use of the affordances of these technologies (Kopcha, 2012).

The integration of information and communication technologies could help revitalize teachers and students in secondary schools. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas. To achieve these objectives, teachers need to be involved in collaborative projects and development of intervention change strategies which should include teaching partnerships with ICT tools. Further, there are three conditions necessary for teachers to introduce ICT and use it in their classrooms: teachers should believe in the effectiveness of technology, should believe that the use of the technology will not cause

any disturbances in students learning, and finally in their control over the new technology (Cheung & Slavin, 2012). However, research studies have shown that most teachers do not make use of the potentials of ICT to contribute to quality of learning environments in spite of the value they attach to the technology (Butler, Hallissy, & Hurley, 2018).

Only self-assured teachers who are eager to explore new chances for modifying their classroom practices through the use of ICT will see the benefits of adopting ICT. As a result, ICT use not only improves education but also gets the next generation ready for their future lives and careers (Wondemtegegn, 2018). With a different pool of teachers will come new duties and a different set of abilities for teaching in the future that will involve advanced ICT and a need for more facilitative than didactic roles (Oyovwe-Tinuoye & Adomi, 2022).

The flexibility in time-space accounted for by the integration of the ICT infrastructure into teaching and learning processes contributes to increase interaction and reception of information in education. Such possibilities suggest changes in communication models and in the teaching and learning methods used by teachers by giving way to new scenarios that favour both individual and collaborative learning in schools. The use of the ICT infrastructure in educational setting by itself acts as a catalyst for change in the domain. ICT tools encourage and support independent learning in schools.

The influence of the technology on supporting students learning will continue increasing. In the past, the conventional process of teaching has revolved around teachers planning and leading students through a series of instructional sequences to achieve a desired learning outcome. Typically, these forms of teaching have revolved around the planned transmission of a body of knowledge followed by some forms of interaction with the content as a means to consolidate the knowledge acquisition. Learning approaches using contemporary ICT provide many opportunities for constructivist learning through their provision and support for resource-based, student centered settings and by enabling learning to be related to context and to practice (Fanso & Ngwa,, 2022).

The usage of ICT infrastructure in educational contexts enables a variety of knowledge production strategies, and the more students incorporate ICT into their learning activities, the more significant their influence becomes. Teachers deliberately use ICT to improve learning to provide meaningful and interesting learning experiences for their pupils. Students take pleasure in their education and the autonomous inquiry that creative and effective ICT use fosters. The study found that a relatively small number of schools used ICT primarily for computer classes and office activities.

Infrastructure is a critical requirement in ICT implementation in institutions. This is due to many setbacks in electricity connectivity, inadequate funding, lack of enough space, skill challenges by staff, lack of good security, high cost of installing ICT gadgets, and poor maintenance. ICT infrastructure plays a pivotal role in successfully implementing ICT in secondary schools. The infrastructure has been established as a significant challenge of ICT implementation since the process is highly dependent on ICT tools like the adequacy of computers for learners and instructors. Despite the international pressure to embrace ICT in teaching and learning, this limitation in inadequate infrastructure and technical expertise makes the implementation process an uphill task.

Since ICT infrastructure is a significant element for effective ICT implementation in teaching and learning which involves both the hardware and software, such as computers, internet connectivity, computer software, and computer labs should be adequate and operational To support the process should be consistently maintained so as to provide good learning condition to the students. Similarly, institutions need to use ICT to support their learners by providing adequate infrastructure, including network connectivity, computers, and technical support for academic staff and learners. Then, through this, the CBA can have an impact in the lives of the learners.

The government through the institutions should make ICT equipment available such as computer, projectors; printers, DVDs/ VCD players. However, many ICT equipment available in schools were not adequate. Attitudes of participants on the integration of ICT in teaching and learning are generally positive; despite the challenge of inadequate facilities, all respondents are enthusiastic and eager to integrate ICT in

teaching and learning. In addition, they emphasized that ICT helps them to improve academic performance of students in respective schools. The government should see into it, notwithstanding the high cost of ICT hardware, software, improvement cost, development, and the expertise required. Thus, there is a need for prior planning and budgeting since such infrastructure is perceived as an additional cost. Physical infrastructure is a critical prerequisite in ICT implementation. ICT implementation needs excellent investments in the models while maintaining economies of scale. Therefore, institutions need to use ICT to support their learners by providing adequate infrastructure that includes network connectivity, computers, and technical support for academic staff and learners.

ICT infrastructures are the major impediments influencing secondary schools ICT implementation. There is, therefore, the need to empirically establish the policies and infrastructure challenges influencing ICT implementation to enhance accessibility and efficiency. The findings would be helpful by providing guidelines for university managers and administrators to evaluate ICT policies and infrastructure for effective ICT implementation. Generally, the study provides valuable baseline information to stimulate investment in teachers' capacities influencing ICT implementation to streamline university education by enhancing accessibility, quality, and efficiency. Further, the study recommends that secondary schools administrators and all the stakeholders should support and prioritize the ICT policies and improve infrastructure for effective CBA teaching and learning methods.

ICT use in the classroom should be emphasized because it helps students to develop new skills and become more creative. ICT stimulates the development of imagination as well as initiative. It is a valuable tool for producing work, both in terms of content and form. It improves students' academic performance as their classroom experience also improves substantially. It motivates and attention levels are increased, contributing to greater effectiveness in the learning process. It also increases students' responsibility and sense of autonomy.

The practical implications of the results of this study indicate the need to supplement the investment in ICT infrastructure with other measures. Specifically,

educational policies should increase the investment in teacher training, their professional development in ICT, and the creation and dissemination of quality educational software for classroom use. In this sense, it would be worthwhile to encourage new pathways for teachers' professional development based on modalities such as online teacher learning communities, blended learning, “on the job” training, and peer learning and peer sharing activities at school. Furthermore, the development of the ICT competency of teachers should have a prominent place in initial teacher training by promoting skills acquisition for ICT use in the classroom and developing positive attitudes towards the value of ICT in teaching. At the level of educational institutions, time should be allocated for teacher collaboration, the shared reflection on experiences regarding the use of ICT in teaching and learning and the joint assessment, selection and adaption of digital learning resources. These measures may have an impact on schools, teachers and students.

Conclusively, the idea is to develop a school culture that favors the integration of ICT into education, increased teacher competence and confidence in the use of ICT, which results in the greater use of ICT in classrooms and contributes to students' improved motivation, learning and digital literacy.

There is no widely acknowledged practical definition for the term “competence,” according to Tarchi & Surian, (2022). A person is able to demonstrate competence, in their words, through “an action, behavior, or outcome.” This term emphasizes what a person is capable of (output). Competence, according to Kirschner et al. (1997), is the capacity to select and apply the attitudes, knowledge, and skills required for performance at the desired level. According to Kouwenhoven (2003), competency is the capacity to select and use a coordinated set of information, abilities, and attitudes with the aim of realizing a task in a specific setting, wherein human qualities like drive, self-assurance, and willpower are included. Competency is defined by the National Post-Secondary Education Cooperative (2002) as the collection of knowledge, skills, and abilities required carrying out a certain work. Despite the differences in the definitions, they all emphasize that competence involves both the physical and intellectual capacity to perform an action well over time. All of these point out the

necessity of incorporating knowledge, skills, and attitudes into all learning activities while implementing CBA in educational institutions. Savage (1993) asserts that CBA is a functional approach to education because it promotes life skills and measures mastery of those skills that are required for a person to live well in a particular society. Such a change has pedagogical repercussions since, as Rutayuga (2014) pointed out, CBA calls for measuring each learning outcome rather than just a set of learning elements. Similar to this, Ng'andu (2022) maintained that student-centered teaching and learning are necessary as we move away from a content-based approach and toward one that is competency-based.

PART TWO

HARNESSING THE POWER OF E-LEARING IN TRANSFORMING PEDAGOGY, ENHANCING EDUCATION, AND STRENGTHENING CBA IN CAMEROON'S SECONDARY SCHOOLS

CHAPTER FOUR

ENHANCING SECONDARY EDUCATION THROUGH E-LEARNING AND COMPUTER-BASED TEACHING

The provision of an E-Learning system is an important factor in providing a comprehensive Information and Communications Technology solution within schools. Blackboard and other similar systems provide an easy-to-use, well-structured medium to assist learning and teaching because students and teachers are able to access information from anywhere around the world. An E-Learning system used properly is an important support structure for the delivery of modern, productive pedagogy. The implementation of e-learning by any institution can be achieved using one of three approaches: using the technologies to support or supplement the traditional face-to-face course, integrating online activities into a traditional course to enhance the learning experience, and delivering a course that is entirely online (Newen & Cheny, 2022). Any of implementation approaches an institution chooses depends on the level of readiness in terms of the budget, infrastructure, and human resources such as experience, skills, knowledge, and attitude. E-learning readiness assessment provides key information to organizations willing to supply e-learning solutions that can cater to the specific needs of each learning group. E-learning is an extended form of classroom teaching where learning, either online or offline is facilitated by the use of computers, telecommunication devices, networks, and storage capacity.

On top of its easy delivery of information and interactive nature, the main benefit behind using e-Learning instead of the traditional way is that learners develop communication as well as personal skills such as autonomy, analytical perception, abstraction, and others. E-learning is a term that encompasses a broad array of content and instruction methods, and that has come to mean a new model of education involving revised curriculum, infrastructure, teacher professional development, textbooks, and exams to provide students with technology and "21st-century skills" such as creative problem-solving. A particularly useful aspect of ICT in education includes accessing the enormous number of educational resources on the Internet and online libraries. The

networking of teachers, students, and others can also produce a lively community sharing information, ideas, and strategies (Erol, 2021).

4.1. Role of ICT in facilitating pedagogy

In a qualitative study conducted by Haji (2015) about Science Teachers' Attitudes toward the use of Information and Communication Technology in Secondary Schools in Cameroon, the role played by ICT in enabling teaching and learning is analysed.

Active learning: ICT enhanced learning mobilizes tools for the examination, calculation, and analysis of information in order to provide a platform for student inquiry, analysis, and construction of new information. The learners, therefore, learn as they do and, whenever appropriate work on real-life problems in-depth. Moreover, ICT makes learning less abstract and more relevant to their life situations. In contrast to memorization-based or rote learning, which is the feature of traditional pedagogy, ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning can also be 'just-in-time' learning in that the learners choose what to learn when they need it.

Collaborative learning: ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides an opportunity to work with students from different cultures, thereby helping to enhance learners teaming and communication skills as well as their global awareness. It models learning done throughout the learner's lifetime by expanding the learning pace to include not just peers but also mentors and experts from different fields.

Creative learning: ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the duplication of received information.

Integrative learning: ICT enhanced learning promotes a thematic integrative approach to teaching and learning. This approach eliminates the artificial separation

between the different disciplines and between theory and practice, which characterizes the traditional approach.

Evaluative learning: ICT enhanced learning is student-directed and diagnostic. Unlike static, text, or print-based education, ICT-enhanced learning recognizes the presence of different learning pathways to explore and discover rather than merely listen and remember.

4.2. Benefits of ICT Integration in Education

Integrating ICT in education is crucial for users in order to maximize the advantages, improve appropriate use, decrease the negative impacts, and prevent slipping into them (Magaña & Marzano, 2011). An increasing number of studies have recently shown that using ICT in education has both benefits and drawbacks (Arkorful & Abaidoo, 2015).

Raise Education Level

Before the advent of ICT, education was thought of as a singular process carried out in a solitary setting. The Internet, however, provides worldwide access to various data resources and facilitates global contact without limits, making education an open system and expanding and simplifying access to information (Arkorful & Abaidoo, 2015). Noam (1995, p. 1) makes the following observation regarding this: "In the past, people went to the information, which was at the university". People will receive information in the future, no matter where they are. Through these cutting-edge ICT capabilities, teachers can reach their students anywhere in the world, and students can engage in autonomous learning and conduct informational searches without being reliant on instructor contact (Mohammed & Yarinchi 2013). As a result, the first goals of ICT implementation were to improve education to a higher and more sophisticated level, to establish shared values via the exchange of information and knowledge, and to free the current educational system from the relics of the past (Al harbi, 2014).

Documentation management

ICT is a useful tool for managing academic documents since it makes it possible to organize and maintain databases, spreadsheets, and presentations. Additionally, ICT provides the most comprehensive and reliable data source that can help researchers with their data collection and research. In these ways, ICT integration into the educational process promises to significantly improve educational outcomes for both students and teachers, who can use ICT tools to diversify and enhance their teaching materials, methods, and techniques. Students gain the skills necessary for their future employment (Omona, Weide & Lubega, 2010).

This is significant for this study because it allows instructors to take advantage of current research, avoid spending time and money printing out sheets, and avoid losing work if they switch to an online text and material system. Both instructors and students also have access to the use of ICT resources in the educational system on a variety of levels, notably, from document management to the use of online platforms for registration, absences, and learning resources. These benefits, if not completely appreciated, have a significant impact on the usage of ICT and, as a result, may operate as obstacles to its use in education.

Improve learners' capabilities

Another significant application of the term ICT is the so-called ICT capability, which relies on both cognitive and technical proficiency to access, retrieve, use, produce, develop, and disseminate information appropriately and utilize ICT tools. Learners are likely to demonstrate this capability when they know how to apply and use technology in a way that facilitates their learning (Algahtani, 2011). As a result, learners are able to solve problems, exchange and analyze information, produce their own ideas, develop models and take control over devices, showing discernment in their use and choice of ICT tools and information. Moreover, they can recognize the value and contribution of these ICT tools to their progress in their studies through systematic review and evaluation (Hertlein & Ancheta, 2014). The term ICT capability refers, therefore, not only to the acquisition of competency in operating technical resources and software applications, but also to the development of the ability to select, execute, and evaluate outcomes. Hence, it is essential in teaching ICT capability to educate

learners in identifying the ICT tools available and determining when and why to use them to achieve the objectives (Pierce, 2013).

Prepare students for the labour market

A more regularly cited reason for the employment of ICT within classrooms, especially in high schools, is that it prepares the present generation of learners more effectively for a work environment in which the use of ICT, especially computers and the internet, is becoming progressively omnipresent (Schwab, 2019; Sjodin, 2021). Technological literacy or the capability to employ ICTs tools competently and successfully is therefore viewed as providing a competitive advantage in a progressively globalized labour market. Hence, it can help the present generation of learners to understand the importance of how computers and computer software are applied to their future jobs (Skills& Partnerships, 2014).

Communication

Another area of ICT application in education is that ICT facilitates communication between teachers and students to discuss their thoughts and share their perceptions in the subject area, so allowing for the matching of learning styles and techniques in a more effective way (Hertlein & Ancheta, 2014). In addition, ICT could be a channel to communicate with parents, by giving them more opportunities to be involved with the school community (Hadjithoma-Garstka, Clark, Banaji & Selwyn, 2010). Students' reports can be presented with high quality and can be made more comprehensible. In addition, it gives the parents greater access to more accurate information such as students' attendance, behavior, and attainment raising awareness of pupils' education and proficiencies, due to a rise in learning activities being located at home.

Furthermore, school calendars, term times, and activity logs can all be viewed online by individual log-in details for each child. This maintains privacy and confidentiality and saves time for parent-teacher meetings (Jewitt et al. 2010). To sum up, the examples provided of the affordances that ICT could offer to the teaching and the learning process, albeit limited in scope; demonstrate the positive influence ICT is having on enhancing the educational process and its outcomes. It is clear; moreover,

that the present trend of integrating ICT into teaching and learning is a global one, and that the importance of ICT tools in education is publicly acknowledged. This viewpoint is supported by several studies and research in specific subject areas (Schwab, 2015; Sjodin, 2015; Mohammed & Yarinchi 2013), which concluded that this process of integration of ICT in education, although challenging, is likely to produce considerable positive outcomes in the areas of teacher performance and student learning.

4.3. Effective use of ICT tools within the school premises

For ICT integration to be effective in Cameroon secondary schools, ICT tools must be available. As seen at the beginning of this work, ICT tools are devices and objects used in information and communications technology. Some of these tools are put in place to facilitate and ease the teaching and learning of ICT in Cameroon secondary schools. The available tools and how often both teachers and students use them, determine the effective utilisation of these ICTs in and out of the school premises.

4.3.1. Various ICT tools use by Teachers

Despite the massive investment in the integration of ICT in secondary schools, the effective and efficient pedagogical use of these ICTs has come to a big challenge (Pelgrum, 2001). A 21st century teacher needs to be endowed with new skills in curriculum development and technology, lesson planning, class management, innovative teching and evaluation strategies. Current teaching and learning in today's world is being driven by electronic applications and processes. The process of teaching is incomplete without the use of pedagogic resources which have evolved with time from traditional media to advanced media thereby stimulating students to learn with the use of educational technology. Today, we cannot talk about pedagogic resources without talking about ICT tools which include: calculators and telephones, computers and data storage tools, projectors, Dictaphones, LMS and MOOC. From our observation, we noticed that in GBHS Essos, GBHS Emana, GBHS Ekounou, GBHS Limbe, and GBHS Molyko, at least one teacher in each department owns a Personal Computer or Smartphone to assist them to learn ICT, to develop skills and to prepare and deliver their lessons. In the course of our interview, the heads of departments

(HODs) in the targeted schools assert that teachers make use of different ICT tools such as computers, mobile telephones, calculators, USB flash disks and internet out of school in order to prepare and deliver lessons. Meanwhile within the schools premises, teachers at times use labtops, tablets, smart phones, projectors, and internet. Printers and photocopy mechines are avalaible and used in all the schools to realised examination questions, school and administrative documents.

4.3.2. Various ICT tools use by Students

Living the 21st century era has exposed so many students to different Information and communication tools. This exposure and the integration of ICTs into Cameroon educational sysytem has made easier for some students to access and use these tools. According to Santrock (2004, p. 51), Vygotsky (1896-1934), like Piaget, "believed youngsters actively develop their knowledge." ICT, however, assists students in producing their own knowledge. The development of the cultural approach to instruction has been impacted by Lev Vygotsky's theories of learning, which is noteworthy. The cultural approach has prompted a more in-depth analysis of how current ICTs have permeated the educational system. Such thinking led to the creation of the activity-centered design for instruction and the activity theory. The systemic model by Cole and Engestrom identifies three crucial mutual interactions in each activity (Bottino, Chiappini, Forcheri, Lemut, and Molfino, 1999, p. 283).

Additionally, educators have conducted a great deal of research on Gardner's theory of multiple intelligences (Gardner, 1983), and some have changed their courses to accommodate students of varying intelligence levels. Gardner's multiple intelligences are changing many present assessment procedures and instructional strategies (Passer and Smith 2001, p. 347).The domain of ICTs therefore comprises several tools including calculators, telephones, tablets, computers, printers, Dictaphones, camera, overhead projectors, interactive white boards, data storage tools and online learning platforms. We observed in the course of the research that both teachers and students make use of some of these tools. These different tools assist them in their teaching and learning exercise. Data gathered from teachers especially computer teachers and class prefects say that computers, calculators, USB keys and internet are

use by students within the school premise. Out of school (home and cyber cafes), they are exposed to computers and internet which they make effective use of for assignment and leisure (participant 12.

From the gathered information, it is cleared that, learning in GBHS Essos, GBHS Emana, GBHS Ekounou, GBHS Limbe, and GBHS Molyko is evident with ICT tools. Even though most of the leanrners are excited using ICTs more for leisure and relaxation, when it comes to assignments and homework, they do not relent their efforts in making sure they meet up with the demands of the teachers helping them to learn.

Furthermore, educators and students can benefit greatly from Levy's (1997) concept of collective intelligence, particularly concerning how it articulates through ICT learning. Collective intelligence is the unavoidable result of intelligent systems, which are fundamentally coupled through ICT mediation (Zembylas & Vrasidas 2005).

These theories also demonstrate the evolution from behaviorism, which emphasizes the function of technology and the individual, to socio-constructivism, which focuses on pedagogical issues like instructional design, the social nature of learning, and the development and operation of learning communities.

The choice of this research was influenced by the fact that Cameroon has achieved progress in its use of ICTs in its different development areas, including education, and is still doing so. Without ICTs, it is impossible to discuss education in Cameroon today, especially given the spread of the Coronavirus. ICTs are used extensively in Cameroon's educational system, just like they are in every other African nation. In essence, our choice to focus on ICT in education has increased our awareness of the necessity of ICT integration. Through this, we learned how crucial ICTs are to the teaching-learning process in Cameroon, especially in the COVID-19 age. One of the nations in sub-Saharan Africa making significant strides in the use of ICTs in education for high-quality education is Cameroon. The idea of quality education also led to a shift in Cameroon's educational system from an objective-based to a continuing CBA manner of teaching and learning. The goal of this shift, such as change, pedagogically integrating ICTs into the Cameroon educational system is to improve the quality of education. Our interest in conducting a thorough examination is sparked by the impact

that this pedagogical integration of ICT has unquestionably had on the CBA teaching and learning process.

Actually, there is no research without motivation in the academic cycle. As a teacher of the twenty-first century, I realized that the appropriate implementation of the CBA method and the pedagogic integration of ICTs in Cameroon's educational system present challenges for both instructors and students. Private schools in Cameroon felt it was vital to integrate ICTs into their curricula and use their own teaching methodology in the 1990s due to the importance of ICTs in education. This was brought about by the lack of a clear policy governing the use of ICTs in teaching or learning.

The government of Cameroon became intrigued by this, which prompted the official adoption of ICTs in its educational system. Following President Paul Biya's speech to the young people of Cameroon on February 10, 2001, this innovation became official. The President pledged "the introduction and the generalization of computing learning in schools, and the endowment of at least one computer room with a connection to the internet network" in République du Cameroun (2007c, p. 3). The President's commitment began to take effect in 2002 as ICT was introduced to secondary general and technical schools in Cameroon. The presidential gifts of internet-connected multimedia centers have benefited numerous schools. In 2003, official ICT curricula for secondary schools were developed. Alongside the CBA teaching and learning approach, the process of adequate ICT integration is currently ongoing.

Our observations led us to the conclusion that the Educational Research Network for West and Central African Countries, also known as ROCARE in French, suggests incorporating ICT into the teaching-learning process. A workshop on the incorporation of ICTs in schools and training facilities was organized by ERNWACA-Cameroon and conducted in Yaoundé, Cameroon, in December 2005. Without a doubt, effective ICT implementation speeds up the transition from traditional pedagogical and administrative culture, from teacher-centered pedagogies and memorization as a learning strategy to a more constructivist, learner-centered approach, with learners taking on greater responsibility, a CBA objective. ICT tools consequently promote the growth of analytical and problem-solving abilities.

Given the significance of the aforementioned technologies, it was the ongoing transformation in the teaching-learning process in Cameroon's government bilingual secondary schools that drew our attention. Since the use and regions of implantation of ICTs are diverse and present in nearly all domains of human activity, there is cause for concern that this behavioral change is still being witnessed among the numerous actors in Cameroon's targeted government bilingual secondary schools. It is crucial to do a social analysis of the behavioral shift brought about by this innovation.

In addition, the overall purpose of introducing ICT as a discipline in secondary schools is to achieve the objective of preparing students to become ICT professionals in the future in order to alter the socio-economic situation to coincide with globalization. ICT as a subject in schools assists students to build skills that enable them to be self-employed and easily integrate into the working population for better goods, much like the CBA teaching and learning technique. We are therefore curious to discover if the shift seen in secondary schools in Cameroon aids in the achievement of the stated goal. The New Partnership for Africa Development (NEPAD), which acknowledges that the development of human resources is the primary concern in Africa, reaffirms this goal.

Another driving force is the pressing need for young Cameroonians who want to become teachers to develop the academic and professional abilities, attitudes, and values appropriate for education in the twenty-first century. Additionally, the researcher was inspired to conduct this study by Cameroonians' unrelenting love of modern equipment including computers, the internet, digital radios, digital televisions, and mobile devices like phones. Finally, the government of Cameroon's rising interest in the telecommunications industry and the researcher's mastery of the subject matter served as further driving forces. It is evident from the information provided above as to why we choose to do research on the subject that this study adds to a variety of research areas. The knowledge base in human, social, and educational sciences undoubtedly grows as a result of this study.

The Ministries of Basic and Secondary Education abruptly adopted in September 2018 the immediate application of a competence-based approach also known as pedagogic integration in the Cameroon educational system (Alemnge & Andongaba,

2021). It is important to remember that the educational system in Cameroon has undergone pedagogical evolutions, moving from the Objective-based Approach (OBA) to the Inferential Thinking Approach, often known as the New Pedagogic Approach, and now, as of 2018, to the CBA (Alemnge & Andongaba, 2021). A competency-based curriculum built on the development of competencies was used to create school programs. Schools are addressing and redressing new difficulties related to teaching, learning, evaluation, assessment techniques, and the legal environment.

According to Fafunwa (2010), national examinations create a wrong impression when in possession of paper qualification, which is the certificate obtained and is more important than the ability possessed. According to Blank (1982), the old traditional instructional approach depends on teachers'lectures and demonstrations, and is thus teacher-centered. Students only receive little feedback from the teachers. Ellery (2008) confirms that, since assessment is a key factor that affects student-learning methods in formal education, the traditional method of assessment promotes passive learning, surfaces and it is teacher-centered. Teachers group learners to spend the same amount of time on each unit of instruction and usually based on textbook reference materials, and other materials that do not meet the requirements of employability. Students rarely know what they are learning; the program is built based on chapters, unit blocks, and other segments of the book, which gives some meaning only to employability.

The traditional approach of the OBA only measures what learners have achieved from the objectives as stated in the syllabus. Learners are evaluated based on essay-type questions, structural, and multiple-choice questions (MCQ). The idea of using multiple-choice tests for evaluating students' achievement is no longer acceptable. A quotation from Herman (1992) in Hossein Farhady (2003) states*:* "Life is not multiple-choice. As children and adults, we must be able to apply what we know to create solutions, approach and solve novel problems, and communicate effectively to name just a few areas that call out for other than multiple-choice assessment" (p. 3).

The weakness of the traditional assessment approach prompted Cameroon to the adoption of CBA as an alternative method. This CBA subsided therefore a change of paradigm in education. According to Bissonnette and Richard (2008), different

educational stakeholders were urged to pass from the paradigm of teaching to the paradigm of learning. The underlying philosophy of the CBA requires that learning is based on the potential of the learner. The focus is on learning and not on teaching. The learner is responsible for his/her own learning. The new curricula give the teacher the latitude to use the methods or pedagogic strategies that enable them to easily attain their objectives and develop competencies in the learners. The essence of CBA lies in its shift away from typical school practices.

Integrating ICTs to teach is a notion that involves technology that acquires the acquisition of knowledge, skills and attitudes in these subject areas and the ability to use them to address challenges in real-life situations. Merely everyday transactions and real-life problems, and most forms of employment, require confidence and competence in a range of basic mathematical skills and knowledge – such as measurement, manipulating shapes, organizing space, handling money, recording and interpreting numerical and graphical data, and using ICT. Teachers themselves, equally, need a large range of such skills in their everyday professional life such as organizing their timetables, planning the spatial arrangement of the classroom, processing assessment data, interpreting inspection reports, and using ICT in their teaching.

The development of a new curriculum took into consideration the international, continental, and national instruments in light of Cameroon's goal of becoming an emerging African nation by 2035. At the completion of the primary school cycle, the learner should have mastered seven national core skills and demonstrate the four broad-based competencies, according to the Ministry of Basic Education's plan to improve the knowledge, skills, and attitudes of learners under its control.

The seven National Core Skills are:

1. To communicate in the two-official languages, (English and French), and the use of at least one national language;
2. To use basic notions in mathematics, science and technology;
3. To practice social and citizenship values;
4. To demonstrate the spirit of autonomy, a sense of initiative, creativity, and entrepreneurship;

5. To use basic Information and Communication Technology concepts and tools;
6. To practice lifelong learning; and
7. To practice Physical, Sports, and Artistic activities.

The four broad competencies are Intellectual, Methodological, Personal and Interpersonal, and Communication Competences (School Curriculum, 2018).The researcher is interested so much in the National Core Skills, which is to use basic notions in technology and CBA.

Through CBA, therefore, the learner improves his/her knowledge of science, technology, agriculture and engineering. CBA is thus regarded as an extremely powerful tool for the development of other human disciplines and represents most of the phenomenon under natural sciences more accurately and exactly (Goodwin, Piazza & Rozin, 2014). People without competency have great disadvantage in dealing with this information to make reasonable decisions affecting their work, their life, and their society (Spannberg, 2011) cited in Tadesse W (2014). The CBA is the ability to understand, judge, do, and be applied in a variety of contexts and situations (Niss, 2002).

One of the purposes in using the CBA to teach is based on the notion that an educated person has the right to be initiated into all the various forms of human knowledge and to appreciate their distinctive ways of reasoning and arguing. The secondary-school teacher is responsible to teach nearly all the areas of the curriculum. In shaping, monitoring and evaluating their medium-term planning, teachers should ensure that sufficient prominence is given to each of the following five reasons for teaching using the CBA:

1. Its importance in everyday life and society;
2. Its importance in other curriculum areas;
3. Its importance in relation to the learner's intellectual development;
4. Its importance in developing the child's enjoyment of learning;
5. Its distinctive place in human knowledge and culture (Christophe, 2022).

Understanding the CBA demands that learners develop confidence and become problem solvers, communicate, and be creative as well as critical thinkers. Instead of

objectives, expected learning outcomes are defined. As far as the CBA is concerned, learners are evaluated evaluation criteria as labelled based on the disciplinary competences or terminal learning outcomes against in table 1 below.

Table 16: Terminal Learning Outcomes and Evaluation Criteria

Terminal Learning Outcomes	**Evaluation criteria**
Solve problems involving sets and logic	Group, match, and classify objects and numbers in different attributes
Solve problems involving number operations	Correct representation of sets, symbols, and figures
Solve problems involving measurement units	Correct use of symbols, signs, and diagrams
Construct different geometric shapes	Ordering and consistency
Categorize statistics on graphs	Appropriate use of operations and formulae
Use mathematics skills in daily life	Associating quantities, figures, and words
Show interest in mathematics	Proper use of mathematical tools
	Solve meaningful daily life problems

Source: (School Curriculum, 2018).

If a grade one teacher is expected to assess the above-mentioned skills, attempts are made to clarify, as clearly as possible, the competences, the procedures to achieve the competences, the expectations from the learners, the ways their work are evaluated, and their responsibilities towards their own progress as stipulated in specific outcomes of competencies. Sometimes the results of students are reported on a numerical scale, reflecting quality of learning through a quantitative score or mark. Higher grades reflect higher levels of learning or competence whereas lower grades reflect a deficiency or incompetence related to the target content. Smith and Keating (2003) share the view that one cannot really assess competence from performance. Performance is not the same thing as competence, though it is taken to be an indicator of competence. A person's competence is something that lies behind what he or she actually does. Noddings & Shore (1984) argue that, if we view competence as a set of observable

behaviors, then the same set or list of observable behaviors is observed by anyone deemed competent in the same field; they thus disputed the notion of competence being linked to performance. Norris (1991, p. 336) argues that: "competence appears to circumvent the issue of what people need to know, it shifts the balance of power firmly in the direction of practice and away from theory". A comprehensive assessment of how well a country is performing in education must therefore look at the cognitive, affective and attitudinal aspects in relation to the development of competence. Evaluation reform obliges all stakeholders to adapt to the recommended model and thus review assessment practices that will enhance the success of a greater number of students. It has been recommended to lay emphasis on the learning success and to ameliorate the context in which it takes place.

4.4. ICT and the enhancement of the CBA

The CBA was officially introduced in Cameroonian secondary schools in 2012 (Ntongieh, 2016). To her, the CBA was the fourth approach introduced in the educational system after Grammar-Translation, Direct Method, and Communicative Language Teaching. But Nkemleke and Enama (2019) have acknowledged that the first two years were only a trial period and that the CBA was preceded by the Skills-Based Approach, which focused on the acquisition of knowledge. O'Sullivan and Burce (2014) proposed that the CBA has three main components, notably, a knowledge component, a behavioral component, and a value component. Thus, a competent person possesses the skills, knowledge, attitudes, and behaviors necessary to perform a particular task. Put simply, teaching with the CBA in mind means teachers need to take into account understanding, demonstration of this understanding practically by the students as well as the frame of mind to espouse in a particular context. The CBA was introduced in Cameroonian secondary schools because the government believed that, in addition to acquiring knowledge, it would enable students not only to interact out of the classroom but also to be able to solve real-life problems (Nkemleke & Enama, 2019). O'Sullivan and Burce (2014) noted that the most important characteristic of the CBA is that it measures learning rather than time; put simply, a student is allowed to move to a higher level with more challenging competencies if they demonstrate that they have mastered competencies at a lower level, irrespective of how much time is involved.

Teachers need to be versed with ICTs that facilitate their practices. It is now established that any teacher training that ignores the use of ICTs in its theory and practice does not only fail its students in their current learning but also ignores the huge challenges they face in the field upon graduation. In Ntongieh (2016) view, the computer may collect the responses or may equally judge them. However, computer-assisted testing has evolved to include many aspects of assessment previously reserved for teachers. Computers are not only useful in designing tests, administering tests, and distributing test scores but are also useful in scoring, giving appropriate feedback, and increasing engagement and interaction among students. But this is easier said than done as many teachers are still unprepared to use computers in their teaching and testing activities (Khan, 2014; Ngoungouo, 2017). Similarly, Chiatoh & Chia (2020) highlighted low ICT competence, power failure, and poor internet connectivity as some factors that stood in the way of teachers of English implementing an online teaching experience during the Covid-19 lockdown in Cameroon. Recommendations that ICT be included in different sectors of education, including the training of teachers, are no longer the talk of a limited few; it is now a universal requirement:

> *Integration of ICTs enhances the quality of education by helping teachers to do their job and by helping students to learn more effectively. Consequently, schools of teacher education play a crucial role in preparing future teachers to become proficient in the integration of ICTs into the curriculum. They need to help prospective teachers understand how ICTs can be used to teach content in rich and meaningful ways* (Goktas et al. p. 193)

However, Khan (2014) stated that the instruction of ICT in teacher training programs is a challenging task that is not limited to acquiring tools and throwing them in the classroom. Instead, he recommended that teachers be skilled at the use of the tools as well:

> *"... the mere adoption of new or innovative technology is not enough to meet the student's learning needs and opportunities. Technology alone could not sufficiently bring about the desired changes in students' competencies and behavior. It is the teachers' competencies to integrate ICT in their instructional*

tasks that can facilitate these desired changes to the maximum level" (Khan, 2014p.21).

Different interesting, and sometimes competing, models have been proposed on how teacher-training institutions integrate the use of ICTs in training programs. One of such interesting models described by Khan (2014) is based on the model of Koehler & Mishra (2005). According to this model, teachers need to acquire knowledge (K) in three areas to be successful at integrating technology in their educational activities, namely technology (T), Pedagogy (P), and Content (C). Thus the TPCK Model has to do with knowledge of technology, pedagogy, and content. Khan (2014) maintained that these elements are not supposed to be mutually exclusive. Citing his Bangladesh context, he stated that few teachers have technical knowledge of the use of computers; most of them use their knowledge to do administrative work and remain incompetent when it comes to integrating technology in the classroom. In this wise, he suggested that teacher training programs not only teach trainees how to use computers, but how to effectively integrate technology in their classroom. In the area of assessment, therefore, teacher training programs must teach trainees how to assess with computers and also let them have first-hand and hands-on experience in assessing students with the aid of technologies (Akongoh, 2021).

According to Gonczi, Hager and Anthanasou (1993), the CBA is the assessment of a person's competence against prescribed standards of performance. It is thus the process of judging competence against pre-established performance standards. This view is supported by Tyler (1949) cited by Alkin and Ellet (1990) and Ho (2017). The syllabus of a CBA follows an outcome-based approach to learning. Akongoh (2021) holds that the CBA syllabus is based on social constructivism in that it regards learning as occurring through social interaction. Thus, learning is not concerned with the transmission of pre-determined knowledge to be produced *in vitro* but as creative use of newly constructive know-how through the process of socialization. Richards (2006) in support of the idea of social constructivism sees a language class as the world in miniature, where classroom activities and tasks must be life-styled and community-oriented. Following the above, a CBA focuses on a real-life situation and is acquired to

solve real-life problems. That is systematic real-world activities that may be related to any domain in life and more especially to survival-oriented and work-related situations (Akongoh, 2021) are used in CBA.

CBA is not fashioned around the notion of subject knowledge but rather around the notion of competency. That is, CBA focuses on students. It is in line with the emphasis on usage that (Akongoh, 2021) pinpoints that the teacher is expected to provide a list of competencies that the course is going to deal with. She further added that these competencies selected by the teacher are typically required of students in real-life role situations. Following the above objectives, the learning outcome of a CBA lesson is to perform realistic social interaction and instill behavior, and attitude change in learners. According to Larsen and Matthew (2015), the purpose of the CBA is to test learners' competencies and to test usage in a realistic situation. According to Agbor (2016), CBA focuses on learners' knowledge. Teaching and learning always need to be connected to the social context of usage. CBA is thus considered as the functional and interactional perspective (Akongoh, 2021).

Agbor (2016, p. 1) points out that, "the competencies in CBA consist of the description of the essential skills, knowledge attitudes, and behaviors required for the effective performance of a real-life activity which forms the basis for assessment". The important source of temptation in a CBA is to use a narrow evidence base (Sadler, 1987). This is supported by Gonczi, Hager and Anthanasou (1993), who insist that performance on paper and pencil is probably too narrow a base for assessing competence and thus recommend a mix of methods such as direct observation of activities (Docking 1991), skills sample tests, projects/assignments, evidence from prior learning and log books be used for providing evidence on which to infer competence.

Furthermore, looking at the stages of a CBA lesson, it is clear that a CBA course takes into consideration several types of assessments (Initial, formative and summative assessment). CBA assessment follows certain principles which must be considered when judging learners. They are the communicative principle, task-based principle, functional principle, behaviorist principle, integrative principle, and team principle (Tabe, 2019). CBA encourages group evaluation because it favors peer learning and

interaction. This interaction is also encouraged by Vygotsky's social constructivist theory as it lays emphasis on collaborative learning where less competent learners develop with the help of more skillful peers (Nalova, 2021).

ICTs are observed elsewhere and have touched and influenced the lives of students. In fact, they have imposed their presence into human daily life so much so that the latter cannot function without them. They are present in communication, finance, health sciences, music, cinema, architecture, cuisine, sport, and education, to name just a few domains. As mentioned above, this revolution touches the domain of education which is the center of this work. In this precise domain, ICTs play a very important role as they ease the teachers' teaching using the CBA methods duty (typing, content multiplication, automatic examinations, marking and corrections, research, and others) (Nalova, 2021). Furthermore, they contribute to the self-training of learners through the same means mentioned above. Most importantly, they have improved the traditional teaching methods through several Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs), the latter being much adapted to the present-day educative reality (Ngoungouo, 2017).An interactive method with six separate parts makes up the learning process. Memory, focus, language, coordination, processing, writing, and higher-order thought. These elements must all work together for learning to take place (Bandura, 1969). For instance, a learner needs to comprehend the language of instruction in order to understand algebra. The student should then pay close attention to the instructor and have the mental capacity to efficiently analyze and organize formulas. Finally, yet importantly, a student is able to resolve them and then think more abstractly to resolve another equation (Bandura & Walters, 1977). Learning components that work along with learning components are necessary for the learning process. They consist of teachers, classroom climate, conduct, social skills, and emotions.

The behaviorist school of thinking, which elaborates on the different types of learning, dominated psychology during the 20th century. According to Watson & Kimble, (2017); Moore, (2011); O'Donohue & Kitchener, (1998), learning leads to different types of learning, including:

Classical conditioning. The neutral stimulus occurs before a naturally occurring response as a result of this process that links a neutral stimulus and an unconditioned stimulus. For instance, when a dog initially hears a tone that is later associated with food, the dog will gradually respond by salivating the next time, it hears the tone. Therefore, unconditional, conditioned, and neutral stimulus as well as conditioned and unconditioned response are features of this learning. This style of education has the benefit of demonstrating the significance of nurturing to grow. However, it violates one's right to free will.

Observational learning. Animals and humans both use imitation and observation as a primary method of learning. In observational learning, operant and classical conditioning are both more effective. Maria, for instance, can mow after watching her mother use a lawnmower for the first time. Observational learning does not come from personal experience; it is learned by observing others. It is how little ones learn to walk and talk. Response to environmental cues and interaction are traits of observational learning. Real-world applications are one of this sort of learning's biggest advantages. However, this kind of education can easily introduce immoral elements, especially to young people.

Operant conditioning. In this sort of learning, an organism’s likelihood of making a response is raised or lowered by punishment or reinforcement. Punishment decreases the likelihood of responding, but reinforcement increases it. For instance, Joe discovers that when he compliments his grandmother, she smiles and gives him a hug. The smiles and hugs serve as operant conditioning incentives. People pick up new behaviors through engaging in behavior, followed by punishment or reward. While penalised activities are avoided, rewarded behaviors are frequently repeated. Some of the traits of this learning include extension, punishment, and reinforcement, which can be positive or negative.

Cognitive learning. It is a sort of education that stimulates the mind's memory. In order for learning to take place, it adheres to the registration, storage, and retrieval stages. Learning depends on the capacity of the human mind to absorb new information and store it securely so that it may be quickly recognized or recalled, depending on the

circumstance. This learning's thinking, memory, perception, attention, and language skills are only a few of its traits. The main benefit of this style of learning is that it enhances the learner's problem-solving abilities. However, because these learning processes take place in the mind, they are generally invisible.

It is important to note that only classical conditioning, observational learning, and operant conditioning are observable types of learning. Cognitive learning is also learning, though not classified under behaviorism since it cannot be observed. Latchem (2019) 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 implements a learning plan and evaluates the learning gained. Latchem (2012, p. 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.

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" (UNESCO and UNICEF, 2012, p. 43).

4.5. E-Learning as a Substitute for Traditional Educational Methods

Technology facilitates almost every field of life, including education; technology usage has become an integral part of our daily lives. Today, the global-village concept facilitates communication, collaboration, education, and information with ease of access and more significant benefits (Shahzad, Hassan, Aremu, Hussain & Lodhi, 2021). Fischer, Heise, Heinz, Moebius & Koehler (2014) examined students' perceptions regarding E-learning as a substitute for traditional learning methods. Data revealed a strong, significant interest in E-learning as an extension of learning. Respondents considered E-learning an adequate substitute for traditional learning environments. Goyal (2012) considered that E-learning is the future of education,

offering brighter prospects to students. With an efficient bandwidth network, internet-based learning is a need of almost every student. E-learning is an effective alternative to traditional learning environments as it is growing briskly as an inevitable part of formal and informal education procedures. Due to its distinct features, students also prefer E-learning, indicating users' appreciation arising from E-learning's unique characteristics and benefits.

Owens and Price (2010) examined the impact of modern E-learning and information technologies (IT) on UK higher education. The results showed that E-learning and other technologies were valuable means of providing modern education to students and of potentially developing student interest in exciting ways. Rana & Lal (2014) conducted a study to investigate the benefits and challenges of E-learning. They found that respondents considered E-learning an adequate substitute for traditional learning patterns and policies. However, participants also expressed some challenges regarding E-learning's implication and usage, such as the unavailability of sufficient financial, social, cultural, local, national, and regional resources to meet modern study requirements. Mohajan (2017) found that students and teachers are still grappling with its implementation. Although education policymakers are also concerned with E-learning and implementation, there is still a long way to go. The E-learning policymakers and stakeholders also need to focus on some other areas, such as social, environmental, personal, and cultural factors, in this regard.

Furthermore, Arrey-Ndip, Carole, Njikam & Tamajong (2020) examined Cameroonian secondary students' perceptions regarding E-learning as a substitute for conventional learning. The results revealed that school administration largely relied on E-learning to improve students' learning skills. Obi, Charles-Okoli, Agunwa, Omotowo, Ndu & Agwu-Umahi (2018) stated that E-learning helps students to stay connected to national institutions and to avail themselves of what international institutions can offer. Due to increased opportunities, students can today expand their exposure and attain better opportunities in different study disciplines. De Giusti (2020) scrutinized the effectiveness of E-learning for US postgraduate programs in medicine and showed that asynchronous E-learning had been widely adapted and had replaced

conventional learning as it provided ease of access and ease of schedule to residents with busy schedules.

Descriptive Statistics on E-Learning

Table 17: Information on E-learning

Item	Statements		SA	A	Un	DA	SDA	Mean
1	In my school, there are online learning platforms	*fi*	159	272	198	162	318	2,81
		%	14,3	24,5	17,9	14,6	28,7	
2	My teachers teach through WhatsApp effectively	*fi*	200	191	196	324	198	2,88
		%	18,0	17,2	17,7	29,2	17,9	
3	I easily retain lesson presentation through Television	*fi*	198	259	218	209	225	2,85
		%	17,9	23,3	19,7	18,9	20,3	
4	I visit lessons from my teachers through youtube	*fi*	101	92	184	288	444	2,20
		%	9,1	8,3	16,6	26,0	40.0	
5	The internet works well in my school for studies	*fi*	184	159	204	346	216	2,77
		%	16,6	14,3	18,4	31,2	19,5	
6	I find the use of zoom for academic exchange interesting.	*fi*	552	---	164	265	128	3,52
		%	49,8	---	14,8	23,9	11,5	
7	Whatsapp and zoom increase my learning cooperation with my teachers	*fi*	260	284	195	200	170	3,23
		%	23,4	25,6	17,6	18.0	15,4	

Source: Field Statistics

Item one on this table presents the distribution of the respondents according to whether in their school, there are online learning platforms. The data gives us a mean of 2.81 implying that most of the respondents agree with this statement. Even so, 318 of them strongly disagreed. This could mean that the ability of learners to use devices connected to a network, offering them the possibility to learn with any means, in any rhythm, any time, and from anywhere is not available in their school. This high number of students shows that they do not have learning experiences in synchronous or asynchronous environment using different devices such as laptop, and smartphone with internet access. Yet, the mean implies that, in this environment, students can be anywhere to learn and interact with their instructors and other students.

Item two distributes respondents according to whether their teachers teach through WhatsApp effectively. 18.0% (200) and 17.2% (191) strongly agreed and agreed respectively. 17.7% (196) were uncertain while 29.2% (324) and 17.9% (198) disagreed and strongly disagreed. Based on this data, we have a mean of 3.39 which is within the acceptance range. Yet a great number of the respondents who disagreed with the statement could be indicative that teachers need to review their teaching methods in secondary school in 21st century knowledge economy.

Item three is the distribution of respondents according to whether they easily retain lesson presentation through Television. Based on data, the mean is 2.85. This is found within the acceptance region. Yet 218 respondents were uncertain, 209 and 225 disagreed and strongly disagreed. This implies that students are not used to distant learning because they have never seen the teacher teaching them in person.

Item four is the distribution of respondents according to whether they visit lessons through youtube. 9.1% and 8.3% agreed while 16.6% were uncertain. 26.0% and 40.0% disagreed. So even though the mean of 2.20 is within the region of acceptance, secondary schools should rethink their online platform.

Item five distributes respondents according to whether the internet works well in their school for studies. Based on the data, the mean is 2.77 which is found at the acceptance level. This means that most respondents supported the statement. There is however need for more constant internet in schools looking at the numbers who disagreed (346 plus 216).

Item six is the distribution of respondents according to whether they find the use of zoom for academic exchange interesting. Based on the data, the mean is 3.52. This falls within the accepted range and implies that most respondents agreed with the statement, that there is need for effective use of ICTS in the pedagogic process in secondary school is interesting. This is because 265 and 128 think that ICT tools are not yet effectively in use.

The final item (seven) distributes the respondents according to whether whatsapp and zoom increase their learning cooperation with teachers. The data gives us a mean of 3.23 which is acceptable. Even so, some 18.0% and 15.4% of the respondents

disagreed with the statement. This implies that even though the mean is accepted, the objectives of ICT increasing learning cooperation with teachers.

Hypothesis three

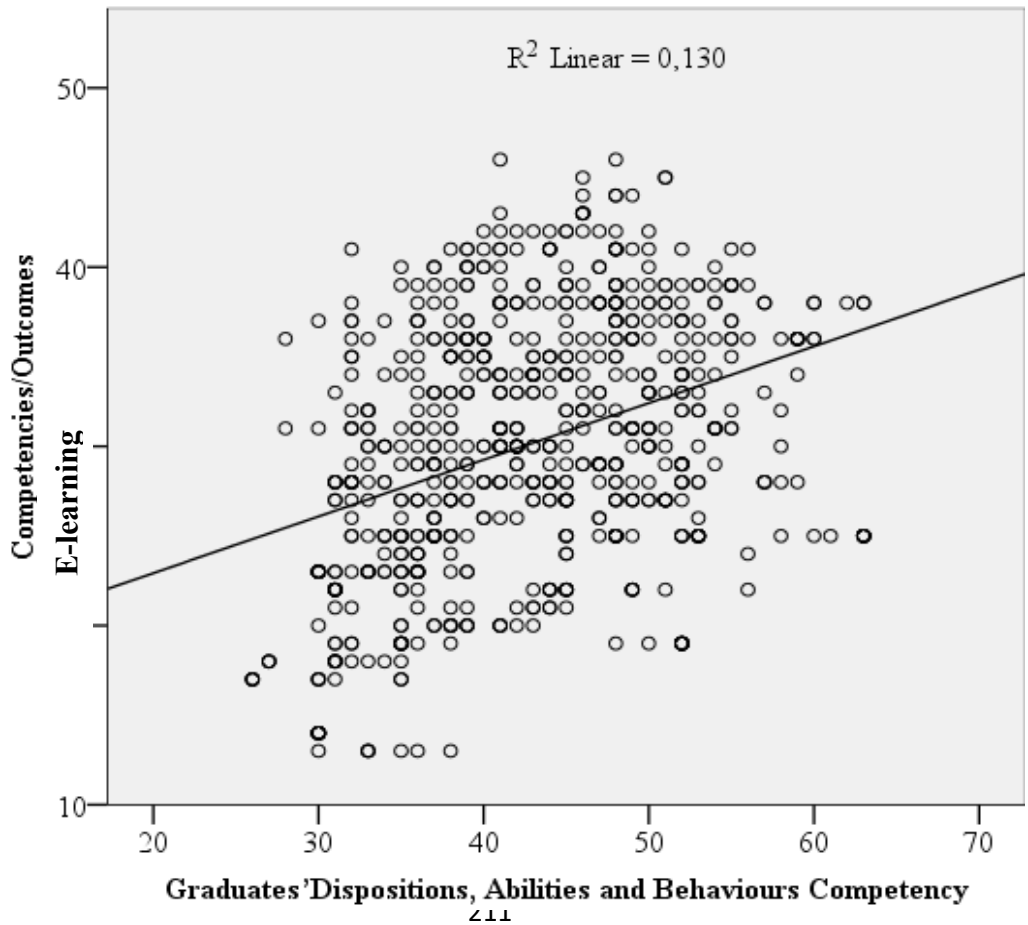
Ha₃: There is a relationship between e-learning fosters - CBA teaching-learning methods in government secondary schools in Cameroon

Ho₃: There is no relationship between e-learning fosters - CBA teaching-learning methods in government secondary schools in Cameroon

Table 18: Correlations of E-learning and CBA teaching-learning methods

			E-learning	CBA teaching-learning methods
Spearman's rho	E-learning	Correlation Coefficient	1,000	,357**
		Sig. (2-tailed)	.	,000
		N	1109	1109
	CBA teaching-learning methods	Correlation Coefficient	,357**	1,000
		Sig. (2-tailed)	,000	.
		N	1109	1109
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: (Researcher, 2023)



CBA teaching-learning methods

The correlation table above reveals the relationship between E-learning and CBA teaching-learning methods. The statistical Spearman rank correlation index of 0,357 was a positive coefficient. This is based on the fact that the level of significance is 0.00 thus less than 0.05 which is the alpha, that is, the standard error margin. The results reveal that we have no chance of making an error if we accept that the association between the variables exists. We can therefore conclude that the e-learning significantly influences CBA teaching-learning methods in Cameroon government secondary schools.

4.6. Discussion on E-learning and CBA in Cameroon Secondary Schools

Data collected on this third hypothesis was also tested using the Spearman rank correlation and multiple regression. It was found that e-learning as such can significantly influence CBA teaching-learning methods. The statistical Spearman rank correlation index of 0,357 was a positive coefficient revealing that the relationship between this e-learning in secondary schools and CBA teaching-learning methods is high and positively significant. Based on the level of significance of 0.00 we can therefore conclude that there will be no errors in admitting that E-learning can positively affect CBA teaching-learning methods.

Most of the respondents, (318), strongly disagreed with the statement that in their school, there are online learning platforms So even though online learning platforms in secondary school can positively affect CBA teaching-learning methods, if the students are unaware of the needs of this knowledge economy, the teaching methods with e-learning will be seriously inadequate to meet these needs, thereby impairing the process of skill development in the students. Also, 324 respondents disagreed and 198 strongly disagreed with the teachers teaching through WhatsApp, Zoom, and Moodle effectively. In fact, 265 and 128 disagreed and strongly disagreed respectively on the fact that the teaching methods involved the use of ICTs and other communication gadgets. This could imply that most students could leave the secondary school without

being exposed to ICTs and other modern technologies that are hall marks of the 21st century knowledge market economy. By providing adequate and up-to-date ICT infrastructural facilities, there is likelihood of staff professional development where staff learns on the job as they use them in the process of teaching in school. This would create a good working school environment where staff and students feel valued and cared for. The provision of up-to-date ICT infrastructure in school would be a motivation for school staff not competent in ICT skills to train on them. The method of providing ICT infrastructure before staff undergoes training in them is becoming a popular approach in the implementation of ICT in schools. More schools are increasing ICT infrastructure without sending their staff for in-service courses, such as supplying computers to classrooms so teachers are encouraged to try them. Through regular and consistent use of ICT hardware, teachers and learners who are not competent in its use could develop the required skills in the use of ICT in teaching and learning in schools.

The majority of the respondents (444) said that they did not receive course syllables on their online class platform. If teachers know that they could be inspected from time to time through this online platform, they will sit up and not do what they like. Furthermore, eliciting to know whether ICT increases learning cooperation with teachers, most respondents (200 and 170) disagreed and strongly disagreed respectively. This implies that one of the foremost objectives of the secondary school which is to carry out innovative research and produce knowledge could be seriously obstructed due to the lack of ICT cooperation with the teachers. So, for teaching methods to effectively and positively influence CBA teaching and learning methods service retraining of teachers must be reconsidered to equip and keep updating them on the needs of the knowledge economy and the use of modern technologies such as ICTs. They will be a need to implement quality control measures in secondary schools, furnish school labs so that they could become digitalized to a modernized society. In this way, it will be more likely to respond to challenges of innovation characteristic of the knowledge society.

Students were not using the internet, according to the findings, since lack of internet capabilities in the computers, lack of internet usage expertise, and poor

computer speeds prevented them from doing so. The majority of students who accessed the internet did not do so for academic purposes, as was also discovered. It was suggested that additional internet-connected computers be made available and that students be trained on how to use the internet.

As for the students'opinions of online learning resources, the study looked at the differences in how students who used web-based resources and those who used traditional textbooks changed their attitudes toward computer technology. The majority of the students in both the web-based and traditional textbook groups had personal computers and had access to the Internet at home, thus it is probable that computer use was the same for all groups, it was noted.

According to Arrey-Ndip et al. (2020), the internet has revolutionized the computer and communications landscape to the point where the world would not be the same again. According to them, the invention of the telegraph, the telephone, the radio, and the computer set the stage for this unprecedented integration of capabilities, creating a formidable mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location. Participant P 11 said that

> *From the foregoing, it is easy to see that the fallout of the internet revolution is the birth of the e-learning concept. Indeed, since the acceptability of the internet by the global academic community 'as a means of communication' […] academics have been aware of its massive potential as a learning tool* (Interview, November 2, 2022).

The era when learners must travel out of their immediate vicinities in search of knowledge seems to be a thing of the past. The introduction of e-learning as an alternative means of acquiring knowledge and skills, through the power of the internet and new information and communication technologies has empowered individuals to freely choose between an online course and a traditional course, a feat that would not have been imagined only a few decades back.

According to Newen & Cheny (2022), it can also be considered as the amalgamation of modern technology into the classrooms which can sometimes include

learning that is completely independent of mediation. E-learning is most widely used in schools, colleges, and universities which have paid special attention to e-learning in order to advance the learning procedures. The use of technology in learning can be referred to as e-learning which comprises a wide range of applications and processes designed to deliver instruction through electronic means (Ouma, Awuor & Kyambo 2013). E-learning signals a paradigm shift in education and its profound effect on education cannot be underestimated. According to Ouma, Awuor & Kyambo (2013), an E-learning platform can only be managed and used by people with some level of technical skills. Broadley (2012) affirms that teachers'perceptions and attitudes towards e-learning play a critical role in e-learning implementation besides teachers'ICT capacity. This is because e-learning has become ubiquitous, faster, and increasingly accessible to non-technical communities and social networking. Collaborative services have grown rapidly, enabling people to communicate and share interests in many more ways.

Mbakwa (2020) observed that the web has resources of varying levels of interactivity and functionalities that can be exploited by teachers to teach mathematics. The different strategies teachers typically use in a mathematics classroom can be further enhanced or replaced with the use of web objects that are available on the web (Krönke, 2020). It was concluded that the World Wide Web has the potential to be a significant resource in mathematics education. The variety and interactive nature of the materials available can make mathematics teaching much easier and enable students to visualize mathematical concepts in ways that were previously not easily achieved without e-learning. The e-learning platforms are underutilized (Ajero, Ukaga & Ebirim, 2011, Nwagbo & Ugwuanyi 2015) but there are some teachers who are beginning to explore the possibilities and so it is important that these explorations are investigated in order to make the best use of the internet to enhance students' understanding of mathematics. According to Jackson (2022), e-learning implementation by any institution can be achieved using either the technologies to support or supplement the traditional face-to-face course, integrating online activities into a traditional course to enhance the learning experience, and delivering a course that is entirely online. The adoption of any of these approaches by an institution depends on the level of readiness in terms of the budget,

infrastructure, and human resources such as experience, skills, knowledge, and attitude (Jackson, 2022).

Bandura (1977) propounded a theory that states that learning by observing behavior could account for a wide range of learning experiences that occur in the real world. Three types of modeling were outlined in the theory which include live model (the actual person demonstrates), verbal instruction, and symbolic instruction (via media). Bandura (1977) posits that learning is not purely behavioral; rather it is a cognitive process that takes place in a social context. Also, it was noted that learning occurs by observing behavior or the consequences of that behavior, extracting of information from the observation, and then making decisions about the performance of the behavior. Finally, it was concluded that the learner is not a passive recipient of the information but that cognition, environment, as well as behavior mutually influence each other. There is a need to investigate the readiness of teachers and students regarding their skills in e-learning and also the logistics to accommodate learning.

With numerous uses and global networks, telecommunications are a dynamic and expanding technology. When information technology and telecommunications are integrated with advancements in instructional and learning technologies, new learning formats and capabilities are made possible. Teaching and learning have moved outside of the traditional classroom as a result of the growing strength and sophistication of communication and computing technology. Microcomputers have been included in teaching and learning resources as a way of supplementing classroom instruction. The contemporary attempts at integration, however, seem to be the work of lone educational trailblazers.

A lack of knowledge about how to speed up the process contributes to resistance to pedagogical changes brought about by the use of technology. This essay is an attempt to start cataloging the methods and approaches employed in these many initiatives to include computers and communication technologies into the existing curricula. Teachers cannot continue to focus on imparting a static body of knowledge to their students. Instead, students must cultivate critical thinking abilities and an understanding

that lifelong learning is essential to both quality of life and a career (Fanso & Ngwa, 2022).

The two-class computer society of today, the user and the non-user will only be sustained if technological integration into coursework is put off further. The information "haves" will be those who understand even the fundamentals of telecommunications technology and the corresponding access tools. The permanent have-nots in terms of technology will be those who struggle with worry and dread, which in turn leads to dissatisfaction and failure. The workforce of the future will require individuals with telecommunications knowledge and skills; people without these abilities will have few employment opportunities starting in the year 2000 (Nsangong & Nganji, 2022).

E-Learning, which is the umbrella name for the subjects of online learning, web-based training, and technology-delivered education, is the utilization of technology to aid and enhance learning. Al Sabah (2020, p.34) clarified the notion of e-learning that:

> *E-learning is a self-learning process using IT communication networks and other means or remote education using the internet and/or other information technologies. When it stated that e-learning comes from using ICT to broaden educational opportunity and help students develop the skills they and their countries need to pheneturide 21st century; an American multinational corporation and technology company, Intel, was clear about the role of ICTs in the operation of e-learning strategies.*

E-learning applications and processes include web-based learning, computer-based learning, virtual classrooms, and digital collaboration. The author further stressed that, apart from through the internet, e-learning content can be ‘delivered via the …intranet/extranet, audio or video tape, satellite TV, and CD ROM. E-learning comes to the fore when, for example, students participate in an activity as basic as a ‘video documentary in class, or a more complex activity. E-Learning occurs when someone or an individual learns through the usage of ICTs which suggests that ‘e-learning happens simultaneously with the usage of ICT tools for learning (Odoyo & Olala, 2020). FGD revealed that the advances of e-learning are phenomenal. This could easily be seen from its various phases of evolution, such as from the initial use of the television and

overhead projectors to the advanced use of ‘interactive computer programs, 3D simulations, (tapes, satellite broadcasts, interactive TV), video and telephone conferencing and real-time online discussion groups comprised of students from all over the world (FGD, November 12, 2022).

In secondary schools e-learning is used to define a specific mode to attend a course or programs of study where the students rarely or never meet face-to-face, nor access on-campus educational facilities, because they study online. And it appears this is made possible because, by the very nature of the design of e-learning, students are meant to be guided through specific information, so as to help them succeed in performing specific tasks.

It has long been recognized that teacher quality plays an important part in educational outcomes, including in the classroom. By extension, therefore, the quality of any educational provision cannot rise above the quality of its teachers (Akuegwu, 2015). However, reasoning along the lines of the e-learning strategy, participant P 5 emphasized that: "what makes you a good instructor (or teacher) in the classroom, does not necessarily translate to good pedagogy in an online learning environment" (Interview, November 9, 2022). While participant P 1 stressed that to promote success in the virtual class, it will require some important considerations - one of which is the online learning environment because whatever grade of students you are building an online course for,the environment should be that which would enhance the learning experiences of your learners (Interview, November 8, 2022). Narayanan, H. (2020, p. 4) advises:

> *that it is wise to consider factors like the learners' age, the curriculum in use, their developmental stage, and their learning needs and interests when building an online learning environment for them. In light of this, a learning Management system for primary students... will be more visual based with lots of icons, whereas e-learning courses for higher education students...tend to be very textual, not forgetting visualization as this is a very powerful tool for comprehension, and it would be mistaken to assume that our older learners do not need visuals to support learning.*

Apart from gauging the impact of e-learning through understanding how the teacher or the school incorporates the new ICT into their teaching, knowledge about the impact of e-learning could as well be obtained by understanding how students perceive the e-learning strategy overall. Against this backdrop, it can be argued that specific individual variables such as age, gender', and important characteristics such as 'previous experience of computers, technology acceptance, and individual learning style (Fanso & Ngwa, 2022) may influence the degree to which students perceive the impact of e-learning on their education.

According to Fanso & Ngwa (2022, p. 3) "students overwhelmingly prefer to take classes using e-learning than a traditional course because they felt that e-learning was a helpful tool in their learning". With regards to experience, some students may have experienced e-learning in secondary schools while others may have met computers for educational purposes at the secondary school.

E-learning, as a modern concept has both merits as well as demerits. Distance learning is designed to satisfy different instructional and learners' need. Hence, when learners engage in distance learning, this is done because of the convenience of being able to take courses and enhance professional possibilities from the comfort of their homes, with fewer disruptions to daily life. E-learning reduces learning time by at least 25 to 60 percent when compared to traditional learning… and it cuts down on the training time required because: a) it does not take as long to start and wrap up a learning session; b) learners set their own pace, rather than the pace of the group; c) no travel time is needed to get to and from training events; and d) learners can focus on elements of a program they need to learn and can skip what they already know. When compared to the traditional mode of classroom learning, there is clear evidence that e-learning brings: faster delivery, lower costs, more effective learning, and lower environmental impact.

E-learning increases engagement from the learners; positive work attitude from the teachers involved, leading to the provision of more personalized learning; encourages family involvement in students' learning; provides inclusive learning, in other words, students can learn in a relatively anonymous environment without the

embarrassment of failure and/or socio-cultural bias from personal contact (Fanso& Ngwa, 2022).

In spite of these accolades, e-learning has its pitfalls. The most glaring is the fact that it is extremely difficult to pick up any form of practical skills from online resources - for instance, it would not make a difference showing students a video of how to make a chair without them actually having hands-on experience on the actual thing. Other issues that have been recorded include isolation, although e-learning offers ease and flexibility in its offerings (where students can remotely access any instruction in their own time and in the comfort of their bedrooms or lounges, there is loneliness and isolation associated with this type of learning (Fanso& Ngwa, 2022). However, 'learners can now engage more actively with professors or other students using tools such as video conferencing, social media, and discussion forums amongst others' (Epignosis, 2014), for those who have the advanced tools; yet again, the total process is technology dependent and requires expensive resources such as fast internet, software and good computers - something which is a superfluity in a country like Cameroon. Some other obstacles that students have to overcome as they engage in e-learning relate to the issue of the absence of proper guidance for students to remind them about class time, or deadlines for assignments or exams, thus it is likely to make them easily procrastinate (Fanso& Ngwa, 2022).

Table 19: Pedagogic ICT Integration and CBA Teaching and Learning Methods

ICT Tools	Active Use	Passive Use
Projectors	PowerPoint presentation, picture display,	
Laptop, desktop,	video lessons, showing animated videos, lesson presentation,	Research, searching information, finding out better presentation method, lesson preparation,
Google, Google Scholar	Teaching students to find academic materials on the Web.	Searching information, assigning students to search information
Virtual lab software	Showing practical scientific videos	

Phones, Ipad and other mobile devices	Reference in the classroom, showing real images to students	searching information, SMS teaching, research practices
Radio/TV	Teaching through music	

Source: (Researcher, 2023)

Many instances were given of how instructors use ICT tools in their classrooms, starting with those who were thought of as active users of ICT tools in the teaching and learning process. It was clear that the majority of them began their courses by using the conventional teaching style to explain the topics in their various subjects. They later took the students to the school's multimedia center to demonstrate the notion to them using ICT tools. While some teachers utilized the resources offered by the school (by bringing the students to the school's multimedia center), others took the effort to include ICT resources in their lesson plans.

It was vital to ask teachers and administrators about how ICT affects pedagogy in order to acquire a complete picture of the use of ICT in general. Finding the teaching and learning outcomes ICT has brought to schools was the main goal of this question. Teachers readily acknowledged the importance of ICT in education and how its practical application may enhance both the teaching and learning process.

The study revealed that the attitude of teachers is not impeding ICT integration since the majority of teachers have a positive attitude towards the integration of ICT in teaching and learning. Findings from the interview from participant P1 showed that all teachers had positive attitude towards the use of ICT in teaching and learning. Participant P5 commented:

> *"ICT is a very important tool for education in today society. I love using ICT in my teaching work. It makes my work very easy and I do not think that I can do my work without ICT"* (Interview, November 9, 2022).

The emergence of a knowledge-based economy has increased competitiveness in all sectors of society more than ever before. This proves that teachers like using ICT and they find them effective. Governments in all parts of the world are striving to achieve access and good quality education for their citizens (UNESCO, 2013). In the

FGD, the participants point out that "ICT in education increases access to education, particularly for the rural population, and to make teaching and learning pleasurable" (FGD, November 12, 2022). The use of ICT in education is an enabler in the process of teaching and learning by assisting the learners to grasp concepts that would otherwise have remained abstract. Participant P1 response made this clear:

> *For instance, in my class, typically, before I bring them here at the school multimedia center, I teach them in theory the various concepts in the subject area, then later bring them here so they can see for themselves the concepts I taught using displayed image on the computer* (Interview, November 8, 2022).

Participant P12 who took the initiative to integrate ICT into his classroom said,

> *As you can see in my backpack, my laptop. I frequently use films on lab experiments when I teach my subject. Due to their inability to visualize the process, I begin by describing the concept to the students before starting to play videos on my laptop* (Interview, November 5, 2022).

Projectors were mentioned by many of the teachers who actively utilize ICT; participant P6 explains that "Sometimes I prepare my lessons using PowerPoint, putting it into slides and present to my students using overhead projectors" (Interview, November 4, 2022). Another subject participant (P13) commented:

> *Basically, after doing the standard traditional instructional teaching in the classroom, I take my laptop to the ICT labs, using the projector to project images, I stand behind the class allowing the students to watch video lesson for some time then, and I pause from time to time to explain* (Interview, November 9, 2022).

Projectors serve as a tool that can be easily used to assist numerous children at once, according to the professors, who went on to comment on the context and student-teacher ratio in the school. Participant P11 gave a succinct explanation for this, saying,

> *The tools are limited around our schools so we use what is available. We have a projector, so to project the visuals so that it may reach a broad audience as is the case here* (Interview, November 5, 2022).

Participant P9 described a new method he had just developed in light of the enormous class size, in which he paired quick and slow learners to work cooperatively. He said:

> *I typically pair three or sometimes four students with one computer in my lesson to accommodate the large class size. While other students (slow learners) see what they do and follow the instructions, I let the pupils who are proficient computer users sit directly at the computer* (Interview, November 5, 2022).

Participant P9 describes how he uses his personal laptop in the classroom;

> *I use my laptop computer in the classroom, as I have software and scientific videos which I demonstrate to the students when teaching. I have programs in my portable computer like virtual lab and 4 stroke engine animations* (Interview, November 5, 2022).

P4 acknowledged showing their students real-world photographs on their phones and IPads while teaching and used them as a reference tool;

> *As you can see, I have an Apple IPad with me. When I discuss concepts like folding and faulting or volcanicity in class, I use real images from my tablet to demonstrate them. I make every effort to improvise and align my instruction with reality* (Interview, November 2, 2022).

Participant P1 said: When I am teaching, I keep my Tablet beside me to verify what I'm teaching and to check from other sources online (Interview, November 8, 2022). Furthermore, participant P3 stated, I use my phone too. When a student has a hard question in class or I need to apply what I'm learning to a real-world scenario, I might just use my phone to browse through resources relating to the topic I'm teaching (Interview, November 2, 2022).

The investigation revealed that the other group of teachers admitted to using the tools indirectly to ensure effective teaching rather than directly in the teaching and learning process. They noted that pedagogic use of ICT may include passive (indirect) uses of the tools that support the teaching and learning process in addition to direct (passive) uses of the tools in the classroom. All of the teachers also acknowledged

possessing personal computers, but when asked how they used them, they gave varying answers. The majority of them replied that they use computers for social purposes, research, communication with coworkers and students, lesson preparation, and other things. Participant P18 commended that;

> *Whenever I am at home, I typically search online for and store PDF versions of advanced mathematics-related articles. I typically review these materials at home to aid in my improvement as a mathematician. I therefore use my computer at home to study most of the time. Additionally, I prepare evaluation exams using it* (Interview, November 8, 2022).

Participant P15 said;

> *So basically, I use the ICT tools just for research purposes to complement my lesson notes. In case I found new materials, I try to add to my lesson notes so that the student and myself are abreast with the information that are changing* (Interview, November 8, 2022).

To continue, it was evident that during the FGD, teachers are actively making use of some mobile applications as a collaborative tool with their students as he explains: "I use recent mobile applications like Viber and WhatsApp to communicate with the students giving them academic directives in my subject area" (FGD, November 12, 2022). The reason these teachers are using these mobile applications as a pedagogical tool was also questioned, given that it was evident from the observation that students are not allowed to use mobile devices in class. One replied from the FGD:

> *CT in the teaching and learning process is a vital issue that must be taken seriously because we have gone past the age where teaching must be done in a classroom, or under a tree. We are now in an age where technology rules, so at least we should try as much as possible in our Cameroonian schools to incorporate ICT in the teaching and learning process* (FGD, November 12, 2022).

Participant P16 discussed how he teaches his students to obtain quality academic materials online and said that some teachers assigned students to find information on the internet in their subject area.

> *I give them advice on how to conduct research on the internet. For instance, when I am teaching a topic like science, I typically give them homework after class, instructing them to type the url google.com into the Google search box when they are browsing the internet at home* (Interview, November 4, 2022).

Inasmuch as the majority of the teachers were considered both active and passive users of the ICT tools in the teaching and learning process, few teachers admitted not using the ICT tools pedagogically. Their views, they asserted that ICT in education is still a new concept so it will take time for teachers to start making use of the tools in the teaching and learning process. It was evident that pedagogic use of ICT still posits as a difficult challenge amongst teachers as some of the teachers were more comfortable with the traditional instructional method of teaching. They explain that ICT was inappropriate in their subject area. Appraising the traditional instructional method of chalk and chalkboard, they explained that they saw no need of using ICT in teaching some practical lessons as it demands step by step processes which are more suitable or better understood when the chalk and chalkboard are used. Participant P15 and P13 in their responses said:

> *It has been a good experience so far given that we are using our traditional method of teaching. We live in a country where ICT is still developing, and so I prefer to use the traditional method, the board and chalk and it has been fine* (Interview, November 8, 2022).

> *I think physics is more of a practical subject that needs demonstration in certain aspects and is not enough to use ICT tools to teach the subject. In physics you actually have to demonstrate aspects such as solving equations using the chalkboard so students can clearly see the steps. But using ICT tools like projector will not be effective in such lessons* (Interview, November 9, 2022).

From a general point of view, the pedagogic use of ICT in both schools can be considered as very low. The majority of teachers were passive users and only two

teachers created innovative classroom practice with ICT in which they gave the students active role in participating in their learning. In as much as many of the teachers considered the tool vital in the teaching and learning process, it seems the interest in incorporating ICT in pedagogy is still in a surface stage in these schools.

The teachers' replies indicate that using the ICT tools has enhanced their material and pedagogical skills because they are now able to present their classes without many challenges as before. Some of the teachers acknowledged that their function as guides instead of instructors has changed as a result of adopting ICT, making their work easier than it formerly was. Additionally, some educators actively engage in project-based and collaborative learning. ICT is a collaborative tool that teachers utilize with their pupils to help them understand more. ICT's diverse effects led to teachers developing their lesson plans knowledge, pedagogical knowledge, technological knowledge and students' achievement.

The teachers reportedly acknowledged that their use of ICT affected their subject area primarily. All teachers use the resources to do research and develop their subject-specific knowledge. Teachers talked about how they have been exposed to a wide range of online resources through using the internet to find information in their subject areas. This has broadened their awareness of their various topic areas and improved their content expertise. Teachers also concurred that using ICT to prepare their classes had made their jobs easier because they no longer needed to log bulky textbooks and paperwork into the classrooms. One of the teachers emphasized how the internet has helped him find a variety of resources in his subject area and lower the cost of textbook purchases:

> *When I am browsing the web, I find much more information that is not available in textbooks because the truth is textbooks are limited when it comes to finance. Through the internet, I can get a diverse source of information without spending much* (Interview, November 8, 2022).

Participant 3 agreed that by using ICT tools to plan their courses and doing more research in their subject areas, they had been able to increase their confidence when teaching because they were now exposed to a variety of knowledge sources:

> *Using the internet, I found a whole bulk of information concerning my subjects and in several ways which make it easier for me to understand. Also, I have become more confident in class than before because of the distinct kind of information I got through the internet. Now I prepare my lesson using my personal computer which for me has helped in organizing my teaching* (Interview, November 2, 2022).

Participant 9 said:

> *If the computer was not there, I do not know I would have found it tough to pass information to the students. Because when I am preparing my lesson, I make sure I visit as many scientific websites as possible to get diverse information about my topic. I don't just focus on textbooks because knowledge there is limited. So, ICT makes a difference* (Interview, November 5, 2022).

From the discussions, we therefore conclude that there is no doubt that e-learning fosters - CBA teaching-learning methods in government secondary schools in Cameroon. E-learning increases engagement from the learners; positive work attitude from the teachers involved, leading to the provision of more personalized learning; encourages family involvement in students' learning; provides inclusive learning, in other words students can learn in a relatively anonymous environment without the embarrassment of failure and/or socio-cultural bias from personal contact (Fanso& Ngwa, 2022).

CHAPTER FIVE

THE ROLE OF COMPUTERS IN CBA TEACHING/LEARNING METHODS IN SECONDARY SCHOOLS

Computer-based direct instruction is the method used to assess learning through software using a personal computer. Looking at the current widespread diffusion and use of ICT in modern societies, especially by the youth, and digital generation, then it is clear that ICT affects the complete learning process of today and in the future. There is also a common belief that ICT can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student centered. This transformation results in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communicational skills, and other higher-order thinking skills. Teachers can harness the positive vibes of CBI in the form of less drudgery and repetition, tremendous ease in updating instructional materials, more accurate appraisal and documentation of student progress, as well as adequate time to work directly with students.

With increasing advances in computer technology, computer-based instruction is now seen by many as a method of providing relevant instruction for large numbers of students. Learning with, for instance, mobile game technologies can indeed make learning more pleasant and more effective (Ginns & King, 2021).

Education in the modern era pays more attention to increasing individual competence, therefore it is hoped that educational institutions are able to equip students with the competencies needed in the 21st century coupled with strengthening cultural values and responsibilities. Interactive multimedia has several characteristics that make it special, namely interactive multimedia is able to provide an interactive process and provide easy feedback, and makes it easier for students to choose learning topics with systematic control. The application of interactive multimedia in the learning process is to describe the various uses of media in an integrated manner in presenting a material topic where each element of the interactive multimedia constituent reinforces each other

in providing an interesting learning experience. Technology in the form of multimedia in the classroom allows students to have competencies regarding technology.

5.1. Learner-Centred Teaching approach

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, p. 556) postulates that "one of the major forces which have driven change has been the assumption that meanings are lost if teaching/learning is simply seen as the transmission of information". Gifford and Enyedy (1999, p. 191) state that "in the LCD, the learner, his or her goals, misconceptions, and cognitive capacities are placed at the center of the model". The student is at the center of the model because learner-centered 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 decontextualized minds of learners this approach to instructional design is called LCD. 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, p. 190) highlight 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) 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), a system like a Microworld provides the user with a number of objects and functions that can be combined in order to produce the 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 is built up around a given knowledge domain that has to be explored by interacting with the program. Most of these learning environments are founded on the information-processing model of cognition. Bottino (2004) concludes that learning is progressively considered as being based on active exploration and personal development.

5.2. Cultural Approach to Learning

Crook (2001, p. 19) points out that the emergence of new educational technologies has catalysed 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, p. 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 deeply influences the technology used. This is particularly true now, when technological progress is constantly opening up new opportunities for elaboration, representation, and communication of which the potential for educational purposes has yet to be fully exploited. These new functions and opportunities change the models of practice which have inspired the construction of the technology itself. However, Crook (2001, p. 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 teachers' 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 ICTs into educational practice promises more benefits as far as social contexts are concerned (Rohman & Fauziati, 2022; Crook, 2001, p. 33)

The cultural approach has challenged the main concerns of behaviourism, cognitivism and constructivism. This makes it more comprehensive in its scope

(Rohman & Fauziati, 2022). According to Crook (2001, p. 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 ICTs, 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, p. 23). Therefore, cognition is 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. Qiquan (2021, p. 8) affirms 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 (Qiquan 2021, p. 10). On his part, Mumford (1966) in Engle (2001, p. 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, Vygotsky (2021) 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, like STELLA, where a graphical diagram is supplemented with textual equations. Vygotsky (2021) 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, p. 364) propagates that "well developed mental models consist 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, p. 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.

Furthermore, 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, Teixeira (2022) 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. Khan & Meraj (2022) presume 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, p. 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 emphasizes 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.

Secondly, 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. Crook (2001, p. 26 cited in Demeter & Bajnok (2022)) states that such ventures illustrate a route towards greater participatory experience that is based upon creating authentic *communities of practice*. On their part, Manesis, Nikolakaki, Georganta & Vlachou (2022) stressed the *connections between individuals and social structures and notions of intersecting personalities*. Their 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 (Shibina & Vijayalakshmi, 2022).

Third, Crook (2001, p. 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, p. 28) stressed that there is a great need to recognize the role of 'social' into teaching and learning most especially in higher education. However, some lessons of electronic remediation at this level are 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, p. 29).

Nsolly & Charlotte (2016). Integration of ICTs into the curriculum of Cameroon primary and secondary schools: a review of current status, barriers, and proposed strategies for effective Integration. This study used a descriptive survey designed to collect data. The sample population was teachers of Biology. The findings revealed that calculators are the most available (80%) for teaching/learning Biology in secondary schools. In addition, Software such as Word, Access, Excel (71%), digital cameras (76%), laptops/netbooks/tablets/ipads (74%), satellites, disks/decoders (84%), UPS power supply and networking cables (71%) were indicated as not available for teaching/learning of Biology. Teachers were not sure if other ICT resources, Modems/routers, Monitors, scanners, television), video cassette players and recorders, networking cables, scanners, television speakers, and headphones, were available for use in the teaching/learning of Biology. This implies that teachers were not conversant with the basic accessories used in the ICT teaching/learning of Biology.The study concentrated only on the teachers of Biology; the current study includes teachers of several subjects to get the influence of ICT on students' performance.

Osodo (2004) did a study on the evaluation of ICT in secondary schools; a case study of schools in Nairobi Province. The study used teachers to collect data. The study found that training and technical assistance are important in teaching and learning ICT. The researcher later pointed out that teachers are responsible for the use of ICT in the classroom and the influence they can have on the students. The study found that most schools in the slums were poorly equipped to teach ICT and most teachers have developed a negative attitude towards ICT. Though the study covered slums in Nairobi, there is no clear information about the ICT infrastructure in the Kibera slum which is a part of Langata Sub County.

A survey was done by Nguea (2020). The Impact of Infrastructure Development on Foreign Direct Investment in Cameroon revealed that secondary schools have at least some equipment installed; only twenty-eight percent (28%) of them offer computer lessons to students. Furthermore, they did another research on the use of computers in educational institutions which stated that just over half of these (28% of all schools) offered computer lessons to students. The software installed on these PCs for use by students came exclusively from Microsoft Office. The cost of licenses for these software packages was prohibitive for most educational institutions. No educational software in any subject was found. Some secondary schools do not exploit the resource of the internet for educational purposes. The teachers interviewed appeared not to use the internet to search for information related to their teaching and learning.

Despite the necessity of the ICT in education, educational institutions have faced some challenges in the incorporation of the ICT into the school curriculum. The lesson here is that computers are a subset of the information communication technology facilities necessitated in schools and that even then, they have to be furnished with quality accessories, installed with appropriate software, and linked to necessary networks to allow access to rich resources beyond the school rather than serve as a resource for minor typesetting and other word processing activities. Hence, this study filled the gap in theory and practice and sought to establish how ICT had been integrated into the curriculum in school and the influence they have on learning. While the above studies attempted to generally explain how the availability of ICT tools affects learning,

they did not look at the way particular ICT tools clearly affected students learning and performance. This study provides a questionnaire for students to check how particular ICT tools such as projectors, internet; E-readers affect their learning and performance in secondary schools in Cameroon.

5.3 Obstacles Associated with Pedagogic Use of ICT

Studies in Sub-Saharan Africa, South America, and a few European nations have revealed significant efforts made by governments and other international organizations in the creation of infrastructures and the purchase of ICT instruments. Teachers continue to struggle with integrating ICT into the teaching and learning process (Kozmaet al., 2004). Even so, secondary school teachers frequently employ the 'speak and chalk' method, in which the teacher does most of the talking and pedagogical work, and the students are treated as passive recipients of knowledge (Voogt & Tondeur, 2015). They confirmed that teachers are only given introductory ICT courses in many countries during pre-service training to prepare them for integrating ICT into their various subject-area classrooms. This has led to a great deal of uncertainty over the readiness of pre-service teachers for the new teaching approach that emphasizes student-centered learning, teacher flexibility, and the use of ICT. Almas and Krumsvik (2007) concluded that instructors have continued to replicate an existing pattern of schooling focused on a teacher-centered approach and interaction after looking at pre-service training programs in Norway. They claimed that the poor usage of ICT in Norwegian schools and subjects could no longer be attributed to a dearth of ICT resources or accessibility, but rather to a dearth of instructors who are proficient in using ICT in the classroom on a daily basis. In his analysis of in-service ICT programs for Cameroonian teachers, Nkwenti found that more than 60% of the training skills needed to apply ICT in pedagogy are theoretical, and only 1.2% of teachers had received on-the-job ICT training (Ndongfack, 2010).

According to a study by Cuban (2001) conducted in Silicon Valley higher secondary schools, it is rather amazing that politicians and curriculum developers who are adopting ICT in schools have yet to make modifications to the regular school schedule that teachers use. According to the curriculum guidelines, secondary school

subjects are separated into periods that span anywhere from 45 minutes to an hour on a regular basis. Due to their limited time with the children, this always makes it challenging for teachers to engage in new classroom activities while integrating ICT (Voogt & Tondeur, 2015). As a result, using ICT as a pedagogical tool in classrooms is significantly hindered by the school's structure and curriculum.

Since the 19th century, polls have repeatedly shown that the most common and effective method of instruction is the chalkboard, pen, and pencil (Shulman, 2013). This has had an impact on teachers in the 21st-century perspective, who now view ICT in the classroom as an add-on rather than a pedagogic tool (Shulman, 2013). Cuban (2001) went on to say that the majority of the software programs utilized in schools, such as databases and spreadsheets, were developed for commercial rather than educational goals. Although many teachers have begun to utilize this software in the classroom, it was not initially intended for this use, and as a result, it is still challenging for teachers to use this software in the teaching and learning process (Pelgrum, 2001).

According to a review by Chigona and Chigona (2010), in order to fully utilize the benefits of ICT in the teaching and learning process, educators must make use of new pedagogical techniques and capacities that can only be attained through successful ICT use. This study's findings lead to the definition of capacity as the ability of an educator to effectively use the ICT tools and resources at their disposal by incorporating ICT into their instruction as needed. This Studies of Chigona and Chigona showed that teachers lacked the skills necessary to properly use ICT to deliver their lectures (Chigona and Chigona, 2010).

5.4. Archaeology of the teaching-learning method in Cameroon

5.4.1 CBA Teaching-Learning Methods

Table 20: Information on CBA Teaching-Learning Methods

Item	Statements		SA	A	Un	DA	SDA	Mean
1	I always research information for my assignment after school	f_1	574	535	---	---	---	4,51
		%	51,8	48,2	---	---	---	
2		f_1	578	321	152	58	---	

	My teachers use real life situations in teaching	%	53,0	29,0	13,0	5,0	---	4,22
3	My teachers teach using practical examples	f_1	456	344	145	72	92	3,90
		%	41,1	31,1	13,1	6,5	8,2	
4	Teaching methods vary including, group work, guided-work, online teaching	f_1	422	393	132	162	---	3,96
		%	38,1	35,4	11,9	14,6	---	
5	The computer teacher puts us to work in groups	f_1	320	363	120	202	104	3,53
		%	28,9	32,7	10,8	18,2	9,4	
6	Most of the activities in my class are challenging	f_1	260	428	136	126	159	3,45
		%	23,4	38,6	12,3	11,4	14,3	
7	My teacher always controls and inspects us to ensure effective quality learning	f_1	487	521	70	31	---	4,32
		%	43,9	47,0	6,3	2,8	---	
8	There is an effective and proper use of gadgets in the teaching-learning process	f_1	294	348	235	132	100	3.54
		%	26,5	31,4	21,2	11,9	9,0	
9	My teachers prompt me to participate in class	f_1	500	601	---	---	---	4.45
		%	45,1	54,9	---	---	---	
10	Internet facilitates and supports our research	f_1	461	392	86	94	76	3,96
		%	41,5	35,3	7,8	8,5	6,9	

Source: Field statistics.

Item one on above table presents the distribution of respondents according to whether they always research information for assignment after school. Based on the data 574 (51.8%) of the respondents strongly agreed with this fact while none of them simply agreed. None disagreed and none is uncertain. Based on this data the mean is 4.51 it could be concluded that students in Cameroon secondary school research information to do their assignment.

Item two distributes the respondents according to whether teachers use real life situations in teaching. 578 respondents strongly supported this statement, while 321 supported it. None were uncertain and none disagreed. The mean is 4.22 which is accepted. This implies that most students agreed on the teachers teaching approach to

learning. Even though teachers are still an authority figure in students-centered teaching model, teachers and students play an equally active role in the learning process. The teacher's primary role is to coach and facilitate students leaning and overall comprehension of material, and to measure student learning through both formal and informal forms of assessment, like group projects, student portfolios, and class participation.

Item three is the distribution of respondents according to whether teachers teach using practical examples. 456 and 344 respondents agreed with statement. 145 were uncertain while only 72 and 92 strongly disagreed respectively. Based on this data, the mean is 3.90 which is accepted. This implies that student-centered classroom, teaching and assessment are connected because students learning are continuously measured during teacher instruction.

Item four is the distribution of respondents according to whether teaching methods vary including, group work, guided-work, online teaching. Based on the statistics, the mean is 3.96. This means that most respondents who actually did lectures, tutorials, seminars online deliveries, workshops, directed activities, and group projects supported the statement, because these helped them to transit from school to work more smoothly.

Item five presents the distribution of respondents according to whether the computer teacher put them to work in groups. Based on the statistics, the mean is 3.53 which is found at the level of acceptance. Most of the students supported the statement.

Item six is the distribution of respondents according to whether most of the activities in class are challenging. 260 plus 428 strongly agreed and agreed respectively that most of the activities in my class are challenging but not too challenging to complete. The mean is 3.45 which falls within the accepted range. This implies that the skills they learned from school were scarcely useful.

Item seven is the distribution of the respondents according to whether teacher always controls and inspects them to ensure effective quality learning. Based on the data, the mean is 4.32 which is within the acceptable range. This implies that most respondents supported the statement.

Item eight presents the distribution of the sample according to whether there is an effective and proper use of gadgets in the teaching-learning process. The data brings out the mean of 3.54, which is found at the acceptance level, implying that most respondents accepted and supported this statement.

Item nine shows the distribution of the respondents according to whether teachers prompt me to participate in class. All the respondents supported this statement with 500 strongly agreeing and 601 agreeing. Based on this, the mean is 4.45 implying that teachers are addressing the pressing needs of the knowledge economy of the twenty-first century.

Item ten distributes the respondents according to whether internet facilitates and supports their research. Based on the data, 461 strongly agreed, 392 agreed while only 86 were uncertain. 94 plus 76 disagreed and strongly disagreed respectively. The mean is 3.96, falling within the acceptance range. This implies that a laboratory is always considered as a relevant and essential part so far as the teaching and learning process is concerned. It also means that every school has a laboratory where student can perform researches, experiments or even learn new things with the help of internet facility.

Pedagogic ICT Integration and CBA in schools

This section consists of the QDA carried out during this study. The data was collected through 18 interviews and focus group discussion. ICT use and development have only accelerated, affecting how research and instruction are conducted.

To adequately express the teachers and parents teachers' original thoughts about ICT integration and the CBA teaching and learning methods, direct quotes and synthesized stories were used to show objectivity of the research. The objective demonstrates real-life practice of ICT in Cameroonian schools, its impact in the teaching and the learning process and role teachers' play in enhanced ICT in the pedagogy.

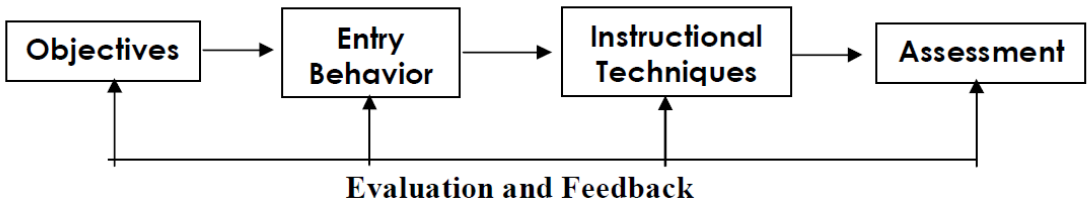
Prior to the start of instruction, objectives are put out as planned learning outcomes. General Objectives: Statement of educational aim; general statement of student capacity. Student ability in terms of specific and observable is the precise

objective declaration of the educational purpose. The value of objectives, their components, the condition for terminal behavior, and criteria (Levy Nahum et al. 2010).

Learning is frequently divided into three major categories or domains by authors including: the psychomotor, cognitive, and emotional domains. The psychomotor domain includes those abilities that are involved with physical dexterity, such as changing a tire and injecting a patient. While both tasks require information, they primarily require physical skills, which require practice. The cognitive domain includes knowledge, reasoning skills, and understanding how and why. Examples include naming the primary bodily bones and explaining why there are tides. Both of these need to be performed through thought processes. The emotive realm is the third domain, which we frequently overlook. It has to do with mindsets. For instance, the need to consume a good, balanced diet, the need for equality of opportunity for all, and politeness are examples in this area. These are distinct from the examples in the other areas since they deal with feelings and emotions (Sequeira, 2012; Ziv, M & Frye, 2004; Fenstermacher & Richardson, 2005; Klausmeier, 1992).

When these three dimensions are viewed as interrelated, affective learning takes place. The development of each of these domains ought to be a component of a teaching/learning session. Learning objectives for each of them are able to be specified by teachers. Different teaching and learning strategies are frequently required for learning in these three domains. Though they are frequently viewed in isolation, in actuality, all three of them experience simultaneous learning.

Figure 4: Basic Teaching Model



Source: (Dunkin, 1995)

In the past, a teacher's primary responsibility was to disseminate knowledge; they served as the source of all knowledge. This conjures up an image of students seated in rows in front of the teacher, who is speaking and presenting material to them using a

blackboard. The pupils are either passively listening or, if the teacher is lucky, taking their own notes. Of course, this is no longer the case. A facilitator is someone who helps students' study on their own in the modern classroom. Instead of being seated in rows, students are more likely to be working in groups and engaged in a variety of activities. Some may be writing, engaging in practical work, using specialized equipment outside of the classroom, or researching a topic in the library. Due to the possibility that each student is learning at a different stage, each student's needs and talents are considered while designing the curriculum (Braga, 2022).

There are several reasons why this model has changed from the conventional one. First, it is acknowledged that adults, as opposed to young children, have a lot of experience and are highly capable of planning their learning. Second, not every person learns in the same way, so if a teacher talks to the class, some pupils may gain while others may not. Third, everyone learns at their own pace and not, of necessity, at the pace set by the teacher. Therefore, individualized learning has clear benefits (Sequeira, 2012).

There are no concrete solutions for teachers based on research into how people learn. If it had, then every teacher would employ the same methods. However, studies have shown that learning is often more successful when it is founded on experiences, whether they are firsthand or read about events (Braga, 2022; Gürses, Sahin & Güneş, 2022; Müller, Fasemore, Elhossary & Förstner, 2022). The former of the two experiences is more likely to be successful than the latter. As a result, learning is more likely to occur with concepts that can be applied or seen. At this point, there is a need to think about how teachers give the experiences in a way that makes learning as simple and quick as feasible. Two different methods for designing a teaching program according to Dunkin, (1995): A program where the content is carefully derived from an analysis of the student's personal, social and/or vocational needs and which is implemented by you in such a controlled and organized manner that the student is almost certain to learn, and is aware when the learning has taken place. By this method motivation is generated by immediate success and the avoidance of failure. The other approach starts from the experience of the student, experience that has taken place as part of life or which has been organized as part of the programme. It then depends upon

the student identifying and accepting a need to learn. Such an approach has been described as problem solving, student-centered learning, participative learning, and so on.

Unfortunately, there is a basic reason why this rarely occurs. It reinforces to them that learning is a process that is structured by someone who knows better, aside from the necessity for the students to put themselves in the hands of the teacher and so tend to build a relationship of dependency. The act of independent learning does not assist students.The challenge with this strategy is ensuring that crucial learning areas are not left out, that the correct balance is found between different areas, and that each subject is studied as efficiently as possible. According to Müller et al. (2022), the following teaching strategies enable the use of this second strategy:

- Project work based on students' real-world experiences;
- Discussions that help students recognize and synthesize what they have learned from the experience while also guiding them to identify what else they need to learn and practice;
- The acquisition of specialized problem-solving skills that may be used in a variety of contexts;
- Activities created to promote certain learning objectives.

If teaching is what happens in the classroom, then the history of teaching is too recent, only 5,000 years, to be considered from an evolutionary standpoint. But when he says that "education is a technique that attempts to make up for what the human mind is innately lousy at," Steven Pinker provides a helpfully wide description (Pinker, 2002, p. 222). Education is a very general term that encompasses the interaction between teacher and student, as well as the institutional frameworks where this activity takes place. Pinker defines schools as places where students are taught ‘‘bodies of knowledge and skill" (p. 224).

Descriptive Statistics on Computer-Based Direct Instruction

Table 21: Information on Computer-Based Direct Instruction

	Statements		SA	A	Un	DA	SDA	Mean
1	My teachers use a computer to teach	f_1	149	178	210	348	224	2,71
		%	13,4	16,1	18,9	31,4	20,2	

2	Rules and procedures are clearly presented on the online platform	*fi*	177	420	220	156	136	3,31
		%	15,9	37.9	18,8	14,1	12,3	
3	The use of computer and smartphones complement face-to-face tutoring	*fi*	194	451	276	38	150	3,45
		%	17,5	40,7	24,9	3,4	13,5	
4	Demonstration and illustration through ICT tools make learning practical	*fi*	239	384	292	34	160	3,45
		%	21,6	34,6	26,3	3,1	14,4	
5	ICTs improve teaching and learning	*fi*	453	506	150	---	---	4,27
		%	40,9	45,6	13,5	---	---	

Source: (Field statistics, 2022)

Item one presents the distribution of respondents according to whether teachers use a computer to teach. Based on the data, the mean is 2.71 which is found within the range of acceptance. Yet, the large number of those disagreeing (348) could be suggestive of the fact that there is need for more variety in teaching methods or the tools used for teaching.

Item two distributes the respondents according whether rules and procedures are clearly presented on the online platform. Based on data, mean stood at 3.31, found at the level of acceptance. This implies that most of the respondents supported the statement.

Item three shows the distribution of respondents according whether the use of computer and smartphones complement face-to-face tutoring. The data gives a mean of 3.45, found at the level of acceptance. This implies that most respondents agreed with this.

Item four is the distribution of respondents according to whether demonstration and illustration through ICT tools make learning practical. The data produces a mean of 3.45 which falls within the range of acceptance. Even so, some 292 respondents (26.3%) are uncertain about whether this demonstration and illustration to a large group is possible.

Item five presents the distribution of respondents on whether ICTs improve teaching and learning. The data gives us a mean of 4.27 which is acceptable. Even so, some 40.9% and 45.6% of the respondents agreed with the statement.

Hypothesis four

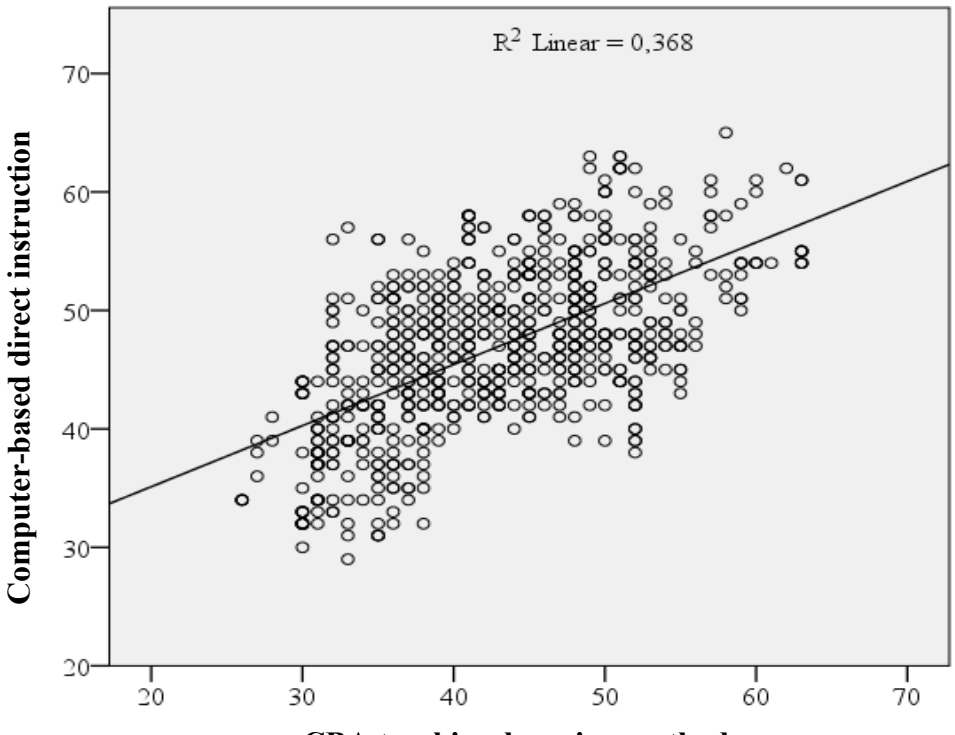
Ha₄: There is a link between computer-based direct instruction enhancing CBA teaching-learning methods in government secondary schools in Cameroon

Ho₄: There is no link between computer-based direct instruction enhancing CBA teaching-learning methods in government secondary schools in Cameroon

Table 22: Correlations of computer-based direct instruction and CBA teaching-learning methods

			Computer-based direct instruction	CBA teaching-learning methods
Spearman's rho	Computer-based direct instruction	Correlation Coefficient	1,000	,587**
		Sig. (2-tailed)	.	,000
		N	1109	1109
	CBA teaching-learning methods	Correlation Coefficient	,587**	1,000
		Sig. (2-tailed)	,000	.
		N	1109	1109
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: (Researcher, 2023)



The correlation table above presents statistical information on the correlation between computer-based direct instruction and CBA teaching-learning methods. The correlation coefficient is 0,587 while the level of significance is 0.000. The level of significance is less than 0.05. The results reveal that there is a significant relationship between computer-based direct instruction and CBA teaching-learning methods in Cameroon government secondary schools.

5.4.2 Discussion on Computer-based Teaching and CBA in Secondary Schools

Data collected on this final hypothesis was tested using the Spearman rank correlation and multiple regression analyses. From the results, it was discovered that computer-based direct instruction can significantly influence CBA teaching-learning methods. Statistically, the Spearman rank correlation index, was 0,587, which is a positive coefficient and reveals that the relationship between computer-based direct instruction and CBA teaching-learning methods is high and positive. Alternatively, looking at the level of significance of 0.00, we can conveniently conclude that there is no error in admitting that computer-based direct instruction can very positively enhance CBA teaching-learning methods.

Our field statistics led us to the conclusion that computer-based direct instructioncan be used to positively enhance CBA teaching-learning methods. Most of our respondents (149 and 178) strongly agreed and agreed respectively that teachers use a computer to teach. This is all about student-centered methods. Today, the trend appears to be towards the creation of courses specifically aimed at computer literacy, as well as towards integrating computer technology in other content areas across the curriculum. Further, computer technology has increasingly been applied to non-instructional (record keeping, grade averaging, communication) and pre-instructional (developing materials, researching instructional content) uses. This great change has

brought forth a fresh perspective on the use of computers in the teaching-learning process. The recent advancement in information technology innovations and computer usage is rapidly transforming work culture and teachers cannot escape the fact that today's teaching must provide technology-supported learning.

Moreover, links have been made between computer use and constructivist, collaborative, and inquiry-based learning and also pedagogical change. Fanso & Ngwa, (2022) suggest that computer technology can overhaul education, serving as a panacea, or as an agent of change. Generally, it is accepted that computers have the potential to enhance teaching and learning and provide students with a learning experience that other strategies cannot provide. Therefore, being prepared to adopt and use technology and knowing how that can support student learning must become integral skills in every teacher's professional repertoire. These include dividing the teachers' application of technology in instruction into six categories: technology related - understanding, designing of experiences, implementation of curriculum plans, assessment strategies, enhancement of productivity, and legal-ethical issues.

This computer-based direct instruction can help students develop skills that could positively influence the CBA teaching-learning methods. 597 respondents also strongly agreed and agreed that test items' rules and procedures are clearly presented on the online platform. Even though quite a good number of them (276) claimed to be uncertain about ICTs enhancing face-to-face tutoring, 645 however agreed that ICTs enhance face-to-face tutoring. The only aspect of computer-based direct instruction according to our field statistics that needed to be improved upon were cognitive and projective plans to frequent computer use so that students could be more versed about computing in the future. 188 respondents did not agree to project more computing in the future. This presumably supports the idea that most of them will not know what to do in the future if they are not involved in this 21st-century knowledge after school. ICT Integration discussed guidelines for developing CBA in Curriculum which comprised of core competencies related to pedagogy (new ways of doing things with ICT, new theories of learning, pedagogical skills: selection, presentation, and assessment); technology (related concepts and operations, social, health, legal and ethical issues);

and technology-pedagogy integration (ethical and legal use of technology to design effective learning experiences, manage students learning, improve professional skills, support interaction in learning/social communities). This is why 453 and 506 respondents strongly agreed and agreed respectively that ICTs promote competency-based learning. The integration of ICT into schooling acknowledges the pedagogical rationale behind this integration and brings to the fore its manifold implications.

The role of education in society is in flux, as a result of the progression of the forces of globalization, the pace of technological change, the ever-increasing centrality of information and knowledge, and the importance of skills to access and use both new technologies and information more effectively. The result is that the aim of education has shifted:

> *As knowledge in itself becomes a perishable item, the ability of learners to think independently, exercise appropriate judgment and skepticism, and collaborate with others to make sense of their changing environment is the only reasonable aim of education* (Haddad & Draxler, 2002, p. 14).

Education has a crucial role in development, which is now universally accepted. Additionally, a number of academics contend that remote learning in particular is critical to overcoming many of the educational difficulties experienced in developing countries. ICTs in education are particularly significant given the emphasis on remote learning and open learning. The growing significance of ICTs in the global information society simultaneously generates fresh challenges and offers answers to persistent issues in education.

Undertaking the development of training materials for teachers and syllabus or instructional materials for students is likely to yield better results if it is accompanied by holding training/orientation programs for teachers towards basic ICT skills relevant to school education and developing the ability to use ICT-based learning materials for the classroom. According to Otoo & Cifuentes (2022) in pedagogy for employability, good assessment projects develop practices that help students make good, well-founded claims on employability. They argue that unless students experience such assessment

approaches, it is hard to see how a school contributes to the achievements valued by employers. Lepper & Malone (2021) corroborates this when he says:

> *If institutions are serious about developing students' attributes or skills (with their implications for interactions between students), then the challenges posed by assessment have to be addressed. A commitment to the development of students' attributes or skill implies, for many subject disciplines, a preparedness to rethink curriculum, pedagogy and assessment*.

To prepare students for life and for their careers requires that educators incorporate technology into teaching and learning in most, if not all, courses. Course activities, projects, and curriculum content can be designed and facilitated through the medium provided by this technology. Students are thus provided with the opportunity to develop requisite technical skills and to possibly explore the specific course content in a new and more meaningful manner. The FGD pointed out that

> *In the initial stages of curriculum revision, the first few classes were given a computer-assisted lecture on the process of using electronic-mail (e-mail) and file transfer. In subsequent semesters, an initial demonstration was followed immediately with a hands-on session, incorporating supervised task assignments with individual assistance. The computer usage time for the semester with the hands-on trained classes increased between a range of 67% and 74%, with 100% of the students participating in the computer-based assignments* (FGD, November 12, 2022).

This experience validates the findings of numerous studies on the importance of hands-on instruction for the development of computer skills. School and administrator reluctance to experiment with new techniques due to a fear of change in general or of the technology, in particular, is a common cause of resistance to pedagogical reforms utilizing technology. A secondary school needs advocates who are willing to help with this transition and training. Additionally, incentives are required to speed up the process of individual course updates. Currently, campus computer center staffs are often accessible for practical demonstrations, learning support, and computer courses as

needed by the school. Online assistants, thankfully, are easily accessible for immediate assistance and support.

Students actively structure their own learning situations and build their own knowledge. However, research consistently shows that the traditional, passive, one-way lecture method that perceives students as empty vessels to be filled continues to dominate classroom teaching (Ginns & King, 2021). Through the Internet, students and professors located remotely from one another may successfully explore, experience, and better understand each other. Because distance is of no consequence, even a space of thousands of miles between people is easily accommodated. The full potential and range of possible interaction have yet to be explored.

Integration of Internet-driven assignments into course work can provide an international, global experience for students without the costs of travel for study abroad. Utilizing communication networks and associated technology can reduce the effects of national boundaries and distance to provide experience with and a better understanding of diverse cultures through personal interactions. Students are better able to develop competence in computer and telecommunications technology and to learn first-hand about other cultures while developing more effective cross-cultural interpersonal skills (Ortega, 2021).

Most computer applications make extensive use of text. The written word is used for instructions, entering data and presenting most information. Two computer applications that are frequently used in tandem and are primarily text-based are online services and databases. Online services play an important part in education, including subject-related databases and library services, online access to information about courses, and links to administrative services such as registration and fee payment. Increasingly, however, personal computers with web browsers have become the most common mode for accessing online services.

Electronic mail also makes extensive use of text. It is a form of store and-forward computer-based messaging that enables a user to send text messages from a personal computer over a data network (such as the Internet) to one or more recipients. Recipients collect messages from their ‘mailbox’ on a central server, using their own personal

computer or workstation. Access to e-mail is becoming widespread in many countries, through institutional and corporate networks or Internet service providers. As network bandwidth and personal computer processing power increase, so does the ability to attach files to e-mail messages, ranging from formatted documents to sound and graphics or even video files. E-mail can be used both for one-to-one and one-to-many communication (through e-mail distribution lists) and thus can support group interaction. The communications technologies used to support interaction are frequently divided into two broad categories:

- Asynchronous (or deferred-time) technologies, which do not require participants to be present simultaneously. Examples include postal correspondence, electronic mail, and computer conferencing.
- Synchronous (or real-time) technologies, which require participants to interact at the same time, generally prearranged. These technologies include telephony, audio-conferencing, audio-graphic conferencing, video-conferencing, and multi-user object-oriented environments (MOOs).

Electronic lectures constitute a forum among and between students and instructors. Electronic formats allow a high level of interaction for everyone, especially in raising questions and sharing access to the ensuing discussion. An additional dimension of this methodology is the development and delivery of guest lectures from remote discussion leaders. Interaction with discipline giants provides students with an otherwise unattainable resource since questions and discussions can persist for an entire semester. Moreover, electronic panel discussions can overlay the content of a course throughout the semester.

Also, with these currently available technological resources, students can get exposure to the processes of seeking information from global on-line sources of information, such as remote libraries, discussion groups, and even computer conferences. Students can gain experience with such utilities as an archive, file transfer protocol, gopher, wide area information services, and World Wide Web. The rapid, nearly instantaneous, turnaround possible with computer communication makes dialogue more efficient. Several methods permit messaging to accommodate time zone

differences between sites, while others required simultaneous availability of people at terminals. Face-to-face classroom discussions concerning the nature and implications of these differences can be explored experientially, greatly enhancing the learning process.

The integration of ICT has had a number of positive impacts including improvement in student's vocabulary, student's keenness to learn computers, improved research, facilitating communication and on-job/online learning. Despite evidence that use of ICT as a pedagogical tool improves the teaching and learning process as well as the motivation to learn, progress toward ICT integration is quite slow. Low access levels and poor Internet connectivity, coupled with inadequate training of teachers and the whole range of attitudes about computers has adversely affected the utilization of ICT for pedagogical purposes in Cameroon schools.

Education has always been the life sustaining aspect since age old days. It accompanies people like a lodestar in every stage of life, providing a proper insight into various aspects and progressing towards destiny. Starting from nature-oriented education, it can be well observed that technology had been in collaboration with education. They are like two faces of one coin. Technological involvement within education improved interaction process between teacher and students which is one of the strong factors for effective learning, apart from having appropriate knowledge. Without technology it seems that education is nothing, rather a tree without blossoms. Up gradation of society leads to evolution of technology and its upliftment has fastened the modification of strategies in classroom teaching process. This, in turn, paves the path for the development of techno-pedagogical skills on the part of teachers who are the artifact of teacher educators. So, the teacher educators are required to be well equipped in technology in terms of techno-pedagogical skills. Various competencies in technology are the measuring stick for the techno-pedagogical skill. And the competence on ICT is one of these measuring instruments of techno-pedagogical skill. It becomes only possible when one uses the technology with maturity and competency.

ICT is thought to have a greater impact on the field of education than any other technology. For sharing information verbally and nonverbally, knowledge and skills in

operating various electronic devices, such as telephones, mobile phones, fax machines, radios, televisions, computers, videoconferencing equipment, etc., are taken into consideration. Teachers are now faced with a dilemma as a result of the pupils' access to a wide range of material and the rapid increase of their knowledge. Therefore, it is necessary for teachers to adapt to the changing demands of contemporary education and to the requirements of their students, since producing effective teachers is the main goal of teacher education. Because of this, the effectiveness of teacher training programs determines how trainee teachers' abilities and skills are developed. In addition to highlighting the value of ICT in education, the National Curriculum Framework (2005) also argues that *ICT*, if used to connect students and teachers with scientists working in universities and research institutes, would also help in demystifying scientists and their work. On the other hand, according to the 2009 National Curriculum Framework for Teacher Education, it needs to additionally prepare teachers with capacity to use ICT for their own professional growth. It is widely acknowledged that ICT can and will enable teachers and students to enhance their creativity, problem-solving skills, informational reasoning abilities, communication skills, and other higher-order thinking abilities, which will ultimately lead to the modernization of the teaching and learning process.

Teaching with ICT is used to enhance learning as well as make teachers comfortable in using it to ensure that students get the full advantages of educational technology. Unlike typical teaching, teaching with technology needs teachers to be trained in how to plan, create, and deliver instruction within a technological setting. To achieve that, a different pedagogical approach is the basic requirement. According to Geer, and Sweeney (2012) teachers do not only need to be trained in regard to the use of technology for the development of good understanding on it but also required opportunities to practice effective technology integration strategies in a helpful context along with learning about new technologies and ways to integrate them effectively in their classroom situation. The results of this study have revealed extreme seriousness over the issue of technology isolation and have just recently produced a set of updated teacher technology standards. According to Rajasekar and Dineshan (2013), ICT was used as a *magic stick* for using technological tools in the teaching-learning process in

the field of education. Since preparing teacher candidates to meet the needs and problems of the 21st century requires new knowledge of ICT, it may be presumed that teachers must learn this information first. Fanso & Ngwa (2022) emphasize the educationist potential of ICT in teaching and learning for improving Cameroon secondary school system. However, proper competence on ICT helps to catalyze the cause and achievement of the goals of teachers in the field of their own area of teaching. Teachers' competencies must be reviewed so that their competencies should be redefined depending on the development of the whole life of individual people and education.

ICT is an effective instrument for conceptual growth, problem solving, and critical thinking that makes learning much simpler for both teachers and students. Presumably, it effectively helps find answers to issues in regular classroom instruction. In contrast, for students to participate fully in the teaching and learning process, teachers must have a strong understanding of ICT. But today, one of the biggest issues facing schools of education is preparing high-quality teachers who also possess the techno-pedagogical skills that are considered to be the fundamental elements of any system of teachers' education.

The emergence of a knowledge-based economy has increased competitiveness in all sectors of society more than ever before. Governments around the world work to provide their populations with access to high-quality education (UNESCO, 2013). For this reason, ICT in education is seen as a means of increasing access to education especially to the rural population and making teaching and learning enjoyable. Different studies have supported the use of ICT in education as an enabler in the process of teaching and learning by assisting the learners to grasp concepts that would otherwise have remained abstract (Béché, 2017, Kozma & Johnston, 1991). Other scholars contend that the use of ICT in education has little benefit because they are merely delivery mechanisms relying on the teacher's pedagogical abilities (Clarke, 1983). Amid these debates, policymakers have continued to lay foundations for the use of ICT to profit from the perceived benefits.

Even in developing countries, there have been increased investments in ICTs for schools despite the lack of adequate empirical evidence on the outcomes of such efforts (Karsenti, 2009). However, the Global Innovation Index (GII) 2019 report by the World Intellectual Property Organization ranks South Africa, Kenya, and Mauritius as the leading innovation hubs in Sub-Saharan Africa. This means that there is a need to explore the opportunities and the challenges that exist in these countries about technology and its use in education. In Cameroon, the policymakers view ICT in education as an enabler for knowledge acquisition leading to innovation and skill development to address the challenges faced by the country educational system.

Distinctly in the year 2020, education systems in all parts of the world were faced with the challenge of the COVID-19 pandemic. Governments in most countries were forced to close schools and minimize any form of gatherings to contain the spread of the deadly respiratory disease. Therefore, to get a better understanding of whether alternative methods of learning such as e-learning would succeed, this study focused on how teachers and schools were prepared for technology integration before the crisis. The availability of ICT facilities in public secondary schools helps teachers' ability to use technology in teaching and learning, and the perception of teachers on the usefulness and the ease of use of ICT. Since digital literacy is considered an important skill to cope with the 21st century developments, the teacher is a crucial player in the successful implementation of ICT and should be well prepared through adequate training (Nzepang, 2022).

The constructivist approach is based on the belief that learners can construct and create knowledge from prior experiences in their environment (Jiménez-Alonso & Brescó de Luna, 2022; O'Connor, 2022; Waweru, 2018). The proponents of this theory shift the focus from the teacher who was traditionally believed to be the source of knowledge to the learner (Barnes & Marlatt, 2022, Waweru, 2018). Two approaches of the constructivist theory were used: one targeting teachers' understanding of individual learners and the other that focuses on group learning. Constructivism can be approached in a way that targets individual learners as well as groups of learners as advanced by Jean Piaget (Jiménez-Alonso & Brescó de Luna, 2022; O'Connor, 2022). The theory

explains that a learner assimilates new knowledge that adds to an existing body of knowledge. It is therefore important for teachers in the process of integrating ICT to understand that learning can be based on individual discovery and interpretation of information. This realization would help the teacher to emphasize the active participation and involvement of learners to harness their creativity and produce individuals for the 21st Century (Jiménez-Alonso & Brescó de Luna, 2022).

The second approach to the constructivist theory is Vygotsky's social constructivism that emphasizes collaboration as opposed to individual learning (Waweru, 2018). The proponents of this theory argue that learners grasp concepts better when they work in mixed-ability groups where they share experiences and come up with a common understanding. In such a scenario, the teacher must create a classroom environment that is based on cooperation, democratic principles, and shared creation of content that makes the learners have a sense of ownership of knowledge (McCourt, 2022). This theoretical understanding was crucial for this study because, in low resource settings where ICT facilities may not be enough for every learner, the teachers can encourage collaborative learning through device sharing.

The Technology Acceptance Model (TAM) is based on the user's perception of usefulness and the perceived ease of use as cited by Sharples and Modules (2014). The theory has been used widely by researchers in the field of technology in education with various modifcations as well as criticism (Rafique, Almagrabi, Shamim, Anwar & Bashir, 2020, Bagozzi, 2007). The perceived usefulness of technology relates to the conviction among users such as teachers that it will make their work or that of their learners easier, thus enhance job performance (Muinde & Mbataru, 2019). This means that if teachers think that the use of computers would make their day-to-day activities such as preparation of lesson plans, lesson materials, or analyses of student's results more organized and accurate, then they would probably use them. The perceived ease of use of new or existing technology would mean that the users view technology as one that does not require a lot of effort to learn how to use (Estriegana, Medina-Merodio & Barchino, 2019). This suggests that teachers possibly adopt technology that they consider easy to learn and use with minimal need for expert consultation.

Globalization and rapid changes in technology have created a knowledge-based economy in the 21st Century. Consequently, governments have invested in the integration of ICT in education at all levels to equip the learners with the skills needed for modern life and beyond (Al-Rahmi, Yahaya, Aldraiweesh, Alamri, Aljarboa, Alturki & Aljeraiwi, 2019). This inclusion and massive investment in educational technology is believed to have had a positive effect in some countries like South Korea where extraordinary economic growth has been experienced since the 1970s (Sanchez, Ney & Labat, 2011).This research has demonstrated that ICT in education helps in creating opportunities for the learners to develop 21st Century skills but this depends on the digital literacy of teachers (UNESCO, 2012). Langat (2015) found that most of the teachers in the study on barriers hindering the implementation of ICT in primary schools in Kenya lacked computer literacy skills. Despite being aware of the importance of technology in education, the teachers blamed the government for the lack of effective planning to offer them in-service training on the use of technology in teaching and learning. Similar complaints were made by teachers that two-thirds of the respondents could not integrate technology in the teaching. However, for teachers who received training, it was basic computer literacy on computer programs such as Microsoft Office and Excel that did not equip them for technology integration in classrooms.

Indeed, the race towards emergence has led the States of the world to verify, to revisit, to readjust their practices and their policies in various fields such as education. With time, education has integrated innovative changes as the objective has been to find, starting from these changes and innovations, the practice or the suitable solution for an improvement of the results in this sector of activities. Education therefore is an area of great reflection; and these reflections reveal the indispensable character of education for the development of a country. As such, topics on education are crucial. Science is a dynamic data and its evolution is subject to a set of resolutions, which, yesterday, were zones of shades, misunderstandings, failures, mysteries, and even lies. The integration of ICTs in the CBA teaching and learning methods is an innovation in the field of education, a manifestation of scientific dynamism, which certainly came to perfect the educational practices by proposing new methods of teaching and learning, bringing changes on the previous learning system. It is then endowed with a set of

virtues which are appropriate to it. What we proposed in this work is born with the desire to give a new direction to educational practices as the integration of ICTs in the CBA teaching and learning methods has not yet caused a lot of ink to flow. While some have invested in laying the groundwork for this science by defining its theory, others have presented and continue to present the results of this new teaching/learning approach to the whole humanity in specific experimental contexts, and in so doing, extol its importance.

As the literature defined competence as the ability to act effectively in a defined situation, ability which is based on knowledge but which is not reduced to it, CBA is thus presented as a global and integrating pedagogy to lead the greatest number of learners towards success. It is useful, meaningful, and dynamic. It promotes responsible behaviour in the learners through the acquisition of knowledge, know-how and how to solve everyday problems of life. The CBA promotes development because it is focused on competence. The CBA promotes meaningful learning while emphasizing the challenges of this approach. Policymakers have been insisting on the CBA potential to facilitate the learning and to help students attain a higher degree of competency and be capable of analysing issues, ready to commit themselves, express themselves, give their opinions in what they can do (Ng'andu, 2022). The new reform in Cameroon education, that is the CBA, aims to improve the quality of student learning. From this point of view, it increases the level of qualification of the learners at the end of secondary school. In this way, it seems that the CBA responds better to the needs of the learners as well as the expectations of secondary schools. The CBA plays an important role in the resolution of situations faced by these learners. The CBA tends to reduce the rate of failure and school abandonment, the disparities, thus the gap between the strong and the weak. The CBA also makes it possible to give meaning to learning by showing its usefulness to the learner in practical life. Finally, the CBA permits learners to integrate the school knowledge in order to solve problems of the everyday life, or to use them effectively according to their needs (Ochieng & Kamina, 2022). Wairimu (2022, p. 24). emphasized that the CBA "will be adapted to the national realities, take into account school time, and will aim to train men and women who are creative, productive and open to the world". They will be presented in the form of curricula, with well-defined

objectives, adapted contents, proven practices and methods, and a system of evaluation in congruence with the pre-established objectives. These programs will have to systematize moral and civic education, environmental education, family life, health, human rights, democracy, and tolerance.

In order to improve the relevance and quality of school programs, the Conference of Ministers of Education of French-speaking countries recommended the CBA as a theoretical framework for redesigning curricula in 1994. To operationalize this, the Agence Internationale de la Francophonie (AIF) set up a training program between 2001 and 2003. A pool of experts and resource persons were trained to promote the implementation of the reform in the countries of the Francophone space. The Bureau d'Ingénierie pour l'Éducation et la Formation (BIEF) of Belgium provided scientific and technical support to the pool of experts and resource persons. The official decision to implement the CBA in Cameroon was made following a regional seminar organized by the Organisation Internationale de la Francophonie (OIF) in Yaoundé in July 2003. In this context, a national seminar was organized in Yaoundé in November 2004 to disseminate the approach. The seminar was financed by the OIF. This seminar brought together executives from the General Inspectorate of Pedagogy and the Provincial Coordinating Inspectors. It is this seminar that recommended guaranteeing the penetration of the CBA in the daily practice of teachers throughout the national territory. Training seminars were then organized for all teachers Provincial Inspectors, Directors and those responsible for studies and training in the Teacher Training Schools. The latter were in turn to extend these trainings to the level of the departments within the framework of training.

From the conclusions of the studies conducted on the implementation of PCA in Cameroon (PASEC, 2008-2009 and SOFRECO/AFD-C2D, 2010), we have essentially retained the following finding:

> *The training of field actors is the Achilles heel of all the innovations underway in Cameroon. The system put in place is aristocratic. Everything happens as if training should only benefit the management (especially at the central and deconcentrated levels). The real actors of the reforms only benefit at best from*

awareness sessions. The perverse effect of such a system is that we observe a façade of support for the reform among supervisors and teachers; they speak the language of competencies but nothing really changes in classroom practices (SOFRECO-AFD/C2D report, 2010, p.20)

Following the recommendations made at the end of the above studies, the Ministry of Basic Education, with the support of the Islamic Development Bank (IDB), carried out a new curricular reform between 2005 to 2018 within the framework of the Support for Schooling in Priority Education Zones (PASZEP) project (MINEDUC, 2018). This reform consisted of the production of a Curricular Reform Orientation Framework Document (DCOR), the content of which provided pedagogical and didactic guidelines to the drafters according to the vision adopted by the interministerial committee in charge of supervising this reform. Again, this reform dealt with the application of the CBA in primary school. The intention was to correct the errors noted during the first attempt to implement the CBA in Cameroon. An important part of the implementation of this reform was reserved for training: training of curriculum designers, training of teachers in the use of the new curriculum and in the implementation of CBA in the classroom.

ROCARE researchers (2011, pp. 318-324) in their proposal to frame the changes that ICTs imply for teaching and learning propose eight recommendations to policymakers for the successful integration of ICTs in education in Africa. Among these proposals, the development of a national policy for the pedagogical integration of ICTs figures prominently. In April 8, 2002, the Head of State of Cameroon, by decree No. 2002/09222, created the National Agency for Information Technology and Communication (ANTIC). The overall mission assigned to this agency is to promote and monitor government action in the field of ICT, including in the education sector. In the Document de stratégie du Secteur de l'Education et de la Formation (DSSEF) which guides overall education and training policy in Cameroon (2013, p. 76), it is stated that "among the innovations to be put in place is the use of information and communication technologies and the analysis of classroom practices".

In spite of these orientations of the government policy on educational technologies, Tchombe, in Fonkoua et al, (2006, p.47), observes that in Cameroon, "there is no real policy that guides fundamental questions such as the design of training programs and the training of teachers on the use of ICT". For the process to succeed and achieve its objectives, government policy must be taken into account. According to this author, a national educational technology program must be put in place in order to provide not only a progressive orientation, but also indicators to monitor and evaluate the process of training learners in the use of ICT in schools (Béché, 2017).

5.5. Summary of Findings

Table 23: Recapitulative Table of Findings

General Hypothesis	Research Hypothesis	Analysis	Recommendation	Conclusion
There is a relationship between pedagogic ICT integration influence CBA teaching and learning methods in government secondary schools in Cameroon.	The use of ICTs facilitate CBA teaching-learning methods in government secondary	The relationship between ICTs facilitate CBA teaching-learning methods is positively significant. This is based on the fact that the level of significance is 0.00 thus lesser than 0.05 which is the alpha which is the standard error margin. Alternatively; the correlation coefficient (0. 367) is a positive value and is situated within the normal range. It is high and close to 1, indicating that there is a strong link between variables under investigation.	Researchers who are interested in carrying out a similar study that investigates the pedagogic ICT integration on CBA teaching-learning methods in private schools as well. MINESEC should consider reforming ICT policies and strategies to eliminate challenges to the implementation of ICT in CBA teaching /learning methods in education (Nsangong & Nganji, 2022, Djeche & Eyeang, 2022).	Statistically, the Spearman rank correlation index was 0.367. This coefficient is positive and thus reveals that the relationship between The use of ICTs and CBA teaching-learning methods is high and positive. Alternatively, looking at the level of significance of 0.00, we can conclude that we have no chance of making an error if we admit that The use of ICTs positively promote CBA teaching-learning methods.

There is a relationship between pedagogic ICT integration influence CBA teaching and learning methods in government secondary schools in Cameroon.	ICT infrastructure increases CBA teaching-learning methods in government secondary schools in Cameroon	The correlation coefficient is 0,931 while the level of significant is 0.000. The level of significance is lesser than 0.05 which is the alpha and the standard error margin. The results reveal thatICT infrastructure significantly increases CBA teaching-learning methods in government secondary schools in Cameroon	The same research topic could be carried out with a larger population and sample, covering Sub-Saharan Africa particularly CENAC zone. Other study interest could focus on the comparability of private and public secondary schools in terms of pedagogic integration and competency-based approach teaching and learning methods in Cameroon. There is need to improve on the ICT learning environment by improving supply of tools and ICT infrastructure across all schools (Nchake & Shuaibu, 2022).	It revealed that ICT infrastructure significantly increase CBA teaching-learning methods. The statistical spearman rank correlation key result of 0.931, revealed a positive coefficient revealing that the relationship between ICT infrastructure positively has a significant increase on CBA teaching-learning methods.
There is a relationship between pedagogic ICT	E-learning fosters CBA teaching-learning methods in government	The results revealed that E-learning significantly foster learning methods. Statistically the Spearman	Since ICT is still an emerging concept in Cameroonian education, it would be important to conduct a comparative study in	The results revealed that E-learning significantly foster CBA teaching-learning methods. Statistically the

integration influence CBA teaching and learning methods in government secondary schools in Cameroon.	secondary schools in Cameroon	rank correlation index, stood at 0.357, which is a positive coefficient and reveals the relationship between E-learning and CBA teaching-learning methods in government secondary schools in Cameroon, is high and positive.	the teachers' use of ICT and CBA teaching-learning methods in rural and urban schools. In this way, a more general picture could be achieved. Also, a comparative study between schools in Cameroon who are still in the primary face of the integration of ICT to more advanced secondary schools in western nations (Fanso & Ngwa, 2022)	spearman rank correlation index, stood at 0.357, which is a positive coefficient and reveals that the relationship between E-learningand CBA teaching-learning methods is high and positive.

There is a relationship between pedagogic ICT integration influence CBA teaching and learning methods in government secondary schools in Cameroon.	Computer-based direct instruction enhances CBA teaching-learning methods in government secondary schools in Cameroon	The results revealed that Computer-based direct instruction significantly enhancesCBA teaching-learning methods. Statistically the spearman rank correlation index was 0. 587, which is a positive coefficient and reveals that the relationship between Computer-based direct instruction and CBA teaching-learning methods is high and positive.	Schools need to use computer based direct instruction to support learners by providing adequate infrastructure that includes network connectivity, computers, and technical support for academic staff and learners. Given the rapid advancement in the use ICTs in Cameroun Secondary schools could be improved to encompass the emergence of future changes in the CBA teaching and learning methods should be entailed the same area (Len, Fokong & Collete, 2022)	Statistically, the spearman rank correlation index was 0. 587, which is a positive coefficient and reveals that the relationship between Computer-based direct instruction and CBA teaching-learning methods is high and positive. The level of significance is 0.00, we can therefore conclude that there is no error in admitting that Computer-based direct instruction positively enhances CBA teaching-learning methods

Source: (Researcher, 2023)

Analysis of Multiple Regressions

Table 24: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df2	Sig. F Change
1	,765[a]	,586	,583	5,163	,586	210,449	4	744	,000
a. Predictors: (Constant), the use of ICTs, ICT infrastructure, E-learning, and Computer-based direct instruction									

Source: (Researcher, 2023)

The model summary provides the R, R-square, and Adjusted R-square which are important statistics that are used to determine how well the regression model fits the data inputted. This explains that:

- R (0,765) is the *multiple regression coefficient*. It indicates a good level of prediction. It shows a high correlation between ICT integration and CBA teaching and learning methods.
- R-square or R^2 (0,586), represents the coefficient of determination and shows the portion of variability on CBA teaching and learning methods accounted for by ICT integration.

Adjusted R-square shows the variable fits in the model. In this light, a high R-adjusted value (0,583) indicates a very good variable-fit of all sub-variables (the use of ICTs, ICT infrastructure, E-learning, and Computer-based direct instruction in predicting CBA teaching and learning methods.

Table 25: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	28044,340	4	5608,868	210,449	,000[b]
	Residual	19829,027	744	26,652		
	Total	47873,367	749			
a. Dependent Variable: CBA teaching and learning methods						
b. Predictors: (Constant), the use of ICTs, ICT infrastructure, E-learning, and Computer-based direct instruction						

Source: (Researcher, 2023)

The ANOVA demonstrates that the overall regression model is a good fit for the data. This table indicates that higher education green curriculum statistically predits CBA teaching and learning methods, that is F (4.744) = 210,449, p<0.05.

Table 26: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-6,175	1,545		-3,998	,000	-9,208	-3,143
	The use of ICTs	,212	,038	,152	5,517	,000	,137	,287
	ICT infrastructure	,529	,054	,338	9,823	,000	,423	,635

	E-learning	,190	,044	,167	4,363	,000	,105	,276
	Computer-based direct instruction	,246	,039	,209	6,244	,000	,169	,324
	a. Dependent Variable: CBA teaching and learning methods							

Source: (Researcher, 2023)

Looking at table 26 of coefficients, we discover that all the predictors are statistically significant.The use of ICTs is significant (p=0.000; b=0,212). The coefficient is positive indicating that the better the use of ICTs on CBA teaching and learning methods is enhanced. ICT infrastructure is also a significant predictor of CBA teaching and learning methods (b=0,529; p=0.000). The coefficient is positive, thus indicating that the better ICT infrastructure is defined to target students socio-professional integration is improved. Competencies/outcomes are significant (b=-0,190; p=0.000). Even so, the coefficient is a negative one indicating that if E-learning is not well carried out, CBA teaching and learning methods will not be optimized and education will not necessarily meet its objectives. Computer-based direct instruction is also a salient predictor of CBA teaching and learning methods (b=0, 246; p=0.000). This figure is positive thus portraying that if Computer-based direct instruction matches with the objectives of the secondary schools, CBA teaching and learning methods will certainly be enhanced to a greater extent. It was also discovered that all the predictors are statistically significant.

The result is generally written as: F (4.744) = 210,449*, $p<0.05$.*, R^2 = 0,586. This means the proble of CBA teaching and learning methods is statistically predicted by ICT integration.

Fanso and Ngwa (2022) emphasize differences between subject cultures within secondary schools in terms of ICT practice and it is suggested that creating communities across subjects would encourage sharing of practice to skills in students through the CBA. Develop use of ‘student voice’ information relating to students’ home use of

technology and their views on learning activities and develop methods of disseminating this information.

To conclude this, ICT is shaping the future of education and learning (Khan, 2008). ICT will largely contribute to achieving universal education through the delivery of education and the training of teachers, as well as the offering of improved conditions for lifelong learning. Such lifelong learning involves people that are outside the formal education process, and thus also their improving professional skills (UNESCO, 2005). ICT can improve critical thinking, information handling skills, the level of conceptualization, and problem-solving capacity. When used appropriately, different ICTs are said to help extend the access to education, strengthen the relevance of education to the increasingly digital workspace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life.

The focus today is no longer on whether technology should be integrated into the school setting, but on how this integration should be done to benefit all parties in a typical school setting. In a developing country such as Cameroon, President Biya promised the introduction of computing in schools and the endowment of computer rooms to schools (Mbangwana, 2008). This promise was followed by public and private initiatives, such as the creation of an official computer curriculum outline for secondary schools, the donation of some computer labs by government (National Agency for Information and Communication Technologies, 2008) and private bodies (MTN Foundation, 2005). Some ICT-related policies were formulated, strategies were adopted and legal frameworks were put in place to ensure a step into the "Information Society era". The most prominent of these was the Cameroon National Information and Communication Infrastructure (NICI) policy and plan drafted in 2004. This policy clearly outlined the government's resolve to modernise the educational system through the introduction of ICTs in schools, preparing a sectoral ICT policy for the educational sector, training teachers in the use of ICTs, equipping all schools with ICT facilities, multiplying pedagogic resource centres for teachers and students, and providing support for the production of ICT teaching materials. The effective integration of ICT is a

complex, multifaceted process that involves not just technology, but also a curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing among others. It is a dynamic process involving interacting factors over time.

Table 27: Summary Table

Hypotheses	Alpha	Correlation coefficient	Level of Sig. (2-tailed)	Decision
RH_1		0, 367**		Confirmed
RH_2		0, 319**		Confirmed
RH_3	0.05	0, 357**	0.000	Confirmed
RH_4		0, 357**		Confirmed

Source: (Researcher, 2023)

The first column on the summary table above presents the various hypotheses that were tested within the framework of this study. The second shows the alpha (0.05) while columns 3 and 4 show the Spearman correlation coefficient index and level of significance respectively. A comparative look between the alpha and the level of significance statistically reveals that all four alternative specific hypotheses have been retained. Based on this, we can therefore retain the main hypothesis which stipulates that pedagogic ICT integration influences CBA teaching and learning methods in Cameroon government secondary schools and reject the statistical or null hypothesis that pedagogic ICT integration does not influence CBA teaching and learning methods in Cameroon government secondary schools. From the findings of our study we discover that, the use of ICTs, ICT infrastructure, E-learning, and Computer-based direct instruction are predictors of CBA teaching and learning methods. The regression analysis was carried out to ascertain the degree of prediction per variable.

The use of ICTs in the classroom has improved secondary education, which is essential for the development of productive human capital in any nation. ICT, which is today regarded as one of the most crucial branches of IT, is in charge of the technical transfer of information and instruments to regulate the flow of logic and data transmission over various media. ICTs are frequently employed in certain contexts, such as in healthcare or education. Unquestionably, the dynamic growth of ICT

contributed to the emergence of the knowledge-based society, whose fundamental component is continuous education, often known as lifelong learning. Since the early 1920s, when movies first came out, educationists have focused on the use of technology in the classroom, but computers weren't readily available to instructors and pupils until the mid-1970s when they were first introduced (Nsolly & Charlotte, 2016). Utilizing technology in education helps to inspire and enhance students' learning (Ndongfack, 2015), prompting numerous nations to establish initiatives to incorporate technology into their educational systems. Since 2001, Cameroon has been attempting to incorporate technology into its curriculum for the same reasons.

CHAPTER SIX

OUTCOME OF E-LEARNING ON CBA IN CAMEROON'S SECONDARY SCHOOLS

The Cameroon government recognised the importance of ICT given that the Ministry of Education set out ICTs learning objectives with national ICT policy in basic education in the 2007-2015 programs (Mbangwana, 2008). According to Tchombe (2006), ICT in education especiually in African contexts, can improve the quality of education by supporting new pedagogical approaches in which the teacher is more of a "guide on the side" than a "sage on the stage". E-learning which has been embraced by the Cameoon educational system, has revolutionized the field of education, providing learners with flexible and accessible opportunities to acquire knowledge and skills. One effective approach within e-learning is competency-based instruction, which focuses on students' mastery of specific competencies or skills rather than traditional time-bound curricula. To this, positive effects and some observable challenges that E-learning has on CBA are analysed

6.1. Positive Effects of Elearning on CBA

E-learning combined with competency-based instruction provides learners with flexibility and personalized learning paths which fosters a learner-centered environment. Just as every educational venture needs quality assurance and control mechanisms, the introduction of e-learning to mitigate the adverse effects of the COVID-19 pandemic in Cameroon had to meet required standards in order to enhance the overall quality education. E-learning in Cameroon secondary schools have several potential effects including: improved access to education, increased collaboration and communication that promotes mastery of competencies and prepares individuals for success in their chosen fields.

6.1.1. Accessibilty to Education

The use of technology in learning can be referred to as e-learning which comprises a wide range of applications and processes designed to deliver instruction through electronic means (Ouma, Awuor & Kyambo 2013). E-learning signals a

paradigm shift in education and its profound effect on education cannot be underestimated. It has helped overcome geographical barriers and provide access to CBA resources and materials for students in Cameroon secondary schools. These have expanded educational opportunities and reach a larger number of students, including those who may have been excluded from education due to various challenges. According to Arkorful & Abaidoo (2015), the Internet, provides worldwide access to various data resources and facilitates global contact without limits, making education an open system and expanding and simplifying access to information. Through the cutting-edge ICT capabilities, teachers can reach their students anywhere in the world and students can engage in autonomous learning and conduct informational searches without being reliant on instructor contact (Mohammed & Yarinchi 2013). As a result, the first goals of elearning were to improve education to a higher level, to establish shared values via the exchange of information and knowledge, and to free the current educational system from the relics of the past (Al harbi, 2014).

Discussing the advantages of e-learning, Brookfield (1987) posits that with the e-learning approach, learners have to take control of the learning process, setting their own goals and determining which learning method to be used. This is due to the fact that e-learning allows students to learn at their own pace and convenience, enabling personalized learning experiences. Students can access CBA materials and resources anytime and anywhere, giving them the flexibility to study according to their individual needs and learning styles. Obi et al., (2018) stated that E-learning helps students to stay connected to national institutions and to avail themselves of what international institutions can offer. Due to increased opportunities, students can today expand their exposure and attain better opportunities in different study disciplines. De Giusti (2020) scrutinized the effectiveness of E-learning for US postgraduate programs in medicine and showed that asynchronous E-learning had been widely adapted and had replaced conventional learning as it provided ease of access and ease of schedule to residents with busy schedules.

According to Fanso & Ngwa (2022, p. 3) "students overwhelmingly prefer to take classes using e-learning than a traditional course because they felt that e-learning

was a helpful tool in their learning". With regards to experience, some students may have experienced e-learning in secondary schools while others may have met computers for educational purposes at the secondary school. E-learning, as a modern concept has both merits as well as demerits. Distance learning is designed to satisfy different instructional and learners' need. Hence, when learners engage in distance learning, this is done because of the convenience of being able to take courses and enhance professional possibilities from the comfort of their homes, with fewer disruptions to daily life. E-learning reduces learning time by at least 25 to 60 percent when compared to traditional learning… and it cuts down on the training time required because: a) it does not take as long to start and wrap up a learning session; b) learners set their own pace, rather than the pace of the group; c) no travel time is needed to get to and from training events; and d) learners can focus on elements of a program they need to learn and can skip what they already know. When compared to the traditional mode of classroom learning, there is clear evidence that e-learning brings: faster delivery, lower costs, more effective learning, and lower environmental impact.

E-learning therefore increases engagement from the learners, positive work attitude from the teachers involved, leading to the provision of more personalized learning; encourages family involvement in students' learning; provides inclusive learning, in other words, students can learn in a relatively anonymous environment without the embarrassment of failure and/or socio-cultural bias from personal contact (Fanso & Ngwa, 2022).

6.1.2. Improved collaboration and communication

E-learning platforms facilitate collaborative learning and communication among students, teachers and administratiors in Caneroon government secondary schools. Online discussion forums, chat features, and collaborative projects promote peer interaction, knowledge sharing, and cooperative problem-solving.The commonly used by our target population includes: "Whatsapp and Zoom which have increased my learning cooperation with my teachers" (Interview, November 2, 2022). This can enhance students' communication and teamwork skills, which are essential competencies in today's interconnected world.

From observation P. 11stated that:

> *I am using six different whatsap forums created during the first four weeks of the beginning of this school year. I have been doing so since the year COVID19 was declared in Cameroon. Through I give assignments, explain lessons to my learners, and share information with teachers, administrators and students as well. This has greatly fascilitated collaboration and communication making work eqsier for me unlike the period before COVID19* (Interview, November 2, 2022).

Furthermore, E-learning platforms can provide automated assessment and feedback mechanisms, making the CBA process more efficient and timely. Computer-based assessments can provide immediate feedback to students, allowing them to identify areas for improvement and take corrective measures. This can lead to better alignment between instruction and assessment, as well as more accurate and objective evaluation of students' competencies.

In spite of these accolades, e-learning has its pitfalls. The most glaring is the fact that it is extremely difficult to pick up any form of practical skills from online resources - for instance, it would not make a difference showing students a video of how to make a chair without them actually having hands-on experience on the actual thing. Other issues that have been recorded include isolation, although e-learning offers ease and flexibility in its offerings (where students can remotely access any instruction in their own time and in the comfort of their bedrooms or lounges, there is loneliness and isolation associated with this type of learning (Fanso& Ngwa, 2022). However, ‘learners can now engage more actively with professors or other students using tools such as video conferencing, social media, and discussion forums amongst others’ (Epignosis, 2014), for those who have the advanced tools; yet again, the total process is technology dependent and requires expensive resources such as fast internet, software and good computers - something which is a superfluity in a country like Cameroon. Some other obstacles that students have to overcome as they engage in e-learning relate to the issue of the absence of proper guidance for students to remind them about class

time, or deadlines for assignments or exams, thus it is likely to make them easily procrastinate (Fanso& Ngwa, 2022).

6.2. Challenges of Elearning on CBA

Adopting distance learning or e-learning strategies, proved challenging to implement at various levels given a relatively low internet penetration rate in Cameroon (Tchamabe, 2011). The low internet penetration into Cameroon's educational system thus explains the recent launch of a learning platform called Ohipopo in 2019 (Ngwa, 2020). Ohipopo is the first online learning platform customized for the Cameroonian system of education. The creation of more educational digital platforms and websites by young talented Cameroonians followed including www.eduairbox.com, www.sims.cm, www.treehouse, www.learneverywhere.org, and www.cam-educ.com (Ngwa, 2020). According to Ouma, Awuor & Kyambo (2013), an E-learning platform can only be managed and used by people with some level of technical skills.

Implementing e-learning on Competency-Based Assessment (CBA) in Cameroon secondary schools can present several challenges. While e-learning offers numerous benefits, it's important to be aware of the potential obstacles that may arise.

6.2.1 Infrastrutural and connectivity

Reliable internet access, computers, and other electronic devices, is crucial for effective e-learning. However, Secondary schools in Cameroon are faced with infrastrutural and connectivity challenge hindering access to online resources and communication platforms. All students do not have equal access to devices and internet connectivity at home, leading to disparities in participation and learning outcomes. This can exacerbate existing inequalities among students based on socioeconomic factors, potentially excluding some students from benefiting fully from e-learning initiatives. This explains an observable fact where one of the the students from GBHS Yaounde declared that she has never had the opportunity to use the internet out of the school environs.

Given that e-learning relies heavily on technology infrastructure, including stable internet connectivity, reliable devices, and appropriate software platforms,

ensuring learners access can be a challenge. Learners' access to the necessary technology and technical support is therefore a challenge especially in government secondary schools of Cameroon. Institutions must invest in robust technology infrastructure and provide support mechanisms to address technical issues that learners may encounter.

The difficulty link to Learners' access result to the lack of immediate support and feedback learners would receive in a traditional classroom setting. Efforts should be made to foster meaningful interactions, promote active engagement, and provide timely feedback to maintain students' motivation and enhance learning outcomes.

6.2.3. Inappropriate Use of computer and internet

Managing e-learning platforms and tools effectively and efficiently requires that teachers and students should be trained and supported. Lack of technical expertise among teachers and limited support in troubleshooting technical issues can hinder the successful implementation of e-learning for CBA. Ongoing professional development opportunities and technical assistance are essential to ensure teachers can navigate the digital environment confidently. Students and teachers need to possess adequate digital literacy skills to navigate e-learning platforms, access online resources, and effectively use digital tools for CBA. Inadequate digital literacy can lead to difficulties in using e-learning resources, understanding assessment instructions, or effectively participating in online activities.

The use of digital resources tends to be more fruitful when they are clear, teacher-guided, and students have the necessary technical skills, otherwise, students tend to immerse themselves in searching for unnecessary information. Since ICT availability is one of the most important obstacles to technology adoption and integration in learning, secondary schools should make an effort towards increasing the availability and accessibility and proper usage of ICT resources to students in order to enhance students' academic performance.

Integrating ICTs into the teaching-learning processes is therefore a call for concern to the entire educational team. Challenges linked to inadequate telephone

services, improper maintenance of the damaged equipment and facilities, a lack of ICT facilities, poor electric power supply, a lack of knowledgeable ICT support personnel, inadequately trained ICT teachers, a lack of funding, the high cost of ICT equipment, materials, and accessories, and government payments to support the implementation of ICT policies. If the government upholds its expectations in the execution of the ICT policy, teachers and students in Cameroon certainly will have a large number of learning tools at their disposal (Ndongfack, 2016).

It is worth noting that the successful outcome of e-learning on CBA in Cameroon governmemt secondary schools depends on various factors, including infrastructure availability, access to devices and internet connectivity and teacher training. Also, considerations should be given to address potential challenges such as the digital divide, limited resources, and ensuring equitable access for all students. Competency-based e-learning requires learners to navigate online platforms, interact with digital resources, and engage in online communication and collaboration. Some students are facing a learning curve when adapting to these digital tools and technologies. It is essential to provide adequate training and support to enhance learners' digital literacy skills and ensure they can fully participate in the e-learning environment rather than misusing these resources. More teachers need to be train so that they in turn train their students. Institutions should invest in professional development opportunities for teachers to help them adapt their instructional practices to the e-learning environment.

However, online teaching and learning were introduced by the Cameroon ministry of secondary education to help mitigate the nefarious impact of the COVID-19 pandemic on the attainment of educational objectives. Many school administrators including state media (CRTV) have stated severely that online teaching and learning were carried out in order to contribute to educational quality in terms of knowledge acquisition. This, the government saw as the best way to uphold the educational sector in Cameroon, though many learners especially in rural contexts may find themselves excluded from schooling and unable to access online resources due to the unavailability of infrastructure, electricity, electronic gadgets, and the lack qualified teachers who can assist with online learning (Dube, 2020). It appears that online learning favors urban

and well-privileged learners; thus, widening the gap between the poor and the rich, instead of uniting the nation in the fight against COVID-19 (Dube, 2020).

6.3. Educational Implication of Pedagogic ICT integration

Findings from research are provided to inform the reason for the pedagogic ICT integration into the CBA teaching/learning methods. This should form the agenda of policy, research, and practice. A better understanding is needed about the role of ICT in 21st century learning, especially in relation to the formal and informal settings where 21st century skills may be acquired. Policymakers, leaders and researchers need to work closely together to incorporate 21st century skills in curricula and to develop assessments of those skills. To radically restructure schools to be able to use multiple technology-enhanced pedagogies in order to address students'individual needs, integrated research and development of infrastructure (mobile technologies), digital content and pedagogies are needed to better prepare schools to use technology enhanced pedagogies to benefit student learning.

From the perspective of 21st century learning, the implementation of ICT is part of a comprehensive change of the education system. To establish a clear view on the role of ICT in 21st century learning and its implications for formal and informal learning, ICT must obviously play a primary role in 21st century skills and 21st century learning. The acquisition of ICT skills is therefore not only an educational goal, but ICT also serves as a tool to support teaching and learning. Implementing 21st century skills and 21st century learning is a challenge for the current curriculum, because the change that is being asked for is not about trading 20th century content and goals for those of the 21st century; it is about what has to be core in the 21st century curriculum and about the implications of a 21st century curriculum for the current school system.

Secondary schools in Cameroon all had a strong emphasis on students' independence and responsibility for their own learning and had restructured their school to realize that vision. The use of ICT in pedagogy is vital in the new structure and has to become a routine throughout the school. The teachers in these schools, in order to transform their school, teacher collaboration and teacher learning are crucial and have

to become an integrated part of the school's culture. It is necessary to promote a strong connection between pedagogical aims and ICT, strong leadership, school-wide adoption of ICT, a focus on the process, collaboration with external partners (also from the private sector) and with other schools (to share ideas and approaches), and being able to cope with new trends.

It is better to understand student technology experiences in informal learning environments, in order to inform work in formal settings. Research is needed to better understand the implications of immersion in technology-rich informal learning environments. Policymakers and leadership need to develop policies and actions on the implications of such informal learning environments for formal learning settings.

It is often assumed that through the overall presence of ICT, students automatically are immersed with technology, and that special attention for ICT in the curriculum as a tool and as an object for learning is not necessary. Digital immigrants experience ICT as a phenomenon, alien to their life; while for those who grew up with technology, the digital natives, technology fundamentally impacts their way of learning and living. Digital natives 'think and process information fundamentally differently.

Policy needs to be developed on levels of knowledge responsibility and capacity of teachers in ICT integration. The adoption of technology by teachers is conceived as a process that develops through different stages: from being aware and informed about the possibilities of ICT in education, to a more routine utilization of ICT in classroom practice, and finally to creative uses of technology for teaching and learning. ICT competencies and access to technology are important during the first stages of technology adoption.

In addition, although many teachers possess basic ICT competencies, many of them lack competencies related to the pedagogical use of ICT. This is the impression we got, based on the need to be able to integrate technology skills with pedagogical skills in order to successfully integrate ICT in educational practice. By blending pedagogical and discipline-based knowledge, teachers are able to teach complex concepts. Teachers should become aware that, in today's teaching, technology has an indispensable role, because it can add to the pedagogy as well as to the content of many

subjects. The rapid technological developments require a quite sophisticated support structure. Policy therefore needs to provide for ongoing technical, human, and organizational support. Technical support has to do with keeping the infrastructure up to a certain standard. Teachers need support in keeping up-to-date with the potential of hardware and software for teaching and learning.

Finally, following the importance attached to technology in most parts of the world in almost all sectors, developing countries also have had to make the necessary investments and changes to cope with the 21st Century developments. As a result, education systems have been changed and curricula adjusted to have technology integration in schools. The access to a computer or laptop by learners and teachers is key in the integration of technology in education. Learners had relatively high access to technology devices such as tablet, PCs. The power supply in schools also appears reliable, which could be attributed to the government's commitment and investment towards digital learning in public secondary schools in the country. Since not all schools had a one-to-one ratio in terms of technology devices like tablets and PCs, Fanso & Ngwa (2022) suggest that the teachers in such settings could change their approach by encouraging peer collaborative learning as learners share the available devices. This argument supports the social constructivist approach by Vygotsky that emphasizes collaboration as opposed to individual learning (Nsangong & Nganji, 2022). As Wilson et al. (2018) explain, teachers in areas without adequate ICT devices need to apply teaching methods that create an environment of cooperation and democracy to enable content sharing among learners. Nonetheless, for this to happen, a teacher needs to be equipped with the requisite technology integration skills to be able to assess the learners' use of technology and their use in instruction.

The findings pointed an increase in computer literacy among secondary school students and teachers which has been highlighted as a key determinant in the successful integration of technology in the CBA (Hwang et al., 2010; Kalaš, 2012). The results were consistent with previous research which attributed the increase in the number of computer-literate teachers with the introduction of computer courses in the Cameroonian teacher training colleges. However, although computer literacy among

teachers is important, it does not guarantee that teachers would use technology in their lessons (Nouffeussie et al., 2022) because of gaps in the pedagogical application in actual teaching.

Despite the skill gap that exists among teachers in technology integration, our study shows that, generally, teachers had a high perception. Similarly, Djeche & Eyeang (2022) concluded that teachers in Cameroonian schools had high attitudes towards the use of various technologies indicating that with the requisite support the use of ICT in schools would be achieved. This is also supported by the finding that teachers had the high belief that ICT use would not only benefit them in the organization of instruction but also their learners. The perception of the usefulness of technology to learners by teachers is important because it helps the teacher to invoke the innovativeness and creativity of the learner (Fanso & Ngwa, 2022).

Skinner (1953) thought that young infants may be trained to develop positive traits and behaviors (Fauzi et al., 2022; Diessner, 2008, p. 135). The *teaching machine*, a gadget that applied Skinner's concepts of step-by-step education and rewarding students' reactions, is regarded as one of his greatest achievements. The groundwork for further developments of behavior modification, programmed instruction, mastery learning, direct methods, and other computer-assisted instruction was laid by this strategy. Learning mastery is attained, according to Weimer (2022), Santrock (2004, p. 220), by breaking learning down into manageable steps and praising children as they finish each one. Also, complex behaviors can be efficiently taught by combining many of these processes. Additionally, Skinner suggests that teachers should employ *attractive and attention captivating* methods of instruction in addition to positive reinforcement in place of unpleasant control or punishment. The development of the Transmission model and domain-centered design in instruction has been influenced by behaviorism as a theory of learning.

However, the way a computer processes information serves as the foundation for the model of how humans process information. Working memory or short-term memory (STM) information is similar to computer workspace information. For information to be used in the STM, it must first be retrieved from the Long Term Memory (LTM). Noe

(2002, p. 117) also stated that the information-processing model shows how external events affect learning in addition to emphasizing the internal procedures required to capture, store, retrieve, and respond to messages. These things happen, like:

- Changes in the intensity or frequency of the stimulus affect attention;
- Informing the learner of the objectives to establish an expectation;
- Enhancing perceptual features of the material (stimulus), drawing the attention of the learner to certain features;
- Verbal instructions, pictures, diagrams, and maps suggest ways to code the training content so that it can be stored in memory;
- Meaningful learning context (examples, problems) creating cues that facilitate coding;
- A demonstration or verbal instructions and helping to organize the learner's response as well as facilitate 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 (LCD) of instruction.

According to Seymour (1980), there are three roles for teachers who use the constructionist learning theory in their class: Modelling, Coaching, and Scaffolding to provide sufficient support to promote learning when new concepts are introduced. Hence, the second strength of the theory advocates a learning environment that is democratic; the teacher is not seen as an authority figure as much as a learning guide and the activities are interactive and student-centered instead of lesson-centered. This research helps investigate the teachers' skills on ICT, the integration of ICT in pedagogy on CBA teaching and learning that is clearly seen through the ability of students to perform tasks on their own without the help of teachers.

Apart from the above strengths, Seymour's constructionist theory has two limitations. First, it has a lack structure. Some students require highly structured environments in order to be able to perform their tasks. The Constructionist theory calls for the teacher to discard standardized curriculum in favor of a more personalized course

of study based on what the student already knows. This leads some students to fall behind others in performing their tasks and this also affects the performance of slow learners. The second weakness of the theory is that it actually leads students to be confused and frustrated because they may not have the ability to form relationships and abstracts between the knowledge they already have and the knowledge they are learning in the classroom (Vygotsky, John-Steiner, Scribner & Souberman, 2021). Despite the above weaknesses, the researcher still opted for this theory because it brought out factors that contribute to integrating ICT in pedagogy and CBA teaching and learning in Cameroon. Conclusively, the researcher found this theory appropriate to the topic under investigation.

Respondents' General Profile

Table 28 : Respondents general Profile

Demographic Questions		Responses	
	Modalities	Frequency	Percentage
Gender	Male	494	44,5
	Female	615	55,5
	Total	1,109	100.0
Schools	GBHS Essos	276	24,89
	GBHS Emana	177	15,97
	GBHS Ekounou	239	21.55
	GBHS Limbe	199	17.94
	GBHS Molyko	218	19.65
	Total	1,109	100.0
Own Personal Computer or Smartphone for Studies per School	GBHS Essos	306	28.00
	GBHS Emana	201	18.00
	GBHS Ekounou	253	23.00
	GBHS Limbe	116	10.00
	GBHS Molyko	233	21.00

	Total	1,109	100.0
Number of hours of Computer Usage per day	More than 3 Hours	535	48.24
	3-2 Hours	149	13.43
	1-2 Hours	14	1.27
	Less than one Hour	--	--
	I do not use it at all	411	37.06
	Total	1,109	100.0

Source: (Researcher, 2023)

The whole study was made up of 1,109 respondents. Item one was based on the distribution of respondents according to gender. 494 respondents were male students while 615 were female students. The highest population in the study was from the female students. This could be explained by the fact that female students are many more in these secondary schools than male. Item two was based on the distribution of the respondents according to the school attended. The highest population was from GBHS Essos with 276 student respondents, followed closely by GBHS Ekounou with 239 student respondents. 218 respondents came from GBHS Molyko, 199 from GBHS Limbe, 177 from GBHS Emana. Item three was based on the distribution according to the respondents owning personal computer or smartphone for Studies. Most students who responded to this question were owners of personal computer or smartphone. 306 from GBHS, 253 from GBHS Ekounou, 233 were from GBHS Molyko, 201 were from GBHS Emana, and 116 were from GBHS Limbe. Computer or smartphone enables students to access learning resources through an internet connection. Students learn through these tools anytime and anywhere. Hence, technology, computers and smartphones, attract learners to exploit interactive learning resources. Notably, computers and smartphones have various applications that prove helpful in the educational or learning process.Technology is everything today; it is difficult to stand the test of time without technology, and the advantages it poses in the twenty first century where almost all human activities are technologically driven. Students use

different technology devices and platforms to achieve desired results. ICT is used in learning and is changing how teaching and learning take place. It has created what we can call smart education. A smartphone runs various applications software for education. It provides features especially the multimedia capabilities in lectures content creation and dissemination for use by students. The smartphone best feature is its connection to an app store. The app store enables a user to find software, and install it on their computer or mobile device. It is a collection of free and commercial software, approved for use on the device. An app store is a centralized portal where users can search for and download software applications to run on their phone.

Item four was based on the Number of hours of computer usage per day. 535 students spend more than 3 hours using their computer or smartphone for studies.3-2 hours, 149 students use it per day, for 1-2 hours; 14 of them and 411 do not use it at all for studies. More than half of the respondents use computer and smartphone for studies. This is justified on the fact that during the Covid-19, ICT has modified the world in which students grow and learn. More and more families own an increasing number of computers, most of which are now connected to the Internet. New devices, such as Ipads and smartphones, offer the possibility of accessing the Internet (almost) anytime, anywhere. This, in turn, means that children access and use ICT earlier than ever before and increasingly by themselves, without adult supervision. Within a typical school week, students spend using the Internet at school and at home, both during school days and during weekends. Students who use computers moderately at school tend to be somewhat more skilled in online reading than students who rarely use computers. But students who use computers very frequently at school do a lot worse in reading, even after accounting for students' background. It is true students who are digitally drifted search for specific information on a website. The idea behind the introduction of educational technology is to make learning simple and easy through the production of educational resources in every form possible; visual, textual, video, printed with the aid of computers, phones, and other electronic devices. The Smartphone is one of the best education technology tools teachers and students use. Teachers use it to produce lectures content learning materials at their convenience and disseminate them to students. Students use this technology to access learning resources of any form, read and re-read

at any time, and collaborate and share ideas with others; teachers, and students elsewhere. A good number of students who do not own a computer or smartphone use the cybercafé to do their assignments.

Table 29: Summary Table

Hypotheses	Alpha	Correlation coefficient	Level of Sig. (2-tailed)	Decision
RH_1		0, 367**		Confirmed
RH_2		0, 319**		Confirmed
RH_3	0.05	0, 357**	0.000	Confirmed
RH_4		0, 357**		Confirmed

Source: (Researcher, 2023)

The first column on the summary table above presents the various hypotheses that were tested within the framework of this study. The second shows the alpha (0.05) while columns 3 and 4 show the Spearman correlation coefficient index and level of significance respectively. A comparative look between the alpha and the level of significance statistically reveals that all four alternative specific hypotheses have been retained. Based on this, we can therefore retain the main hypothesis which stipulates that pedagogic ICT integration influences CBA teaching and learning methods in Cameroon government secondary schools and reject the statistical or null hypothesis that pedagogic ICT integration does not influence CBA teaching and learning methods in Cameroon government secondary schools. From the findings of our study we discover that, the use of ICTs, ICT infrastructure, E-learning, and Computer-based direct instruction are predictors of CBA teaching and learning methods. The regression analysis was carried out to ascertain the degree of prediction per variable.

The Internet has also developed into an invaluable resource for the people of Cameroon. The provincial capitals and significant towns currently offer e-mail services, Net phones, and websites. Even though Internet services were operational as early as 1972, Cameroon was the last country to adopt them. Since then, it has gained a lot of

attention, particularly from the general public and secondary school, high school, and university students. Cyber Cafés have been progressively emerging, especially in urban areas. To handle telecommunications-related concerns in Cameroon, a number of government ministries have been established, including the Ministry of Communication and the Ministry of Post and Telecommunication.

Furthermore, the government is making substantial investments in this industry. To promote access to the internet and its resources, the government has undertaken a variety of projects. For instance, the government plans to build more than 20,000 Community Tele Centers in significant towns across the nation as part of collaboration with the Chinese in the North to increase internet access nationwide. The government also invests a lot of money in the energy industry. The government's forecast is to feature as a developing nation by 2035. The Internet holds a special appeal for young people in Cameroon for a variety of more or less significant reasons, including scholarships, pen-pals, education, and more. The majority of organizations, including universities, social-political organizations, and business groups, have already created their own websites, which is noteworthy.

Furthermore, the introduction of mobile phones has significantly changed the environment for information and communication in Cameroon. This industry is promoted by a number of businesses or providers, including Cameroon Telecommunication Information (CAMTEL), Mobile Telephone Network (MTN), and ORANGE. The Cameroonian government has also worked very hard to meet the demands of globalization and the desire for high-quality education. These include the provision of computers and internet facilities in schools, colleges, and universities, the deregulation of the audio-visual media business, and the elimination of customs fees for imported communication equipment. But ICTs and e-learning in particular have the capacity to inform and transform. As a result, educators must learn how to show students how to use new technologies for academic gain and explain to them the benefits that interactive television (TV), digital radio, compact disc read-only memory (CD-ROM), audio/videotapes, cell phones, and the internet have for learning.

Additionally, the knowledge society has been established thanks to the widespread use of ICTs in schooling. A new set of human talents are, nevertheless, needed to participate in the information economy. People must be adaptable and capable of continuing their education well after the conventional age for starting school. The impacts of the knowledge economy, which also includes continuing education and lifelong learning, are realized without enhanced human capital, especially in emerging nations like Cameroon. As a result, these regions are compelled to lag behind and face isolation on the intellectual and economic fronts. The widespread use of ICTs in education has also sparked new advances in educational technology, cutting-edge worldwide delivery strategies like e-learning and fresh worries about the suitability of the curricula and instructional materials. Therefore, future educators must make better use of contemporary ICTs in creating their environment. They must acquire the skills necessary to fully utilize blogs, forums, the World Wide Web, and other online capabilities to address educational issues.

However, despite the fact that developed nations like the United States and other developed countries are thought to be specialists in the use of technology in education, these efforts have not yet been successful due to widespread obstacles (Ndongfack, 2016). The lack of a clear vision and well-planned strategy for ICT integration in education is one such barrier, which is a crucial aspect of technology integration into education and common in most Sub-Saharan African countries, including Cameroon in particular (Wallet & Beatriz, 2015). The Objective-Based Approach method of instruction and learning, which eventually developed into the Competency-Based Approach, was made possible by its integration into Cameroon's educational system.The role of both teachers and students had to quickly shift as a result of the educational system's evolution. ICT is widely used in today's society, and everyone who wants to contribute to its development must have the necessary abilities. A lot still has to be done for ICT to be properly integrated in Cameroon schools, and more study needs to be done for a better understanding of the problems that can be asked, even if ICT implementation in education has advanced significantly throughout Africa and Cameroon in particular.

The effective and efficient pedagogical use of these tools has proven to be a significant issue despite the significant investment made in the integration of ICT in secondary schools. De Witte Haelermans and Rogge conducted a learner outcome study on the usage of ICT using the Trend in Mathematics and Science Study (TIMSS) in 2011, focusing on the learner outcome in the use of these instruments. The results showed that students with teachers who do not suffer an ICT shortage had higher exam averages in mathematics of 544 while students with teachers who experience an ICT shortage had lower test averages of 540 (Ndibalema, 2014). They came to the conclusion from their study that school variables like student enrolment and administration have a significant impact on how well teachers use ICT to teach mathematics.

The proper integration of ICTs into teaching is hampered by numerous obstacles. In their work, Birch and Burnett were questioned about their use of, attitudes toward, and perceptions of the driving forces, facilitators, and inhibitors behind the creation of e-learning environments. They consequently highlighted time constraints and heavy workloads on lecturers as well as pedagogical obstacles like the absence of well-suited course designs and institutional obstacles like a lack of academic leadership and the absence of defined institutional regulations (Birch & Burnett, 2009). Analyzing this study attentively reveals that it highlights the difficulties ICTs have when used to teach in an online learning environment (Birch & Burnett, 2009). However, the study's explanation of the problems brought up as well as the questions put to the participants seemed ambiguous. The views and perceptions presented here are not really clear. Secondly, one is tempted to think that this topic's outcomes were predetermined before an investigation was conducted. This is a result of the sorts of responders being pre-selected, such as pioneers, non-pioneers, and adopters. There are ICT users who may not always be in a classroom but may be at home or in other learning environments.

Additionally, the first Africa Economic Forum, with the subject Challenge of Globalization and Information Age to Africa, was organized in 1999 by the United Nations Economic Commission for Africa. It became clear that there were numerous internal, external, and human barriers preventing the integration of ICTs into education

at the continent's higher education institutions. High ICT costs and import tariffs, insufficient and inconsistent ICT provision, a lack of clear national ICT policy documents, unstable electricity, and constrained Internet bandwidth were some of the external barriers. On the internal side, poor self-organization awareness and response to change as well as poor maintenance were some of the barriers. Human barriers include a lack of support staff and training, systematic ICT integration strategies, and institutions' struggles to retain professionals owing to inadequate compensation. However, this commission is only focused on a few nations, thus a larger observation is required.

The value of ICTs in student learning depends on teachers integrating them to assist instructions, according to Fulton, Glenn & Valdez (2004) analysis of teacher education and planning manuals. The standards for highly qualified teachers outlined by No Child Left Behind (NCLB) (Fulton et al., 2004) are not met by teacher candidates entering today's classrooms without a solid foundation in the knowledge and abilities necessary to use technology effectively It was also reaffirmed that it is crucial for leadership to mandate that new teachers graduate from teacher preparation programs with ICT knowledge and abilities in order to enable them to seamlessly and effectively incorporate technology into their daily teaching, wherever they may be. Even with such mandatory employment standards, people hired must still keep up with the newest, most sophisticated, and powerful ICTs. Only in underdeveloped countries where ICTs are readily accessible, used in instruction, and taught to students are these kinds of recruitment requirements for faculty feasible. Multiple studies must be taken into account in various locations, including the attitudes of faculty on integrating the devices in teaching in various settings, in order to support this. In third-world nations, it is possible for a teacher to complete their training programs without utilizing ICTs or learning from them. Therefore, the precondition listed above might not be appropriate.

Similar research was done by Kramer, Walker & Brill (2007) on the underuse of ICT-assisted collaborative project-based learning among foreign educators in Eastern Europe, Africa, and North America. They found a number of obstacles. These included a variety of issues, including the absence of ICT-related initiatives, a lack of ICT

support, erratic Internet connections, a lack of teacher preparation, the structure of the curricula and programs, and a lack of ICT technical assistance. This analysis demonstrated that the main impediments in Africa were a lack of education and the high cost of Internet access, with the other factors in each case being just marginally important.

Van de Wende and Beerkens (1999) stated that it is important to consider how the situation is in our own country as compared to that of another country in a study on the use of ICTs in higher education in the Netherlands, UK, Finland, Belgium, Australia, and the USA that was commissioned by the Dutch Ministry of Education, Culture, and Science in 1998. The majority of higher education institutions in Europe do not yet have a comprehensive and cohesive institutional policy on the function and use of ICTs in higher education, according to the report. They assert that policies are necessary for universities and other higher education institutions today for the positioning of universities in the market, to speed up growth in demand by students and staff for access to educational technologies, to increase the acceptance of learner-centered (self-paced, self-directed) and more social interaction and communication settings, and to improve efficiency/effectiveness of students. Oliver's assertion that technology-related programs are expensive and that many academics are still hesitant to integrate ICTs in their instruction due to a lack of knowledge and abilities is supported by this study (Oliver, 2002).

Cross &Adam (2007) both came to the realization that while South Africa has made significant progress in implementing an exemplary approach to the adoption of ICTs in schools, it lacks a national policy framework on the use of ICTs in higher education. In addition to the negative impacts of a lack of ICT policy guidelines and tools, the complexity of the local contextual environment makes it difficult to integrate ICTs into higher education institutions. The South African experience demonstrates how South African institutions have responded to these drivers by reflecting local contextual complexities, even though the literature suggests that policy and implementation trends around the world tend to respond to global drivers (knowledge economy and ICT) at the expense of national and institutional interests. They also

observed that the National Commission on Higher Education (NCHE) issued a number of adjustments to the higher education system in the 1990s to adapt it to equal access and equity. Given that, "no reference is made concerning the use of ICTs as a possible resource to broaden access and analysis of crucial issues... ICT policy in higher education does not have the same emphasis (Njoku, 2015), the role of ICTs in this context was hazily described. However, the study warns that depending on how policymakers feel, the prominence of ICT in higher education poses both opportunities and challenges. Haji, Moluayonge & Park (2017), made similar insights in the West as well.

GENERAL CONCLUSION

This study has hopefully achieved its aim of pedagogic ICT integration and CBA teaching and learning methods in Cameroonian secondary schools in so far as it has addressed the application of technologies in teaching and learning activities. Investigating pedagogic ICT integration in Cameroon secondary schools has revealed that incorporating ICT into CBA teaching and learning methods in the country faces many challenges. This study revealed that education is the key process to end poverty and increase global outreach. Teaching and learning in Cameroon secondary schools is gradually moving from the traditional based approaches to the CBA which is largely supposed to be learner-centred. With the introduction of the CBA, teachers in Cameroon schools and colleges are compelled to master and use the approach in facilitating the teaching-learning transaction. ICT use can increase connectivity between students and teachers, increase online learning and produce classrooms that are more efficient. In

order to allow decent ICT usage into the CBA teaching and learning process and incorporation in secondary schools, a constant supply of motivation is needed. About the integration of ICT in teaching and learning in Cameroon secondary schools, it was concluded that ICT integration featured in the syllabus and integration is taking place in respective schools in Cameroon.

The constructivist approach considers learning as authentic and learner-centered. ICT is a great help in the constructivist approach, where one can design simulated and individualized learning environments for students exerting impacts on pedagogical approaches. Their contribution to changes in teaching practices, school innovation, and community services is considerable. That notwithstanding, the integration of ICTs in CBA of our educational system may face various challenges with respect to policy, planning, infrastructure, learning content and language, capacity building and financing. ICT enhanced education requires clearly stated objectives, mobilization of resources and political commitment of those concerned.

The empirical literature reviewed established that ICT infrastructure is among the key factors influencing secondary schools ICT implementation. There is significant evidence that the two key challenges impede the use and implementation in secondary schools. The findings from the review have shown that ICT infrastructure in secondary schools is dependent on policies and infrastructure. Therefore, to successfully implement ICT in an institution, the leadership should own the process and create awareness among staff members and learners on the importance of ICT policy. The policy framework is expected to cover ICT program implementation, oversight, and support mechanisms, including skills development, and infrastructure development plan. Thus, a clear planning framework embedded in a policy framework can greatly influence ICT infrastructure.

After collecting data using a semi structured questionnaire, the findings revealed that the majority of teachers acquired basic knowledge and skills on how to implement the CBA through impromptu seminars and workshops, which however are infrequent to attain to the desired outcomes. Some indicated that, although the CBA was introduced before or when they enrolled in the teacher training colleges, they did not really acquire

specific knowledge or engage in practical lessons that were based on the use of the CBA in enhancing the teaching-learning process. Most of the teachers indicated that, in implementing the CBA, they faced challenges such as overcrowded classrooms, inadequate teaching/learning resources, inadequate knowledge on how to use the approach, limited teaching hours for each lesson, limited professional development programs, students' negative attitudes towards assignments, problems related to some lessons on real life situations and background of students. These challenges constrained teachers to implement the adopted CBA curricula. If teachers are to succeed in implementing the CBA curricula, there is need for teachers to be involved in rigorous professional development activities like seminars, conferences, workshops, observation of others teaching using the CBA, in-service training and individual research.

Furthermore, the findings revealed that the implementation of ICT depends on the availability of adequate infrastructure. Inadequacy of infrastructures such as computers by learners and instructors is a critical hindrance in ICT implementation in pedagogy. The limitation in knowledge to operate these systems is also a significant contributor to failure in ICT implementation. The ICT framework that has been proposed in this study could provide researchers with valid themes and sub-themes, which they can use in their research approaches and comprehensive research instruments.

Moreover, in the learner-centered design ICTs are incorporated into all aspects of the teaching and learning experience. While this is certainly an improvement, it repeats the errors of the domain-centered 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 are 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. Secondly, Domain Centred Design ignores the social context of learning and the important role of conversation and collaboration as part of the active learning process. Thirdly, 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-centered investigations are disconnected from the teacher-centered discussions.

Having explored a study of this magnitude on the "Pedagogic Integration of ICT in Government Bilingual Secondary Schools to Enhance CBA Teaching/Learning Methods in Cameroon," and taking into consideration the immensity of multifaceted conception of CBA approach, it is proper, taking into account suggestions for further research in order to open up and look into future study areas.

Apart from the proposals stemming from the findings of this research, it is important to encourage the exploration of works by various authors encountered after the completion of this thesis. Since ICT remains a relatively new field, and new studies related to these issues continue to emerge, it is crucial for scholars pursuing the suggestions presented in this work to be informed about the most recent findings concerning the use of ICT in CBA teaching and learning methods in secondary schools in Cameroon.

The same research topic could be conducted with a larger population and sample, covering Sub-Saharan Africa, particularly within the Central African Economic Monetary Community (CEMAC) zone. Other areas of interest could include a comparative analysis of private and public secondary schools regarding pedagogic integration and competency-based teaching and learning methods in Cameroon. Additionally, examining how management practices of ICTs influence the transformation of entire universities could also be interesting. Lastly, the above-suggested areas of study could be carried out for longer periods of experimentation and with larger sample sizes and a greater number of cases to enhance the degree of

reliability. The following recommendations are for those specific objectives of this study from the results.

Given the outcomes of this study, it is recommended that future researchers investigating the impact of pedagogic ICT integration in CBA teaching and learning methods consider expanding the scope to include private schools. Furthermore, examining the pedagogic use of ICT from the students' perspective and its impact on learning outcomes would provide deeper insights. Conducting mixed-method studies on CBA teaching and learning methods involving teachers, students, and principals in Cameroonian schools could also be interesting. . In this way, a more general picture could be achieved. A comparative study of ICT use and CBA teaching methods in rural versus urban schools could yield a more comprehensive understanding. Additionally, investigations comparing schools in Cameroon still in the early phases of ICT integration with those in more advanced secondary schools in Western nations would be beneficial. Exploring educational goals specified at various education and training levels, along with different modalities of ICT use that facilitate the pursuit of these goals, is recommended. Policymakers must recognize the potential of pedagogic ICT integration in various educational contexts, as the adoption of a competency-based approach in teaching and learning holds promise for improving education quality.

Further suggestions stem from recent works, particularly those by Professor Marcelline Djeumeni Tchamabe, who addresses issues primarily affecting French-speaking learners in her doctoral dissertation (Tchamabe 2010) and subsequent publications (Tchamabe 2019, Tchamabe & Voulgre 2017, Voulgre & Tchamabe 2019, Nchia et al. 2019). Her dissertation on teachers' pedagogical practices with the ICT in Cameroon between public policies and the techno-pedagogical devices; teachers and learners' competencies public and private practices (*Les pratiques pédagogiques des enseignants avec les TIC au Cameroun entre politiques publiques et dispositifs techno-pédagogiques; compétences des enseignants et compétence des apprenants, pratiques publiques et pratiques privées*), echoes the title of this thesis. The unique specificity of my work focuses on government bilingual secondary schools.

A notable point made during the defense of this thesis by Professor Marcelline Djeumeni Tchamabe, was that any evaluation of the impact of the competency-based

approach must address three areas of performance: knowledge, skill, and attitude, which are emphasized in this research. She also discusses the challenges of implementing the competency-based approach in rural areas without internet coverage in her paper, *Écoles éloignées en réseau et efficacité de la supervision pédagogique en technologies éducatives (TE)*. This issue was highlighted during the defense as a significant barrier to effective implementation. In their paper, "Quelles représentations des TIC par des maîtres du Primaire au Cameroun pour quelle supervision?", Voulgre and Tchamabe (2019) raise critical questions regarding the appropriate supervision of ICT use in elementary schools. In another study, "Faire la classe différemment au Cameroun avec la robotique pédagogique: Bee-Bot avec des élèves de 10-12 ans," Tchamabe and Voulgre (2017) illustrate how ICT can be utilized in teaching primary school pupils. This presents a challenge that should be explored in English-speaking primary schools in Cameroon, considering potential linguistic barriers. Additionally, Tchamabe et al. (2019) in "Quelle école pour demain? Enjeux, priorités et défis" outline priorities and challenges that warrant examination concerning the use of ICT in CBA teaching and learning methods.

A recent presentation by a group of scholars, including Nchia et al. with M.D. Tchamabe, in Côte d'Ivoire focused on the use of CBA in higher education. Their paper, "Optimizing Moodle for Competency-Based Education in Higher Education: Challenges and Opportunities in Cameroon," offers insights applicable to bilingual secondary schools in Cameroon. An excerpt from their abstract illustrates the role of Moodle, a widely recognized Learning Management System (LMS), in supporting a shift towards developing practical competencies such as autonomy, critical thinking, and collaboration. However, the effective pedagogical integration of Moodle remains insufficient due to various institutional, pedagogical, and technical barriers. Recommendations for enhancing Moodle's contribution to CBE implementation include strengthening lecturer capacity, aligning policies with digital pedagogies, and fostering sectoral partnerships.

Lastly, a practical suggestion from Professor Louis Martin Onguene Essono during the thesis defense addressed the challenge of implementing CBA in areas lacking internet connectivity. His experiment with encouraging 10-12-year-old students to

enhance their reading and writing skills through motivational incentives, such as iPads, resulted in noticeable improvements in knowledge, skill performance, and attitudes towards achieving educational objectives. This highlights the critical challenge of whether similar motivational strategies can yield positive outcomes in remote areas without internet access.

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APPENDIX

UNIVERSITE DE YAOUNDE I
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CENTRE DE RECHERCHE ET DE FORMATION DOCTORALE EN SCIENCES HUMAINE, SOCIALE ET EDUCATIVES
******
UNITE DE RECHERCHE ET DE FORMATION DOCTORALE EN SCIENCES DE L'EDUCATION
******

THE UNIVERSITY OF YAOUNDE I
******
POST GRADUATE SCHOOL FOR THE SOCIAL AND EDUCATIONAL SCIENCE
******
DOCTORAL RESEARCH UNIT FOR SCIENCE OF EDUCATION
******

QUESTIONNAIRE

Dear Respondents,

As a doctoral candidate, I am conducting research on the Pedagogic ICT integration of competency-based approach teaching and learning method in Government Secondary Schools in Cameroon. The purpose of this questionnaire is to ascertain how pedagogic ICT integration affects competency-based approach teaching and learning. Feel free to be as open as you can when expressing your ideas. Because you will not be required to write your names down, you can be sure that you will never be identified by the answers provided. Your impartial contribution will be much valued.

Thanks for your cooperation.

Yours faithfully

Thecla DZEKASHU FANSO

SECTION A: BASIC INFORMATION

Instruction: Please tick (√) as appropriate as it concerns you

1. Gender

   ☐ Male ☐ Female

2. What is your class?

   Lower sixth ☐ Upper sixth ☐ Form 5 ☐

3. Do you have a personal computer or smartphone for studies at home? ☐ Yes ☐ No

4. If yes, how often do you use it per day?

More than 3 Hours ☐ 3-2 Hours ☐ 1-2 Hours ☐ Less than one Hour ☐

I do not use it at all ☐

SECTION B: THE USE OF ICTs Tools

Items	Statement	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1	I learn best using internet rather than traditional teaching methods					
2	The computer teacher always provides interesting learning skills					
3	In my school, projectors and computers are in good condition					
4	The computer rooms are spacious enough					
5	My classroom is set up in advance to use educational technology devices					
6	There are enough computers in the computer lab for our lessons					
7	ICTs devices and applications need maintenance					
8	We apply what we have learned using computer and internet					

9	I pay more attention to the ICT subject					
10	ICT as a subject helped me to learn more about computers					
11	The ICT subject provides new information/skills					
12	I already knew most of the computer skills before being taught					
13	I use a phone to interact with teachers and classmates for studies					
14	ICT plays an important part in my learning process					
15	ICT improves my knowledge					
16	I think the use of ICTs to learn is helpful after school					

SECTION C: ICT INFRASTRUCTURE

Items	Statement	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1	I visit the computer room during my free period for research					
2	I have a password in the computer lab that leads to my lessons					
3	My computer teacher pays keen attention to everybody					
4	The computer teacher gives us instructions on how to use the computer					
5	I receive encouragement from my computer teacher for my progression					
6	The computer teacher allows us to use the internet					
7	I love all ICT equipment for studies					
8	There is a multimedia hall for teaching and learning					
9	Cyber café improves my research skills					

10	My school make use of digitalize teaching					
11	Video presentations make learning interesting					
12	My teachers sometimes use smart/digital devices such as phones and laptops in class					
13	My school uses photocopy machines, Scanner, and Printers					
14	I use whatsapp group for academic exchange					
15	At times, teachers use projector during a lesson					
16	Sometimes, I use Microsoft word to do class assignments					
17	I receive and exchange audio records from teachers in the whatsapp platform					

SECTION D: E-LEARNING

Items	Statement	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1	In my school, there are online learning platforms					
2	My teachers teach through WhatsApp effectively					
3	I easily retain lesson presentation through Television					
4	I visit lessons from my teachers through youtube					
5	The internet works well in my school for studies					
6	I find the use of zoom for academic exchange interesting.					
7	Whatsapp and zoom increase my learning cooperation with my teachers					

SECTION E: COMPUTER-BASED DIRECT INSTRUCTION

Items	Statement	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1	My teachers use a computer to teach					
2	Rules and procedures are clearly presented on the online platform					
3	The use of computer and smartphones complement					
4	Demonstration and illustration through ICT tools make learning practical					
5	ICTs improve teaching and learning					

SECTION F: CBA TEACHING-LEARNING METHODS

Items	Statement	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
1	I always research information for my assignment after school					
2	My teachers use real life situations in teaching					
3	My teachers teach using practical examples					
4	Teaching methods vary including, group work, guided-work, online teaching					
5	The computer teacher put us to work in groups					
6	Most of the activities in my class are challenging					
7	My teacher always controls and inspects us to ensure effective quality learning					
8	There is an effective and proper use of gadgets in the teaching-learning process					
9	My teachers prompt me to participate in class					
10	Internet facilitates and supports our research					

Request for Interview

Dear Sir/Madam,

Subject: **Request for Interview**

My name is Thecla DZEKASHU FANSO. I am conducting research on the Pedagogic ICT integration of competency-based approach teaching and learning method in Government Secondary Schools in Cameroon. The purpose of this questionnaire is to ascertain how pedagogic ICT integration affects competency-based approach teaching and learning. My operational contexts of Pedagogic ICT integration: the use of ICTs, ICT infrastructure, e-learning, and computer-based direct instruction. You are free to contribute both in your capacity as an official and or as a researcher/scientist. Your experience in this domain and more could be very enriching to this study.

Yours faithful,

The Researcher

ICTs and Competency-Based Approach in Secondary Schools in Cameroon

Interview with teachers and parents teachers

Focus group Discussion

1. What do you think of the government policy in secondary schools in terms of pedagogic ICT integration of the CBA teaching-learning method?
2. What role do you play in implementing ICT in the classrooms?
3. What is the role of MINESEC in terms of partnerships with schools in Cameroon for proper CBA teaching/and learning methods?
4. How can you measure the change and effects in terms of the employability of graduates?
5. What is MINESEC doing in terms of curricula modification, and harmonization to embed employability skills in secondary education curricula?

Interview Questions to teachers

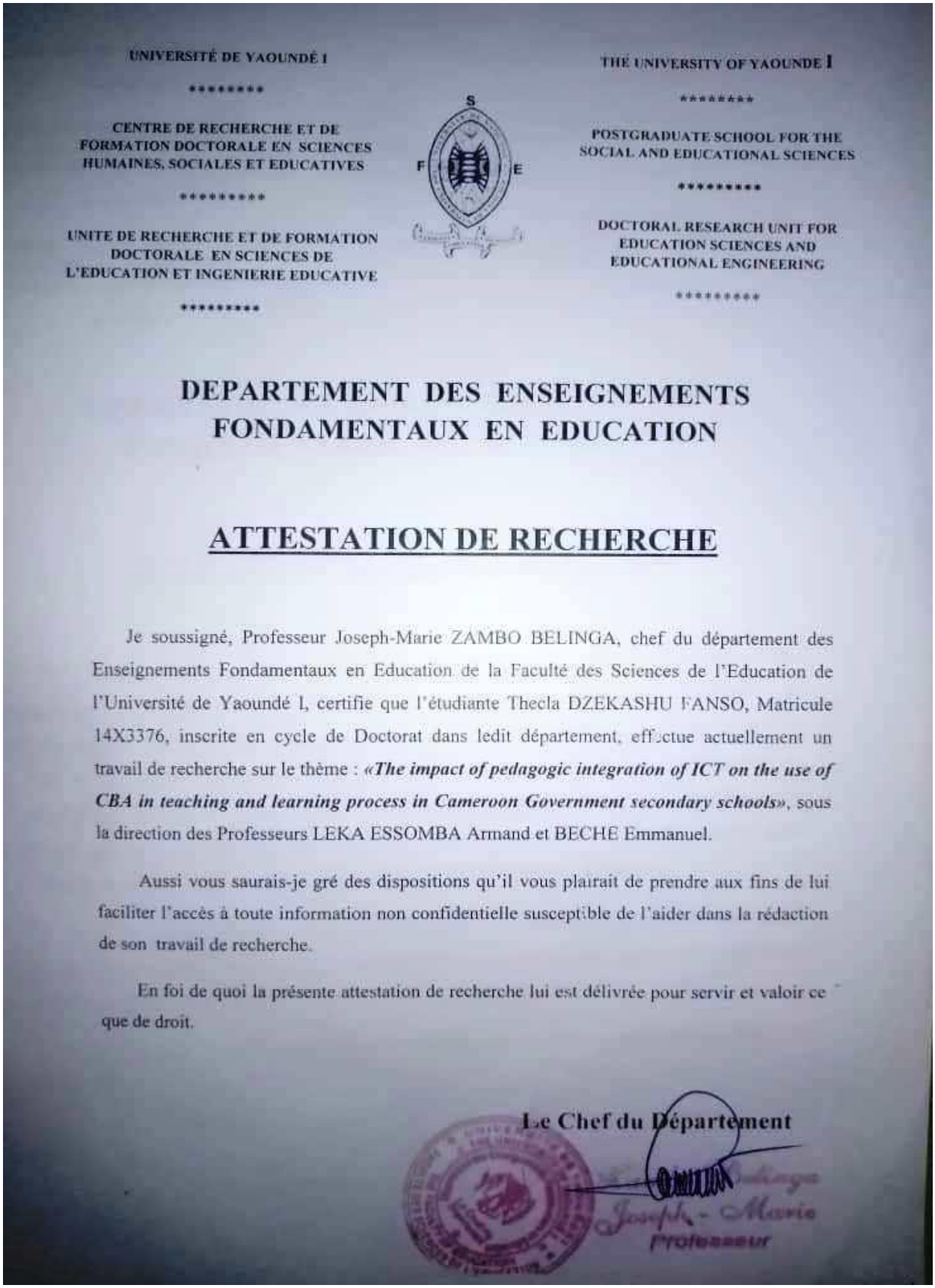
1. What do you think of the CBA teaching-learning method of your institution?
2. How would you describe the role of the school administration and teachers in using ICT and solving students' related problems?
3. What do you wish for pedagogic ICT integration in the future in your school?
4. What do you think hinders the application of educational technology in your school? Are the problems related to the adequacy of devices, time, financial problems, lack of training, or other issues?
5. What are the curricular and pedagogic implications of the CBA?

Interview Questions to parent teachers

1. What is your experience using the CBA teaching-learning method?
2. What are your views on the introduction and use of ICT in your classroom?
3. Do you prefer traditional methods of teaching or teaching using technology and why?
4. What is the current situation related to the use of ICT in your classroom?

5. How can you describe your planning process for a study syllable using the CBA?
6. How have you allowed for different learning styles when teaching a subject?
7. Describe a lesson where you had to use differentiated instruction
8. In your opinion, what is the purpose of the CBA in secondary schools?

Research Authorization



UNIVERSITÉ DE YAOUNDÉ I

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CENTRE DE RECHERCHE ET DE FORMATION DOCTORALE EN SCIENCES HUMAINES, SOCIALES ET EDUCATIVES

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UNITE DE RECHERCHE ET DE FORMATION DOCTORALE EN SCIENCES DE L'EDUCATION ET INGENIERIE EDUCATIVE

****

THE UNIVERSITY OF YAOUNDE I

****

POSTGRADUATE SCHOOL FOR THE SOCIAL AND EDUCATIONAL SCIENCES

****

DOCTORAL RESEARCH UNIT FOR EDUCATION SCIENCES AND EDUCATIONAL ENGINEERING

****

DEPARTEMENT DES ENSEIGNEMENTS FONDAMENTAUX EN EDUCATION

ATTESTATION DE RECHERCHE

Je soussigné, Professeur Joseph-Marie ZAMBO BELINGA, chef du département des Enseignements Fondamentaux en Education de la Faculté des Sciences de l'Education de l'Université de Yaoundé I, certifie que l'étudiante Thecla DZEKASHU FANSO, Matricule 14X3376, inscrite en cycle de Doctorat dans ledit département, effectue actuellement un travail de recherche sur le thème : ***«The impact of pedagogic integration of ICT on the use of CBA in teaching and learning process in Cameroon Government secondary schools»***, sous la direction des Professeurs LEKA ESSOMBA Armand et BECHE Emmanuel.

Aussi vous saurais-je gré des dispositions qu'il vous plairait de prendre aux fins de lui faciliter l'accès à toute information non confidentielle susceptible de l'aider dans la rédaction de son travail de recherche.

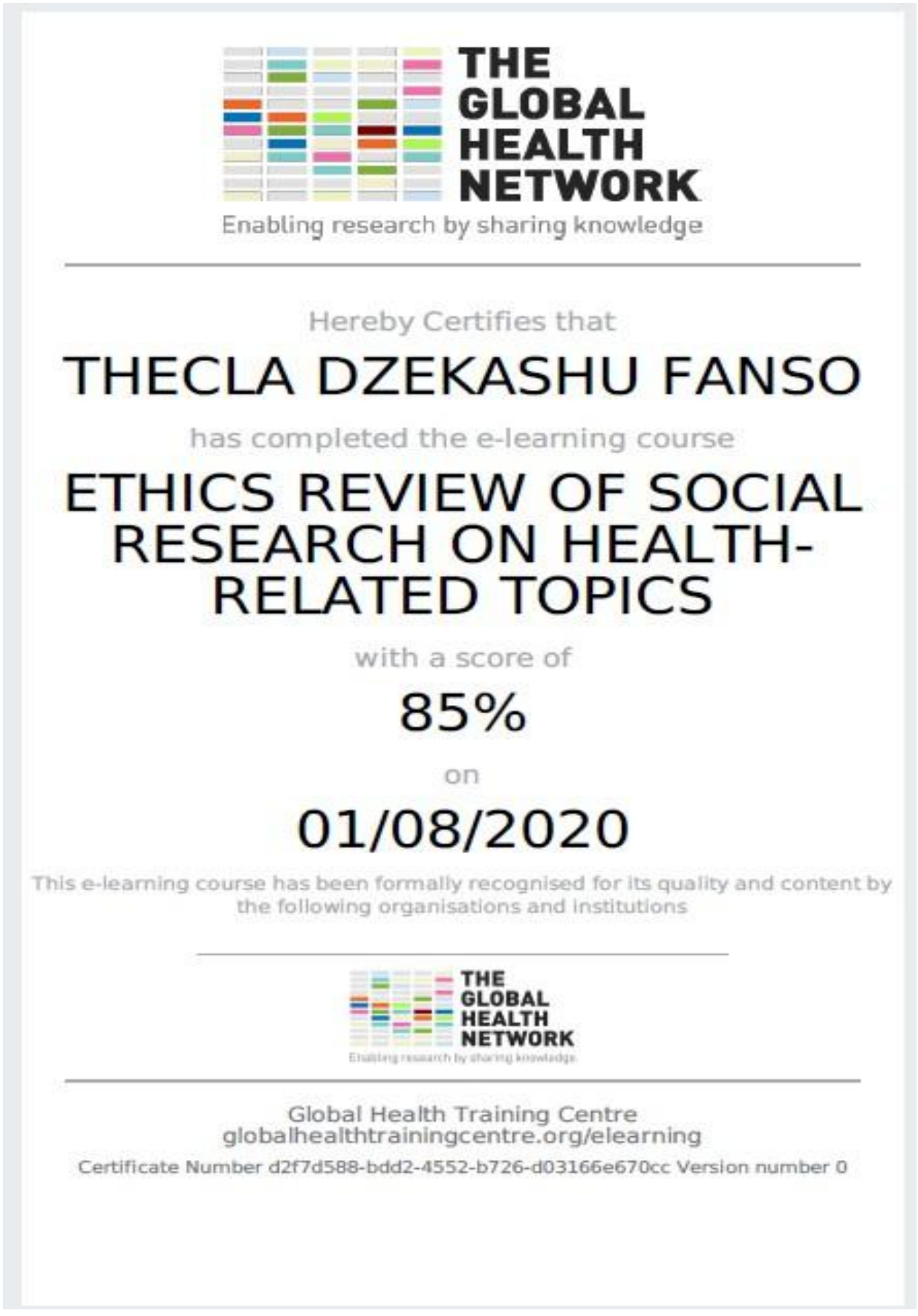
En foi de quoi la présente attestation de recherche lui est délivrée pour servir et valoir ce que de droit.

Le Chef du Département

Joseph-Marie
Professeur

Digital Training Certificate for Educators

Certificate of Research Ethics



Digitalization in Teaching Certificate

Formation de 50 enseignants du secondaire de Yaoundé / Mfoundi

Training of 50 secondary school teachers from Yaounde / Mfoundi

GLOBAL TEACHER GRANT 2023

CERTIFICAT DE PARTICIPATION

ATTENDANCE CERTIFICATE

RITZENTELAR née Thecla D. FANSO

A suivi une formation du 05 au 06 avril 2023 sur

Participated in a training workshop from April 05 to 06, 2023 on

LA DIGITALISATION DANS L'ENSEIGNEMENT

DIGITALIZATION IN TEACHING

Yaoundé, le 06 avril 2023

Yaounde, April 6th, 2023

Le bénéficiaire et coordonnateur du projet

The Grant Awardee and Project Lead

Robert KENFACK

U.S Embassy, Yaounde - Cameroon

Cameroon Fulbright TEA Alumni Association

IREX

FULBRIGHT Teacher Exchanges

LIST OF INFORMANTS

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1	Mrs Mvolo Nee Zangana Tecle	Principal	2023	GBHS Ekounou
2	Mr Tambe Takornkon Beradette Akombi	Vice Principal for the Multimedia services	2023	GBHS Ekounou
4	Mrs Awondo Marthe Viviane	Chief of Service for Multimedia services	2023	GBHS Ekounou
5	Mrs Nweti Abogneshi Benardine	HOD computer Science	2023	GBHS Ekounou
6	Mrs Nformi Yvette	HOD computer Science	2023	GBHS Yaounde
7	Mr TambeAgbor Teddy Tabekwere	Principal	2023	GBHS Yaounde
8	Mrs Ndiangoh Taku	Vice Principal	2023	GBHS Yaounde
9	Mr Djeugang Aldophe	Chief Monitor	2023	GBHS Yaounde
10	Dr/Mrs Vefonge nee Effange Emilia Ngowo	Principal	2023	GBHS Emana
11	Mr. Che Emmanuel Anye	Vice Principal	2023	GBHS Emana
12	Mrs Kuaounang Tatiana	HOD Computer Science	2023	GBHS Emana
13	Mrs Elizabeth Lyonga	Principal	2023	GBHS Limbe
14	Mr Anu George	Vice Principal	2023	GBHS Limbe
15	Mrs Nkeng Vivian	HOD Computer Science	2023	GBHS Limbe
16	Mrs Lyonga Cecillia Namondo	Principal	2023	BGS Molyko Buea
17	Ngongang Duc Roland	Computer Lab. Monitor	2023	BGS Molyko Buea
18	Dimoi Raymond	HOD Computer Science	2023	BGS Molyko Buea

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