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TEACHER TRAINING PROGRAM AND THE INTEGRATION OF ICTs IN CAMEROON SECONDARY SCHOOLS

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This is to certify that the Dissertation titled: **"TEACHER TRAINING PROGRAM AND THE INTEGRATION OF ICTS IN CAMEROON SECONDARY SCHOOLS"** was carried out by **TUMABANG EMMANUEL SHU**, under my supervision and submitted to the University of Yaoundé 1 in fulfilment for the award of a Master's Degree in Curriculum Development and Evaluation.

Name: Prof. KIBINKIRI ERIC LEN.

Signature: ……

Date: ……

DEDICATION

To my parents, Mr Tumabang Samuel Neba and Mrs Tumabang Tryphena Lum.

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LISTS OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

Information and Communication Technologies (ICTs)

Computer and Internet Access Centres (CIAC)

Association for Development, Communication and Environment (ADCOME)

National Agency of ICTs (ANTIC)

Inspectorate General of Education (IGE)

SPSS: Statistical Package for the Social Sciences

Cameroon Radio Television (CRTV)

Southeast Asian Ministers of Education Organization (SEAMEO)

Higher Teacher Training College (HTC)

Technology Acceptance Model (TAM)

Theory of Planned Behaviour (TPB)

Unified Theory of Acceptance and Use of Technology (UTAUT)

Technological Pedagogical Content Knowledge (TPACK)

ICT Infrastructure (ICTIN)

Program and Course Content (PCCT)

Teaching and Learning Activities (TLACT)

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ABSTRACT

The integration of Information and Communication Technology (ICT) has become a new challenge for teacher training institutions in Cameroon who have the responsibility to train teachers that are competent, dynamic and motivated to meet up with the current and future demands of teaching with ICTs upon graduation. Though all teacher training colleges teach ICTs to student teachers, ICT integration is still very low. Nevertheless, teachers who have been trained in these institutions are still not able to integrate ICTs in teaching, implying that there is probably a problem with the training program. The objective of this study was to find out the teacher's perceptions of the effect of the teacher training program on the integration of ICTs in Cameroon Secondary Schools. The research design for this study is the Survey research design (cross-sectional), using the quantitative approach. Sampling was simple random sampling. The sample was Biology teachers who graduated in the year 2018 from Higher Teacher Training College (HTTC) Bambili. Data was collected online using Google Forms from a total of 66 respondents found across the national territory. The data were analysed for both descriptive and inferential statistic using SPSS (version 21) software. The results indicated that Teacher Training Program had a significant effect on ICT Integration in Cameroon secondary schools. ICT Infrastructure, Program and Course Content and Teaching-Learning Activities all had a significant effect on ICT integration. Teaching-Learning Activities which was the strongest predictor constitutes a good target for intervention and is therefore recommended for effective ICT integration in teacher training programs.

Key words: Teacher-training program, Integration of ICTs, Cameroon secondary schools

RESUMÉ

L'intégration des Technologies de l'Information et de la Communication (TIC) est devenue un nouveau défi pour les institutions de formation des enseignants au Cameroun qui ont la responsabilité de former des enseignants compétents, dynamiques et motivés pour répondre aux exigences actuelles et futures de l'enseignement avec les TIC dès l'obtention de leur diplôme. . Bien que toutes les écoles normales d'enseignants enseignent les TIC aux élèves-enseignants, l'intégration des TIC est encore très faible. Néanmoins, les enseignants qui ont été formés dans ces institutions ne sont toujours pas en mesure d'intégrer les TIC dans l'enseignement, ce qui implique qu'il y a probablement un problème avec le programme de formation. L'objectif de cette étude était de connaître les perceptions des enseignants sur l'effet du programme de formation des enseignants sur l'intégration des TIC dans les écoles secondaires du Cameroun. La conception de recherche pour cette étude est la conception de recherche par sondage (transversale), utilisant l'approche quantitative. L'échantillonnage était un échantillonnage aléatoire simple. L'échantillon était composé d'enseignants de biologie diplômés en 2018 du Collège supérieur de formation des enseignants (HTTC) de Bambili. Les données ont été collectées en ligne à l'aide de Google Forms auprès d'un total de 66 répondants répartis sur l'ensemble du territoire national. Les données ont été analysées pour les statistiques descriptives et inférentielles à l'aide du logiciel SPSS (version 21). Les résultats ont indiqué que le programme de formation des enseignants a eu un effet significatif sur l'intégration des TIC dans les écoles secondaires du Cameroun. L'infrastructure des TIC, le contenu des programmes et des cours et les activités d'enseignement et d'apprentissage ont tous eu un effet significatif sur l'intégration des TIC. Les activités d'enseignement-apprentissage qui étaient le prédicteur le plus fort constituent une bonne cible d'intervention et sont donc recommandées pour une intégration efficace des TIC dans les programmes de formation des enseignants.

Mots clés : Programme de formation des enseignants, Intégration des TIC, Lycées Camerounais

CHAPTER 1
INTRODUCTION

We are living in an era characterized by rapid technological development in most aspects of our lives. Technological development is fast becoming the standard for many nations of the world especially in the social, economic and educational domains. This remains a serious challenge for most African countries which are still in the early stages of effective integration of ICTs in the educational system to step up the quality of education and meet up with the demands of the fast wind of globalisation. This has caused a digital divide between most developed countries and the developing countries, with Cameroon being a good example. The introduction of ICT into schools and in the learning process was driven by global forces which are beyond the school-based decision making (Voogt, 2013).

Cameroon has for several years been trailing in the employment of Information and Communication Technologies (ICTs) to facilitate learning and teaching in schools. Although with the overwhelming impact of new technologies globally, numerous factors still account for the setbacks in bridging the digital divide in developing nations (Nganji et al 2010).

An important factor for teachers to integrate technology into instruction is being trained on how to integrate technology into education (Pamuk&Peker, 2009) Information and Communication Technologies (ICT) appear to be not only the backbone of the Information Society, but also a crucial catalyst and tool to bring about educational reforms which enable our students to be productive knowledge workers (Pelgrum, 2001). We must certainly embrace technology in education and integrate it in our classrooms, if we really care about the demands of the coming generation on the students we are teaching. Will these students be able to cope? What are teachers doing about all these? It's up to us to decide.

Background of the study

Historical Background

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 (Shaibu et al., 2017). However, the Law No. 98/004 of April 14, 1998of Orientation of Basic and Secondary Education (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"

Between 1998 and 1999, some private and mission schools such as College François Xavier Vogt made efforts to introduce the use of ICT in education with limited success (Nsolly N. and Charlotte N. 2016). Nganji et al., (2010) reported on one of the pioneer projects, the Computer and Internet Access Centres (CIAC) project, launched in the year 2000 by the Association for Development, Communication and Environment (ADCOME), a non-governmental organisation with headquarters in the Southwest Region of Cameroon. The CIAC project focused on bridging the digital divide mainly in schools through installation of computers and internet and recruiting computer engineers to teach in the schools. ADCOME's initial objective was to bring internet closer to the people at low cost in 2000 (Nganji 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 (Nsolly N. and Charlotte N. 2016).

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 (Mbangwana, 2008). He promised the introduction of computing in schools and the provision of computer rooms to schools. The impact of this Presidential speech acceleratedin 2002, with the introduction of ICT in secondary general and technical schools. Numerous schools have benefited from presidential "gifts" of multimedia centres connected to internet. Official programs of ICT were designed for secondary schools in 2003 (ERNWACA-Cameroon, 2005: 11).

ICT syllabuses and National Sequential Schemes of work published in 2008 were made available to Nursery, Primary and Teacher Training Education. Textbooks have also been written and validated by the National Book Commission to facilitate the teaching of ICTs (République, 2007a). In secondary schools, between 2003 and 2010, there were no qualified teachers except part-timers who were either graduate students in Computer Sciences or teachers of other disciplines like Mathematics, Physics, etc. who had little or no knowledge in Computer Science pedagogy (Nsolly N. and Charlotte N. 2016).

In 2007, the field of Computer Science and Educational Technologies was established at the Higher Teacher Training College (HTTC) Yaounde (Centre Region) to train general secondary school ICT and Computer Science teachers. The following year, a similar field was established at the Higher Teacher Training College, Maroua (Far North Region).

In 2009, an information management system was set up at the Higher Teacher Training College, Bamenda (North West Region) to train technical secondary school teachers. This led to the institution of Information Technology as a school subject in January 2011, which entered into force in February of the same year; IT was introduced as a compulsory subject in all MINESEC official examinations (Nsolly N. and Charlotte N. 2016).

In 2009, Cameroon published the Growth and Employment Strategy Paper aimed at transforming the country into an emerging nation by 2035 (Nkwenti N. 2015). The paper highlighted strategic goals in the area of ICT to be achieved by 2020 namely increased landline and mobile teledensity, improved ICT access and use for villages, and increased ICT sector employment (Republic of Cameroon, 2009, p. 63).

Theoretical Background

The major theories of learning often used in education were developed decades ago at the time technology integration was virtually overlooked as critical issue. These theories have shaped education all these years and despite a lot of research, many of them still stand the test of time. They have mostly appeared as a long continuum of theories with hard-to-determine boundaries. All these theories have in one way or the other affected our understanding of learning and using technologies even till date.

The first learning theory which was used to scientifically explain behaviour in animal and human learning was behaviourism. Behaviourism was initially developed in the 1920s with its golden age in the 1950s (Hammad et al., 2020). Behaviourism defines learning as a sequence of stimulus and response actions in observable cause-and-effect relationships (Mechlova and Malcik, 2012). Behaviourists focus on measurable changes (increase, decrease, or maintenance) in behaviour that comes from the interaction between and organism with the environment. They consider the learner's mind as a black box while always focusing on the changes in the learner's behaviour (Kruse, 2009). It is associated with a number of theorists, e.g. Pavlov and Watson; however, Skinner's view is currently the most dominant (Bates, 2019).

Behaviourism is divided into classical conditioning, which refers to natural reflexes in response to various stimuli, and operant conditioning, which refers to the reinforcement of these responses through extrinsic rewards or punishments so that such responses become more/less probable in the future (Usman and Ogbu, 2019).

Behaviourism is attractive because it easily explains some learner actions (Aubrey and Riley, 2018). On the other hand, it does not explain internal learning processes or learners' reasoning and thinking, especially higher-level critical thinking skills and problem-solving (Agarkar and Brock, 2017).

Despite much controversy over behavioural approaches to teaching, the theory has made significant contributions to pedagogy, including direct teaching, contingency contracts, the role of incentives and reward structures (Shuell, 1986), the role of repetition and feedback (Bandura, 1991), the importance of clarifying learning objectives, and the introduction of behaviour management strategies, such as functional behaviour assessment and positive behavioural supports (Woolfolk, 2011). These have been applied in the integration of ICTs. For example, the setting or goals and the use of incentives and rewards are commonly used to motivate teachers to engage technology integration in their classrooms.

Behaviourism's failure to explain different learning processes led to the so-called cognitivist revolution, which replaced behaviourism in the1960s as the dominant paradigm (Watrin and Darwich, 2012). Cognitivists believe that mental processes are essential for explaining behaviour. Hence, cognitive theories focus on how learners make meaning out of new information and experience. The information processing theory considers the mind as a computer, which means that both humans and computers accept inputs, process the musing previous knowledge and long-term memory and produce outputs (Pratiwiet al., 2019). Cognitivism is effective because it has led to various inventions, including: (1) adaptive systems that analyse learner responses and direct his/her to appropriate actions and (2) artificial intelligence (AI)-based techniques that represent the mental processes used in human learning (Bates, 2019). However, from an epistemological perspective, cognitivism belongs to an objectivism view, which means that knowledge is absolute, matches reality and exists outside the human mind independently of what an individual may or may not believe (Harasim, 2012). This point is obviously not true for all kind of knowledge. This reason, cognitivism should not be seen as the opposite of behaviourism.

The next major theory is the theory of Constructivism. Unlike behaviourism and cognitivism, constructivism takes a holistic approach, where each learner, individually and socially, constructs his or her own knowledge and meaning while he or she learns Hence, learners make sense of their external environments by a meaning-making process that depends on previous internal experiences (Mattar, 2018). Constructivists focus on the uniqueness of learners. Humans are very dynamic in nature: their views and values change over time, and this change impacts future knowledge. Moreover, the learner is at the centre of a continuously changing rich world of facts, experiences and knowledge (Hammad et al., 2020). This therefore implies that despite the fact that learners use previous knowledge to make meaning of their environment, every learner is unique and his or her behaviour is not easily predictable.

According to this theory, when learners see new information, they either Assimilate it or they accommodate it. To assimilate means to fit new information within their existing mental framework, while to accommodate means to add to or modify their existing mental framework.

This theory has been applied in designing lessons related to technology integration. Since technology integration is relatively new to most teachers and teacher educators, the constructivist approach is most helpful because it focuses on building knowledge over time from the surrounding world of changing experiences. As time goes on, more and more teachers get to spend more time with technologies, and therefore slowly build their knowledge and experiences.

Constructivism has been criticised because mistaken mental frameworks might be used to construct new knowledge, and it is not easy to discover or modify mistaken mental frameworks (Hammad et al., 2020).

The social learning theory links learning with its social contexts and perspectives. For instance, Wenger recognises learning as a social process (Farnsworthet al., 2016). According to this theory, knowledge is either acquired through a social process or institutions that are socially constructed (e.g. schools). Consequently, knowledge is conceptualised as content plus the socially constructed value (Bates, 2019). In the social learning theory, knowledge is constructed via social interaction, and learners learn from observing and interacting within social and cultural contexts (e.g.social learning environments). Such environments are built by learners using a collection of social tools, e.g. social networking, tagging, blogging, etc. But, these socially rich environments may distract learners from achieving their goals as they lack effective support (Hammad et al., 2020). The social learning theory is related to cognitivism

because it admits the existence of individual intelligence and reasoning (Farnsworthet al., 2016).

Lev Vygotsky's work is most frequently associated with socio-cultural theory and the social constructivism movement (Laurence, 2009). Vygotsky viewed learning and development as a social process wherein learners "grow into the intellectual life of those around them" (Subban 2006). As such, learning is a process of enculturation or appropriation, wherein learners gradually "internalize or take for themselves knowledge and skills they developed in their inter-actions with others and with cultural tools" (Wood, 1989). Although Vygotsky likely identified the more knowledgeable other as a teacher or a peer, easy access to information afforded today's students (in the form of text, audio, and video) can also support student learning thereby replacing the more knowledgeable other. More knowledgeable others provide support and scaffold the knowledge or skill acquisition process for the learner (Hammad et al., 2020).

This theory is actively being applied in the area of technology integration. Teachers are often encouraged to work with their colleagues who are more knowledgeable than them in terms of technology integration in teaching. Group work is also encouraged during training sessions related to the use of technology in teaching. The social interactions among learners and teachers help to motivate learners and also to break the phobia that is keeping many teachers from taking a first bold step.

The theory of Connectivism emerged based on evolving educational technology advancements. These advancements reveal the following drawbacks of behaviourism, cognitivism and constructivism: their intrapersonal view of learning, their failure to address learning located within technology/organisations and their lack of contribution to the value judgments that need to be made in knowledge-rich environments (Hammad et al., 2020). Siemens (2018) introduces the main principles of connectivism as a new learning theory as follows:(1) learning and knowledge rest in the diversity of opinions; (2) learning is a process of connecting specialised information sources; (3) learning may reside in non-human appliances;(4) the capacity to know more is more critical than what is currently known; (5) nurturing and maintaining connections is needed to facilitate sustained learning; (6) the ability to see connections between fields, ideas and concepts is a core skill; (7) accurate and up-to-date knowledge is a must; and (8) choosing what to learn and the meaning of incoming information is a learning process.

Connectivism is the first attempt to radically re-examine the implications of technological advancements on learning (Bates, 2019). It creates an opportunity to understand new learning models that emerged out of technological developments because it extends learning outside the learner. Yet, Siemens's description of connectivism as a successor to behaviourism, cognitivism and constructivism can be easily challenged because it neither adds to the principles of existing theories nor explains how learning can reside in non-human appliances. Additionally, learners struggle in unstructured learning environments, lack control and get overwhelmed by peer-generated contents and need explicit support (Bates, 2019).

Lessons learnt reveal the importance of analysing various learning theories, as they complement rather than compete with each other. It is clear from our study of the various theories of learning that boundaries between learning theories are not clear to the extent that one learning model can be mapped to one learning theory. This is also reflected in the various classifications of learning theories that exist in the literature. Many of these classifications look into learning theories from one perspective such as epistemology or psychology (Hammad et al., 2020). We can also see that the older theories did not consider the aspect of technology in learning, but their implications could still be exploited to improving the role of ICTs in education.

Among these theories, the constructivist theory is often preferred because constructivism takes a holistic approach, where each learner, individually and socially, constructs his or her own knowledge and meaning while he or she learns. Their external environment becomes a meaning-making process that depends on previous internal experiences. The teachers, being beginners for the most part build their knowledge through their personal and social experiences as they interact with others who are better than them in terms of integrating technology in the classroom.

Conceptual Background

ICT is a one among many words that describe the link between technology and education. It is often related with words such as distance learning, e-learning, digital pedagogy, blended learning, flip classroom, etc. It will be necessary to take a brief look at some of these concepts related to ICT.

The Concept of ICT

ICT is an abbreviation that stands for Information and Communication Technology. According to Ajayi (2008), It is defined as a diverse set of technological tools and resources used to communicate, create, disseminate, store, and manage information. UNESCO UIS (2009) defines ICT as a Diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.)

The Concept of E-Learning

Schank (2002), Roffe (2002), Sambrook (2003) and Tsai & Machado (2002) refer to e-learning as "communication and learning activities through computers and networks (or via electronic means)" To be more specific, Fry (2000) defines e-learning as "delivery of training and education via networked interactivity and a range of other knowledge collection and distribution technologies." This definition by Fry (2000) is in line with the definition proposed by Wild et al., (2002) who defined e-learning as the creation and delivery of knowledge via online services in the form of information, communication, education and training. Horton (2001) highlighted that Internet and web technology is important in e-learning and defined e-learning as "the use of Internet and digital technologies to create experience that educate fellow human beings."

Apart from web-based technology, e-learning seemed to require multimedia-based courseware (Lahn, 2004). Therefore, it is clear that e-learning is centred on Information and Communication Technology (ICT). It is not surprising that Hamid (2002) and Lytras et al., (2002) mentioned that e-learning evolved around Information Technology to enhance the learning performance and efficiency. Furthermore, Evans & Hasse (2001) pointed out that technology is indeed needed in e-learning to educate the learner through the usage of two-way video, two-way computer interaction, cable, satellite downlinks and Internet. Honey (2001) provided many good examples of learning activities that involved ICT. These examples include learning from e-mail, online research, online discussion and coaching by e-mail.

E-learning system can benefit learners over traditional head-on learning mechanism by facilitating students to learn at their own pace and time with the use of computer or mobile,

and internet facility, it reduces the expenses as well by not driving to university or college and other stationary cost consumed by students every day in the classroom (Solangi et al., 2018).

The Concept of Digital Pedagogy

Digital pedagogy is a challenging concept to define because it can be examined from many perspectives (Väätäjä & Ruokamok, 2021). Generally, "digital pedagogy" refers to the use of electronic elements to enhance or change the experience of education (Croxal, 2012). Kivunja (2013, p.131) presented a more detailed definition, referring to "digital pedagogy" as the skill of embedding digital technologies into teaching so that they enhance learning, teaching, assessment, and curriculum.

According to Charles (2013) digital pedagogy simply refers to the embedment into the art of teaching, computer driven digital technologies, which enrich learning, teaching, assessment and the whole curriculum. To Prestridge (2012, p.449), digital pedagogy cannot be considered only as the use of digital technologies within teacher-directed approaches; rather, it also includes practices in which ICT is used to enable learners' collaboration, creation, and active use of information (p.457). By this, he showed that the definition of digital pedagogy should not be limited to the use of digital technologies. Digital pedagogy should involve more than the simple use of technology in the classroom; the use of technology should be based on problem solving and developing higher-order thinking skills (Sailin &Mahmor, 2018, pp.146–147).

Concerning the approach to digital pedagogy, Milton and Vozzo (2013, p.76) argued that digital pedagogy has more in common with the constructivist approach to teaching than it does with traditional pedagogy, because it concentrates on how students construct their own knowledge. This view is in line with with Sailin and Mahmor (2018, p.144) who argued that the teaching and learning processes should become more constructivist and learner-centred when digital technologies are integrated into teaching. The constructivist and learner-centred approaches are expected to enhance the skills students need in the 21st century (Sailin & Mahmor, 2018, p.146–147). On the other hand, Pittman and Gaines (2015) stated that the socio-cultural approach emphasizes giving learners the opportunity to contact other individuals and parties who are not in their immediate vicinity with the help of various media or technologies. Therefore, learners should become the creators of knowledge themselves by interacting with the environment (Pittman & Gaines, 2015, pp.540, 550).

The Concept of Distance Learning

Distance education is the most renowned descriptor used when referencing distance learning. It often describes the effort of providing access to learning for those who are geographically distant (Moore et al., 2010). Relevant literature shows inconsistent definitions of distance education and distance learning by various authors and researchers. As computers became involved in the delivery of education, a proposed definition would be the delivery of instructional materials, using both print and electronic media (Moore, 1990). The instructional delivery included an instructor who was physically located in a different place from the learner, as well as possibly providing the instruction at disparate times. Keegan (1996) went further by suggesting that the term distance education is an "umbrella" term, and as such, has terms like correspondence education or correspondence study that may have once been synonymously used, being clearly identified as a potential offspring of distance education. King, Young, Drivere-Richmond, and Schrader (2001) do not support the interchangeable use of the terms distance learning and distance education, because both terms do differ. Distance learning is referenced more as ability, whereas distance education is an activity within the ability [of learning at a distance]; though, both definitions are still limited by the differences in time and place (Volery & Lord, 2000).

As new technologies become apparent, learning seemed to be the focus of all types of instruction, and the term distance learning once again was used to focus on its limitations associated with "distance", i.e. time and place (Guilar & Loring, 2008; Newby et al., 2000). The term then evolved to describe other forms of learning, e.g. online learning, e-Learning, technology, mediated learning, online collaborative learning, virtual learning, web-based learning, etc. (Conrad, 2006). What we can deduce from the above definitions that one thing was common is that it involves some form of instruction which occurs between two parties (a learner and an instructor); it is held at different times and/or places, and uses it uses varying forms of instructional materials (Moore et al., 2010).

The Concept of Online Learning

Online learning can be the most difficult of all three to define. Some prefer to distinguish the variance by describing online learning as "wholly" online learning (Oblinger & Oblinger, 2005), whereas others simply reference the technology medium or context with which it is used (Lowenthal et al.,2009). Online learning is described by most authors as access to learning experiences via the use of some technology (Benson, 2002; Carliner, 2004; Conrad, 2002). Both Benson (2002) and Conrad (2002) identify online learning as a more recent version

of distance learning which improves access to educational opportunities for learners described as both non-traditional and disenfranchised. Hiltz and Turoff (2005) in particular not only elude to the relationship between online learning and distance learning / traditional delivery systems but then, like Benson (2002) makes a clear statement that online learning is a newer version or, and improved version of distance learning. These authors, like many, believe that there is a relationship between distance education or learning and online learning but appear unsure in their own descriptive narratives.

Singh & Thurman (2019) define Online Learning is defined as "learning experiences in synchronous or asynchronous environments using different devices (e.g., mobile phones, laptops, etc.) with internet access. In these environments, students can be anywhere (independent) to learn and interact with instructors and other students" The synchronous learning environment is structured in the sense that students attend live lectures, there are real-time interactions between educators and learners, and there is a possibility of instant feedback, whereas asynchronous learning environments are not properly structured. In such a learning environment, learning content is not available in the form of live lectures or classes; it is available at different learning systems and forums. Instant feedback and immediate response are not possible under such an environment (Littlefield, 2018). Synchronous learning can provide a lot of opportunities for social interaction (McBrien et al., 2009).

There is a requirement of a quick shift to online learning mode; therefore, the products by Google can be really useful under such problematic situations; they are (a) Gmail, (b) Google Forms, (c) Calendars, (d) G-Drive, (e) Google Hangouts, (f) Google Jam board and Drawings, (g) Google Classroom, and (h) Open Board Software (not a Google product, helps in recording meetings in the form of files). These tools can successfully be used as an alternative for face-to-face classes (Basilaia et al., 2020).

Most of the terms (e.g. online learning, open learning, web-based learning, computer-mediated learning, blended learning) have in common the ability to use a computer connected to a network, that offers the possibility to learn from anywhere, anytime, in any rhythm, with any means" (Cojocariu et al., 2014).

The Concept of Blended Learning

Blended learning is one of the terms often used by authors and researchers when linking education and technology. Even though the term blended learning is frequently used, there is ambiguity about what is actually meant (Oliver and Trigwell, 2005). Interpretations of the

concept to blended learning have varied over time, and it has been defined variously worldwide. The term has been used since the advent of the Internet and the World Wide Web in the late 1990s. Although the concept was first developed in the 1960s, the formal terminology used to describe it did not take its current form until the late1990s (Friesen, 2012).

Graham (2006) defines blended learning as follows: Blended learning systems combine face-to-face instruction with computer-mediated instruction (p. 5). Driscoll (2002) also argued that blended learning has taken on several means, such as combining modes of web-based technology, pedagogical approaches, instructional technologies and actual job tasks. However, she argued that the point of blended learning is that it means different things to different people; illustrating the untapped potential of blended learning.

The use of the term blended learning is relatively new. Before the term became widely used, the term hybrid learning was used quite often. These days the terms blended learning and hybrid learning are used interchangeably (Graham 2009). Similarly, to the reviewed blended learning definitions, a hybrid learning environment has been described as combining face-to-face education with access to online learning tools (Hall and Davison, 2007). In fact, Olapiriyakul and Scher (2006, p. 288) stated that the two terms (hybrid learning and blended learning) are used alternatively but refer to the same concept. The term hybrid learning might have been more widely adopted in practice than in research, as there are quite few highly cited papers on hybrid learning, as compared with blended learning research (Hrastinski, 2019). Blended learning environments include not only the physical presence of teachers and students but also the students' ownership and control of the time, place, setting, path, and pace at which their learning takes place (Banditvilai, 2016).

Contextual Background

Cameroon, like many other developing countries in SSA, is facing numerous challenges when it comes to the integration of technology in education. Teachers' use of ICT in Cameroon has been less than optimal, and in spite of its potential educational benefits of ICT in Education (Shaibu et al., 2017). There have been some initiatives to improving the situation taken by the government. ICT was introduced in secondary schools, they were actually introduced in 1998 but only became operational four years later with the setting up of the general inspectorate in charge of Computer Science (Fouda et al. 2013). In fact, before the ministries of education could provide the ICT curricula, several private primary and general secondary and technical

schools in major cities had acquired computers and begun to provide courses on ICTs and with ICTs (Karsenti et al. 2012).

It was later in February 2001 that the President of the Republic called for the orientation of education toward the knowledge economy in his address to the Cameroon youths (République du Cameroun, 2007). This led to the official introduction of ICTs in general and technical secondary schools and since then many schools have been receiving presidential grants in the form of Multimedia Resource Centres with Internet connection (Mbangwana 2008). Government involvement in the area of ICTs seriously began with the development of the policy document and the general strategy for the integration of ICTs in all sectors by the National Agency of ICTs (ANTIC) and the setting up of Multimedia Resource Centres in some primary and secondary schools (Government Bilingual High school Yaounde, Lycée Général Leclerc, Yaounde and Government Bilingual High School, Joss, Douala), and some primary schools like École des "Champions" of the Chantal Biya Foundation (Nsolly N. and Charlotte N., 2016).

Among the strategies of the government to solve this issue was the publication of the Growth and Employment Strategy Paper aimed at transforming the country into an emerging nation by 2035. The paper underscored strategic goals in the area of ICT to be achieved by 2020 including increased landline and mobile teledensity, improved ICT access and use for villages, and increased ICT sector employment (Republic of Cameroon, 2009, p. 63). Although ICTs are gradually being made available in classrooms, the pace seems to be too slow and these strategies are far from being actualised in the field.

The major shock that hit the world since 2019 was the COVID-19 Pandemic, which exposed the current state of preparedness of the countries of the world to make learning possible despite times of crisis. The pandemic brought many countries to their knees. With more than 320 deaths and almost 15,000 officially confirmed cases as of 6 July 2020 (Coronavirus Statistiques 2020), Cameroon was among the topmost COVID-19-afected countries in sub-Saharan Africa. The spread of COVID-19 in Cameroon, which began on 6 March 2020, has not left the education sector unscathed: on the contrary, it has had a significant impact on schools (UNESCO 2020). The nationwide paralysis of the education sector caused by the pandemic meant that over 6 million learners in primary and secondary schools were out of school. (UNSD, 2020).

The start of the pandemic in Cameroon met with multiple crises affecting the education sector in many parts of the country. UNICEF and other humanitarian actors observed that the crisis in the English-speaking regions had displaced over half a million people and deprived 700,000 children of schooling (SODEI Report, 2021). All these challenges further favoured the widening of the gaps of inequalities, due to the many differences and disparities that exist in terms of geographical location, teacher competence for distance learning, access to ICT infrastructure and tools etc.

The fact that distance technologies are still weakly and unevenly distributed among the Cameroonian population continues to threaten to widen these disparities further (Mbodiam, 2019). Educational structures have proven unable to adapt sufficiently quickly to the COVID-19 emergency to ensure the normal functioning of education throughout the pandemic. One of the reasons for this is that before COVID-19, distance education received little institutional attention, despite the flaunting of techno-pedagogical innovations since 2001–2002 (Béché 2017b).

The amount of time which elapsed between the first confirmed case of COVID-19 in Cameroon (6 March 2020) and the launch of distance schooling (6 April) reflects the chaos and shock experienced in the field of education (Béché 2020). This delay was as a result of the time it took for the stake holders of education to improvise on ways to make learning continue despite the lockdown. Between 6 March 2020, the date of the first confirmed case of COVID-19 in Cameroon, and 17 March 2020, the date of the first government communication on the Cameroonian response to the pandemic, almost a dozen days of silence elapsed. However, on the eve of 17 March, the University of Yaoundé 1, on its own initiative, issued a communiqué listing the academic measures it intended to take in response to COVID-19 (CamerounWeb 2020). The University of Yaoundé 1 was therefore the first institution to publicly demonstrate concern about the corona virus and its impact on education. This university initiated the lockdown of campuses and the suspension of face-to-face academic activities, and in doing so paved the way for what its Rector called “a radical change in teaching methods by strengthening digital education” (CamerounWeb 2020).

Following the Prime Minister’s first communication on COVID-19 on 17 March (SPM 2020), other administrative structures were galvanised into action, as though they had been waiting for the government “referee” to announce “kick-off” (Béché, 2020). On the 18th of March, the Minister of Secondary Education initiated a broad consultation to work out how to

implement distance education. In a memorandum on "Content of distance education" (MINESEC 2020), she invited Regional and Departmental delegates, school heads and teachers to send their "excellent courses" to be used for distance schooling. As an extension of this memorandum, the Inspectorate General of Education (IGE) in turn issued an invitation to teachers on the same day entitled "Fight against corona virus" (IGE 2020), asking them to "propose solutions (within five days) that might enable secondary school pupils to continue to receive distance education. "This is evidence to the fact that the educational system was very unprepared for distance learning, given that it was at this time when the search for solutions was an intentional emergency involving everyone.

At the end of this "national" consultation, the Ministry of Secondary Education adopted television as a means of providing educational continuity, initiating the "School on TV" program which was called in French "L'école à la television." It was launched by Cameroon Radio Television (CRTV) on 6 April (Djimadeu 2020). Since Cameroon has two official languages, French and English, this distance learning concept "[took] into consideration the two sub systems of Education. On Mondays, Wednesdays and Fridays", classes were broadcast in French, while classes in English were broadcast on Tuesdays, Thursdays and Saturdays (Lum, 2020). A course database platform was also created.

The Ministries of Basic Education and Secondary Education launched the "School on TV" program in partnership with CRTV. Particular emphasis was placed on the classes facing examinations: Class six, Form four, Form six and Form seven for French-speaking students; Class six, Form five, Lower six and Upper six for English-speaking ones.For Class six learners preparing for the Primary School Certificate exam, the program ran from 8.00 a.m. to 10.30 a.m. every Tuesday, Thursday and Friday. For those preparing for the First School Leaving Certificate exam, which marks completion of lower secondary school, "School on TV" was held on Mondays, Wednesdays and Fridays at the same time. For general and technical secondary education, the program was from 9.30 a.m. to 6.00 p.m., Mondays, Wednesdays and Fridays for French speakers, and Tuesdays, Thursdays and Saturdays for English speakers (Béché, 2020).

At university level, the Ministry of Higher Education held a meeting on 20 March, four days after the University of Yaoundé 1's solitary initiative, aiming to harmonise its "strategy" for the implementation of "the strategy prescribed by the government" (MINESUP 2020). The meeting was attended by the eight Rectors of public universities, the Rector of the Pan-African

University, the Coordinator of the Cameroon-Congo Interstate University, the heads of public higher education institutions with special status, two representatives of private university institutions, and senior officials of the Ministry of Higher Education. At the end of the consultation, some pedagogical continuity measures were selected. In addition to campus lockdowns and the readjustment of university calendars, this set of solutions included the use of learning management systems, electronic messaging tools such as WhatsApp, and teleworking and videoconferencing tools such as Zoom and Skype. While the University of Yaoundé 1 centralised all its courses on an online platform, other institutions allowed faculty, department and individual initiatives to coexist (Béché, 2020).

In an interview given to CRTV on 20 March 2020 entitled "Can digital technology ensure the continuity of university courses?" (CRTV 2020a), the Minister of Higher Education listed the tools used for this purpose: learning management systems, WhatsApp, e-mail and mobile phones. For distance conferences and meetings, he listed Skype and Zoom. Following this interview, conducted after the consultation meeting of the Ministry of Higher Education held earlier on the same day, academic institutions scrambled to "exhibit" their innovative tools and approaches for maintaining pedagogical and administrative continuity. For example, the University of Yaoundé 1 praised its distance training system built on Moodle, restarted in the age of COVID-19, in a report on national television on 20 March 2020 (CRTV 2020b). The University of Douala launched a digital university press as well as an online course system for each of its fourteen faculties and institutes. The University of Bamenda, for its part, boasted of its proactivity in setting up a platform for pedagogical interactions. This was also the case for the University of Buea and the Catholic University Institute in Buea, whose distance learning programs had been in place for three years.

In sum, the search for pedagogical continuity solutions in Cameroon was a "race against time" in a context that had not yet integrated distance technology as an essential training modality. The responses were a patchwork combination of institutional and individual initiatives, learning management systems and information and communication tools (Béché, 2020).

Emmanuel Béché is of the opinion that the approaches adopted by the Cameroonian government regarding education revealed that the Cameroonian education system is plagued by disorganisation, educational inequalities and exclusion – problems which affect learners' daily lives on a personal level. According to him, the challenge for Cameroon in times of

confinement was how to ensure pedagogical continuity through new educational technologies without exacerbating existing educational inequalities (Béché, 2020).

Statement of the Problem

The Training of teachers in contemporary educational practices is a key aspect in almost every education improvement strategy and constitutes the main component of educational reform programs (MacDonald, 2009). For teachers to be able to use technological tools in their classrooms, an effective ongoing professional development program must be put in place to improve their skills (MacDonald, 2009).

The turbulence of the education sector caused by the onset of the COVID-19 pandemic, occurring in the course of the academic year, meant that all Cameroonian learners were suddenly "involuntarily out of school": 4.5 million in primary schools, 1.8 million in secondary schools, 40,000 learners in vocational training, and 347,000 in higher education (UNSDG, 2020). Until the arrival of COVID-19, schools in Cameroon had not fully grasped the new modes of access to information and the new ways of teaching and learning which these enable (Meirieu, 2020). One of the reasons for this is that before COVID-19, distance education received little institutional attention, despite the flaunting of techno-pedagogical innovations since 2001–2002 (Béché 2017b).

Despite the fact that 100 percent of Teacher Training Colleges teach ICTs to student teachers, a greater part of the training is still theoretical due to the chronic lack of resources and infrastructure (ERNWACA-Cameroon 2010; Ndonfack N. 2010).

In summary, the fact that most teachers who have been trained in teacher training colleges are not able to integrate ICTs in teaching upon graduation implies that there is probably a problem with the training program. Training courses offered by some institutions are not meeting the learning needs of teachers. Therefore, inappropriate teachers' training programs are not helping teachers to prepare ICT based lessons and to use these tools effectively in their teaching practice (Balanskat et al., 2006). Their incompetence during the COVID19 lockdown, for example, affected the learners a lot. More so, Communication between teachers and learners (which had been taking place in the classroom directly) was now mediated by two new actors: screens and platform managers (Béché, 2020). This means teachers were further separated from learners by technology and then platform managers who, being mostly technology technicians, probably lack the understanding of the pedagogical

aspects of online learning. Mishra and Koelher (2006, p. 1033) stated that merely knowing how to use technology is not the same as knowing how to teach with it.

This calls for research to finding evidence-based solutions to improving teacher training programs for effectively integrating ICTs in teaching in Cameroon secondary schools. Identifying how different aspects of the program influence the integration of ICTs can help us to focus on practices that are more effective in improving on the level of ICT integration in Cameroon secondary schools. Since teachers are the main actors, their perception of how these various aspects of the program affect ICT integration is important, given that they are the main products and implementers of the training program.

General Objective

To evaluate teacher's perception of the effect of the teacher training program (of Higher Teacher Training Colleges) on the integration of ICTs in Cameroon Secondary Schools.

General Research Question

What is the teacher's perception of the effect of teacher training program on the integration of ICTs in Cameroon Secondary Schools?

Specific research questions

- What is the teacher's perception of the effect of ICT-infrastructure on the integration of ICTs in Cameroon Secondary Schools?
- What is the teacher's perception of the effect of program/course content on the integration of ICTs in Cameroon Secondary Schools?
- What is the teacher's perception of the effect of teaching-learning activities on the integration of ICTs in Cameroon Secondary Schools?

Specific Objectives

- To evaluate the teacher's perception of the effect of ICT infrastructure on the integration of ICTs in Cameroon Secondary Schools
- To evaluate teacher's perception of the effect of program/course content on the integration of ICTs in Cameroon Secondary Schools
- To evaluate teacher's perception of the effect of teaching-learning activities on the integration of ICTs in Cameroon Secondary Schools

Hypothesis

Hypothesis 1

$H0_1$: ICT infrastructure does not have a significant effect on the integration of ICTs in Cameroon Secondary Schools.

HA_1: ICT infrastructure has a significant effect on the integration of ICTs in Cameroon Secondary Schools.

Hypothesis 2

$H0_2$: Program/Course Content does not have a significant effect on the integration of ICTs in Cameroon Secondary Schools.

HA_2: Program/Course Content has a significant effect on the integration of ICTs in Cameroon Secondary Schools.

Hypothesis 3

$H0_3$: Teaching-Learning Activities do not have a significant effect on the Integration of ICTs in Cameroon Secondary Schools.

HA_3: Teaching-Learning Activities have a significant effect on the Integration of ICTs in Cameroon Secondary Schools.

Justification of the study

Teachers' self-efficacy is one of the most important constructs in teacher competence (Lauermann and König 2016). Based on Bandura's (1997) work, teachers' self-efficacy denotes teachers' beliefs (that is, their own perception) about their abilities to succeed in specific situations. Self-efficacy towards ICT integration is defined as beliefs in his or her capability to integrate ICT effectively in the teaching and learning process (Skoretz, 2011). The extent to which teachers perceive such efficacy may influence whether or not they take action, invest effort in an action, and how long they may sustain possible challenges (Tschannen-Moran and Hoy 2001). When people do not believe in their own ability to produce the desired effect through their acts, they are not motivated enough to carry out the action (Schunk and Pajares, 2009). Hence, high self-efficacy provides greater motivation to meet targets and feel better in coping with adverse situations (Harrison et al., 1997).

Discussion of teacher competences is closely related to the design and quality of learning opportunities to which pre-service teachers are exposed during their teacher education programs (European Commission 2013). This implies that there is an important need for research to restructure and improve the quality of teacher training programs so that the trained

teachers will be able to meet up with the demands of integrating ICTs in teaching in Cameroon secondary schools.

Significance of the study

This study will help us to know the aspects of the teacher training programs that have a stronger effect on teacher's integration of ICTs in teaching as perceived by those who have been trained in the program. By this, policy makers will make informed decisions related to aspects of ICT given their limited funding for example. The study will also help policy makers and curriculum developers know the aspect of the program that need more attention and to develop key interventions to remedy the situation in a sustainable way. Since the stake holders of education in Cameroon are seeking solutions to improving on the use of technology to ensure continuity in normal and crisis situations, the results of this study will be relevant.

Scope and delimitation

This study looks at the general aspects of the teacher training program. The aim is not to do an evaluation of the training curricula, but the program as a whole as perceived by teachers who have gone through the program. This means for example that teachers who have not gone through the training program are automatically excluded. Also, the study is limited only to teachers who graduated from the Higher Teacher Training College (HTC) Bambili.

Operational Definitions of Terminology

Keywords are teacher-training program, integration of ICT

In the context of this study, a teacher training program simply refers to all the various objectives, teaching-learning activities, material/ human resources, etc. put in place in order to ensure that the quality of teachers produced by the training will be competent and confident in effectively teaching in the field.

Integration of ICT in the context of this study is the actual evidence-based and effective use of ICT in teaching.

CHAPTER 2
LITERATURE REVIEW

The key predictor of student learning is the quality of teachers. Although there are many vital components of successful technology integration in education, perhaps the most important of them, as well as the least emphasized one, is the process of teacher education (Cuhadar, 2018). Training of teachers in contemporary educational practices is thus a key aspect in almost every education improvement strategy and constitutes the main component of educational reform programs (MacDonald, 2009). An effective teacher education program is a prerequisite for a reliant education (Lawal, 2003). Since teacher education providers are responsible for the future of teaching (Jones, 2003), teacher training is indeed crucial, and that teacher education institutions will continually face the challenge of preparing teachers who can thrive in a dynamic environment of fast-paced technological change and knowledge production (UNESCO, 2002). Teacher education institutions and programs have a critical role to provide the necessary leadership in adapting pre-service and in-service teacher education to deal with the current demands of society and economy (Bevernage, et al., 2005).

The Southeast Asian Ministers of Education Organization (SEAMEO) recognizes and gives high attention on the importance of ICT in education. As an initial step towards knowledge sharing of ICT practices and experiences, SEAMEO assigned SEAMEO Secretariat and SEAMEO Regional Centre for Vocational and Technical Education (SEAMEO VOCTECH) to conduct a preliminary survey on the status of ICT integration in education in the 11 SEAMEO Member Countries namely Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor Leste and Vietnam (Maftuh, 2011). SEAMEO Secretariat together with SEAMEO VOCTECH in Brunei Darussalam developed a set of guiding questions for countries to prepare a case study to identify the state of ICT integration in their respective countries. According to (Maftuh, 2011), they include:

a) How has ICT been integrated in education among the countries in Southeast Asia?
b) What are the strengths and capacities of these countries to integrate ICT in education?
c) What are the ICT-in-education best practices in these countries and how can they be shared among the countries in Southeast Asia?

Based on these questions, Ten ICT-in-education dimensions were identified based on the country case studies where these dimensions are necessary and sufficient conditions that

support the integration of ICT in education. The ten ICT-in-education dimensions are as follows:

1. National ICT-in-education vision;
2. National ICT-in-education plans and policies;
3. Complementary national ICT and education policies;
4. ICT infrastructure and resources in schools;
5. Professional development for teachers and school leaders;
6. Community/partnerships;
7. ICT in the national curriculum;
8. Teaching and learning pedagogies;
9. Assessment; and
10. Evaluation and research

As important as these factors could be, Teo (2015) shows that no matter how much convenient the components of integration might be, from the technological infrastructure to the legal and administrative issues, the implementers are teachers and success is directly proportionate to their relevant capacity and performance (Maftuh, 2011).As atypical example, it is obvious that quality teacher education primarily underlies the successfuleducational system of Finland, which has received attention all around the world due to the resultsof PISA exams since 2000's (Sahlberg, 2010). Sadly, Teachereducation and effective technology integration in teaching processes are among challenging issues (Teo, 2015).

It is observed that, in most initiatives of technology integration, the dimension of teacher education is not prioritized, and that the graduate pre-service teachers are trained in the job-related use of ICT through teacher education (Cuhadar, 2018). Bakır(2016) argues that the majority of teachers start their job with limited familiarity with technology in their pre-service training, and this is the primary source of the problems. Then, it becomes difficult to change their self-esteem and attitudes toward technology integration in their in-service years.

Aslan and Zhu (2014) found out that pre-service teachers' pedagogical knowledge, their gains from ICT related courses in their teaching program and their perceived ICT competence significantly predict their ICT integration into teaching practice. Professional development should be intentional, on-going, and a systemic process aimed at increasing the knowledge-base of teachers about a topic that will in turn increase their knowledge and the achievement of their pupils (Guskey, 2000).

Theoretical Framework

The theory of Self-Efficacy by Bandura

Teachers' beliefs and attitudes towards technology have been linked to subsequent adoption and integration (Donnell et al., 2011). A key component of these beliefs is self-efficacy, which is broadly defined as an individual's beliefs in their own ability to influence or achieve certain outcomes (Bandura, 1994; Shea & Bidjerano, 2010). The link between teacher beliefs and subsequent integration of technology has been identified as an important area of research, particularly given the potential value of technology use for educational purposes such as personalised learning and links to successful student outcomes (Ertmer & Ottenbreit-Leftwich, 2010).

Bandura (1977) describes self-efficacy as individual's belief on his or her ability to organize and execute the action to attain goals. This belief influences many aspects of behaviour that is the choice of action, amount and duration of effort and emotional response to success. The action taken is based on individual's ability, how long an attempt should be put in and how the individual manages emotions to succeed. As a central component of social cognitive theory (Bandura, 1982), self-efficacy addresses the complex interaction between cognitive beliefs, environment, skills, emotion, and behaviour. It is considered central to an individual's ability to effect change, influencing the choices a person makes regarding new situations or skills, such as using technology in the classroom (Bandura, 2006). Self-efficacy, unlike similar constructs such as self-concept or self-esteem, focuses on an individual's beliefs in their performance capabilities for a particular task that has yet to be undertaken in a particular context (Bandura, 1994; Paraskeva et al., 2008).

Self-efficacy is strongly connected to beliefs about mastery as well as value and usability ofdevices, so it plays an important role in the acceptance and uptake of technology in the classroom (Shea & Bidjerano, 2010). It is linked to success and has been positively linked to achievement outcomes, self-regulation, and cognitive learning strategies (Shea & Bidjerano, 2010; Schunk & Pajares, 2002). Higher levels of self-efficacy have also been connected to greater persistence in new tasks (Schunk & Meece, 2005). Paraskeva et al. (2008) argue that teachers who have high technology self-efficacy are more open to new ideas and they are more willing to experiment with new methods that can benefit students (p. 1084).

Teacher self-efficacy and digital technology self-efficacy in the classroom can also be considered as two different domains. Teachers who have a high sense of self-efficacy are apt

to examine their own practice and teaching approaches as a source for change rather than placing the responsibility solely on the shoulders of their students (Protheroe, 2008). However, a teacher may feel efficacious towards teaching overall, but less efficacious about using technology in the classroom (Shinas et al., 2013). Researchers agree that technology self-efficacy is a key component that needs to be considered when addressing the integration of technology in the classroom (Abbit & Klett, 2007; Celik & Yesilyurt, 2013; So et al., 2012). In Turkey, Birisci and Kul (2019) conducted a study on 174 teachers at the Faculty of Education of a university by using a correlational study model and found that teachers had a high level of ICT self-efficacy, with a positive correlation with techno-pedagogical skills and ICT integration. There was a high and positive correlation between ICT integration and ICT self-efficacy and experience was identified as one of the sources of high ICT self-efficacy of the participants Technology self-efficacy can itself be divided into separate domains, including online (or internet) self-efficacy, specific device (such as laptop or smartphone) efficacy or classroom technology integration efficacy (Ertmer & Ottenbreit-Leftwich, 2010).

In addition to teachers' personal and professional technological self-efficacy, collective efficacy is a further important consideration. Collective efficacy refers to the collective beliefs of a group in their ability to achieve specific outcomes (Bandura, 1998). Collective efficacy encompasses a synergistic approach to problem-solving, in which the combined confidence of a group of peers can be higher than an individual's own beliefs (Bandura, 2006). Research suggests that collective teacher efficacy centres on the perceived ability of the entire group's collective skills and resources (Goddard et al., 2000; Klassen et al., 2010). Kopcha (2012) supports this notion by suggesting that a community of practice, which can be inherent in group environments, can subsequently influence engagement with new initiatives. Positive attitude to the role of technologies among teachers will help the effectiveness of technology integration in education (Kent & Giles, 2017). To fulfil this, teacher's personal and professional technology self-efficacy and collective efficacy should be considered (Tilton & Hartnett, 2010). The extent to which teachers perceive such efficacy may influence whether or not they take action, invest effort in an action, and how long they may sustain possible challenges (Tschannen-Moran and Hoy 2001).

Factors influencing Self-Efficacy

Self-efficacy judgements are influenced through four main sources of information: mastery (or enactive/actual experiences), modelling (vicarious experiences), coaching (verbal

persuasion), and physiological reactions (Bandura, 1977; Hinton et al., 2008; Schunk & Pajares, 2002).

Mastery experiences are the most influential source of information to contribute to the development of self-efficacy, with success generally raising self-efficacy and failure lowering it (Bandura, 1982; Schunk & Meece, 2005).Teachers who invest time in learning how to use technology by themselves, or attending training, by independently exploring the ICT devices etc. are more likely to increase in their self-efficacy than those who do not.

Modelling, which encompasses the observation of similarly skilled individuals in similar contexts, can encourage the observer to attempt similar tasks if they perceive that they could also be successful in similar circumstances (Schunk & Pajares, 2002).If the model does not complete the task successfully, the self-efficacy of the observer can be negatively affected (Tilton & Hartnett, 2016). While much literature on modelling focuses on the observer being influenced positively through this process (Margolis & McCabe, 2003; Schunk & Pajares, 2002), the findings from this study highlight that, when the model experiences success, their own confidence may also be positively influenced, indicating the benefits of modelling may be reciprocal(Tilton & Hartnett, 2016).

Coaching or verbal persuasion by a trusted individual (for example, encouragement to use particular mobile apps) can also have some effect on motivation to try new or challenging tasks, although this can be fleeting (Schunk & Meece, 2005).

Perceived ease of use and perceived usefulness are further important aspects of technology adoption in a given situation (Chuttur, 2009). The easier a user perceives technology to be, the higher the self-efficacy associated with its use (Davis et al., 1989).

Another factor influencing self-efficacy is “physiological and emotional states”. People’s mood, stress, anxiety may affect a person’s beliefs about judgements of related performance. Positive feelings about performance increase people’s self-efficacy; in contrast, negative feelings decrease a person’s self-efficacy (Bandura, 1994). Anxiety, for example, often results in avoidance behaviour. Hesitancy about using computers can be an indicator of this anxiety, and subsequent avoidance may mask low technology self-efficacy (Celik & Yesilyurt, 2013).

Effective teacher training is another important factor. Professional development offers a positive impact on teacher’s self-efficacy and technology integration (Umar & Hassan, 2015;

Unal et al., 2017). Dinh (2015) agreed with BECTA (2004) that the lack of teachers' confidence is due many factors including poor ICT skills of teachers due to lack of training for both technology and pedagogy. When the training is effective, teachers tend to develop confidence in their ability to effectively integrate technology, thereby increasing their self-efficacy.

Limitations of the Self-Efficacy Theory.

Self-efficacy beliefs vary greatly between individuals, which makes them very difficult for researchers to assess. High self-efficacy beliefs do not always guarantee positive outcome expectations (Pajares, 1997). People with high self-efficacy and high skills may lack the resources and equipment to perform. This implies teachers need more than high self-esteem to be effective in integrating technology in teaching. According to Bandura (1986, p. 396), "When performances are impeded by disincentives, inadequate resources, or external constraints, self-judged efficacy will exceed the actual performance."

Evaluating the effect of a teacher training program from the perception of teachers based on their self-efficacy may provide useful information on how to improve on the program for a more effective integration of ICTS in teaching in Cameroon secondary schools.

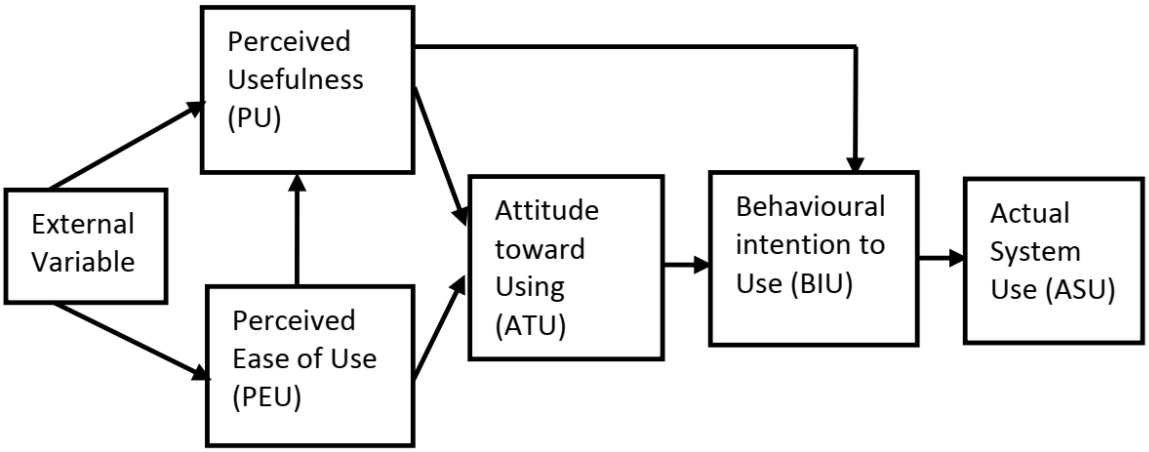
The TAM Model

Several theories have been proposed by researchers to explain and improve on best practices that help in the integration of ICTs in teaching and learning. Some of these include: Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Technology-Organisation Environment (TOE) framework, the Theory of Planned Behaviour (TPB), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Technological Pedagogical Content Knowledge (TPACK) framework. We already discussed the TPACK model, but our focus will be on one of the most used and researched theory, which is the Technology Acceptance Model (TAM).

The introduction of a new technology into the instructional process may sometimes encounter great resistance from beneficiaries (Kamel, 2004). The resistance may stem from stakeholders who perceive the use of the tool as being too demanding in terms of cost, time and energy (McIntosh, 2010). In order to map the factors that affect users' perception and use of technology in the teaching and learning process, the Technology Acceptance Model (TAM) was developed (Davis et al., 1986).

The Technological Acceptance Model (TAM) was developed by Davis (1989). It has actual system use (ASU) as the main variable.Davis defined ASU as an individual's observable usage of a particular system (e.g. technology) as shown in the figure 1 below.

Figure 1:
The Technology Acceptance Model (TAM)



Source: Davis et al. (1989), page 985, Figure 2.

The theory suggests that ASU is a direct function of behavioural intention to use (BIU) a technology, which Davis defined as the degree to which a person has formulated conscious plans to perform or not to perform some specific future behaviour. BIU is in turn, a function of attitude toward using (ATU) and perceived usefulness (PU). ATU is an individual's positive or negative feeling about performing the target behaviour (Davis et al., 1989), while PU is the degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989). According to Figure 1, PU is influenced by perceived ease of use (PEU), which Davis defined as the degree to which a person believes that using a particular technology would be free from effort. Figure 1 further suggests that ATU is determined jointly by PU and PEU. Each of PU and PEU is in turn influenced by external variables such as, development, system characteristics, process, training etc.

However, other explanatory variables notwithstanding, the proponents of TAM (e.g. Davis, 1989) posit that PU and PEU are the two fundamental determinants of ASU. They argue that if users find a technology useful (i.e. having PU) and easy to use (i.e. having PEU), then they develop a positive attitude toward using (ATU) this technology. All these will eventually lead to the behavioural intention to use (BIU) the technology and finally the actual use of the technology (ASU). Since the release of TAM in 1989, many researchers have used it to

investigate the acceptance and innovative use of technology in different fields (Kim et al., 2015; Zhang & Li, 2017; Muganda et al., 2016).

Several researchers have carried out literature reviews on the TAM model. For example, Chuttur's (2009) review provided a historical overview of the TAM in the information system (IS) literature from 1985 to 2007, by focusing on its evolution, applications, extensions, limitations and criticisms. However, he never revealed how he selected the papers for the review, and how he went about the analysis. In terms of findings however, Chuttur reported that the TAM model had indeed been very popular for explaining and predicting system use. The weakness of most of the studies he reviewed was that he mostly concentrating on self-reported data as opposed to observed measures (Luhamya et al., 2017). Also, according to Chuttur (2009) most of the studies he reviewed had focused only on voluntary environments with little consideration for mandatory settings thus leaving a gap to be filled by future researchers on TAM by extending to mandatory settings. He also found out that several studies on the TAM had made use of students as participants, yet according to him, the results obtained from such studies could not be generalised to the real world because students may have peculiar motivations in performing a given behaviour (e.g. use of ICT) such as the need to obtain good grades and rewards among others (Luhamya et al., 2017). Furthermore, Chuttur established that most of the studies he reviewed had been conducted in the US, and UK and very few in other parts of the world particularly in Africa, hence a contextual gap that needed attention by future researchers on the TAM.

Apart from those who reviewed literature on the TAM, researchers have conducted meta-analytic reviews on the model. For example, King and He (2006) conducted a meta-analytic review of 88 published articles to examine to effectiveness and robustness of the TAM in research. Using online search and the Social Science Citation Index (SSCI), they obtained empirical papers on the model. In terms of findings, King and He established that the TAM had been widely used in information system (IS) studies. According to King and He (2006), both perceived usefulness (PU) and perceived ease of use (PEU) had been relevant measures that could be used in a variety of contexts. They also revealed that the correlation between PU and behavioural intention to use (BIU) different technologies had been stronger than that of PEU to BIU; and that both PU and PEU had jointly explained about 50% of the variance in BIU. However, they noted that while TAM correlations had been strong, they had had

considerable variability suggesting that moderator variables if added could help to explain the effects (Luhamya et al., 2017).

Relating TAM theory and Self-Efficacy Theory

TAM predicts the acceptability of a tool and identifies the modifications that must be made to the system in order to make it acceptable by users. From this standpoint, TAM further suggests that the acceptability of a technology is determined by two main factors which are (a) perceived usefulness; and (b) perceived ease of use (NKWENTI).

PU and PEU are the connection between the self-efficacy theory and the TAM theory. The easier a user perceives technology to be, the higher the self-efficacy associated with its use (Davis et al., 1989). Since this research uses self-reported data, the aspects of PU and PEU are important to consider, given that both PU and PEU had jointly explained about 50% of the variance in BIU according to King and He (2006).

Conceptual Framework

ICT Integration

It is surprisingly difficult to locate a direct and consistently applied definition of ICT integration despite its having been an aim of educational systems for some time (Cuttance & Stokes, 2000). The term “ICT integration” connotes a range of learning environments from a stand-alone computer in a classroom to a situation where the teaching is done by the computer through pre-packaged “teacher-proof courseware” (Laferrière, 1999, p. 3). To integrate is to seamlessly combine components, parts or elements into a complex but harmonious whole. The notion of seamlessness is implicit in the definition that ICT integration is the degree to which ICT “vanishes into the background” of the classroom (Fluck, 2003). Hughes (2013) defines integration of technology in teaching and learning (IITL) as the use by teachers and/ or students of digital ICTs that support the constructivist teaching and learning process. According to Maftuh (2011), ICT integration is interpreted as ICT which functions as an integral or mediated tool to accomplish specific teaching or learning activities to meet certain instructional objectives. Their definition seems to fit more with ICTs in general but lacks precision because it fails to distinguish between ICT integration and ICT integration in education. Perharps a better definition will be that of Ghavifekr & Rosdy (2015) who on their part define the Integration of Information, Communication, and Technology (ICT) in education as the use of computer-based communication that incorporates into daily classroom instructional process.

To them, ICT integration in education generally means technology-based teaching and learning process that closely relates to the utilization of learning technologies in schools.

Importance of ICT Integration

ICTs are potentially powerful tools for educational change and reform. When used appropriately, different ICTs are said to help expand access to education, strengthen the relevance of education to increase digital workforce, and raise educational quality by helping make teaching and learning into an engaging active process connected to real life (Pedro, 2006). As stated by Thrilling and Fadel (2009) people who live in the 21st century must have the following skills: critical thinking and problem solving, communication and collaboration, creativity and innovation, information literacy, media literacy, ICT literacy, flexibility and adaptability, initiative and self-direction, social and cross-cultural interaction, productivity and accountability, leadership and responsibility. ICTs appear to be not only the backbone of the Information Society, but also a crucial catalyst and tool to bring about educational reforms which enable our students to be productive knowledge workers (Pelgrum, 2001). In this context, ICT seems to be an important tool to support new ways of teaching and learning (Drent & Melissen, 2008).

Information and communication technology (ICT) 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-UIS, 2015).

ICT in education can help individuals to compete and adapt to the knowledge and information society by achieving the 21st-century skills which can enhance skilled workforce and social mobility. ICT in education has a multiplier effect throughout the school system, by; enhancing learning and providing students with new sets of skills (Balanksat et.al., 2006); reaching students with poor or no access(UNESCO-UIS, 2015).); facilitating and improving the training of teachers (Korea Education & Research Information Service , 2011); increasing the possibilities of communication and reinforcement of the development of skills of coordination and collaboration between peers (Dede, 2009); and minimising costs associated with the delivery of traditional instruction (Gulati, 2008).

Time constraint has always been a serious learning issue in the past. Technology has changed the situation in a positive direction. Today, learners can access any lesson anytime, anywhere (Sabiri, 2020).This has helped the learners to repeat any lessons they want until they

get mastery. Unlike the traditional learning system, ICT integrated education system has a 24/7 accessibility. ICT integration has improved teaching and learning methods by removing the barriers of time and place (McLuhan, 2012). It is obvious that the lockdown imposed by the covid19 pandemic proved to the world how important a healthy ICT policy is for any country that wants to guarantee access to education to her citizens is, especially during crises situations.

Impediments of ICT Integration in Education

The things that hinder the progress of ICT integration in education are many. Researchers have over time classified them in their own ways, and sometimes with other terminologies such as 'impediments,' 'barriers' or 'hindrances' etc. Pelgrum (2001) categorized these impediments as material or nonmaterial. The material impediments are inadequate ICT infrastructure like computers and copies of software. Non-material obstacles are lack of ICT knowledge and skills of teachers, lack of time and lack of awareness of relating ICT with pedagogy. Hew and Brush (2007) in their research grouped the barriers into six categories "resources, institution, subject culture, attitudes and beliefs, knowledge and skills and assessment" but they were of the view that lack of time was not a barrier because it is teacher's ability to use technology in teaching. Groff and Mouza (2008) in their research categorized ICT inhibitors into the Context that is school, the Innovator that is teacher, the Innovation that is project, and the Operator that is student (Groff & Mouza, 2008). Their classification however ignores the critical role of the national vision which controls to a large extent the activities of the school, the Teacher, the project, and the operator.

Some other studies classify these barriers as extrinsic and intrinsic barriers impediments. For example, according to Ertmer (1999), extrinsic barriers are cited as time, access, support, training and resources and are referred as first order barriers. Intrinsic barriers are cited as teachers' attitude and beliefs, resistance to change and are referred as second order barriers.

Another perspective of the classification carried out by Johns (2004) is teacher level barriers (individual level) such as lack of time, resistance to change, lack of confidence etc. or school level barriers (institution level) such as lack of training and lack of access to resources. However, Balanskat et al. (2006) categorized them into micro level barriers (that is teachers' attitude towards ICT), meso level barriers (related to educational institutes) and macro level barrier (related to broader educational perspective).

We shall focus on the classification of Ertmer (1999) which groups the impediments into two broad groups namely Extrinsic barriers and intrinsic barriers. However, a few more points were added in both classifications. The purpose was to give a broad scenario of the extrinsic and intrinsic impediments faced by contemporary societies in the integration of ICT (Salam et al., 2018). Intrinsic impediments were related to teachers such as lack of time, lack of confidence (knowledge and skills), resistance to change and lack of accessibility.

Extrinsic Impediments

These include impediments which are beyond the level of the teacher, also known as first-order barriers. In Ertmer's framework, she describes first-order barriers to technology integration as 'being extrinsic to teachers and include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support' (Ertmer, 1999: 48). Barriers cited as time, access, support, training and resources and are referred as first order barriers. Lack of policy and planning, lack of training opportunities, lack of technical support, dearth of funds, access to internet/electricity, language and curricula issues were included in extrinsic barriers.

Lack of Policy and Planning

An important key factor hindering the successful integration of ICT in public schools is the well-defined educational policy and planning especially depicting the ICT integration. Systematic implementation of ICT depends upon the educational policy makers' perception and vision, towards the use of ICT in school culture Pelgrum and Law (2003). Inadequate ICT planning and strategies may hinder teachers' efforts to implement ICT into their teaching practices in classrooms (Wozney et al., 2006). Tondeur et al. put emphasis on the schools' shared vision for ICT implementation, stable strategies and teachers' consideration of school policies for ICT implementation. In a study about four schools, carried out by Lime and Khine (2006), the importance of shared vision and ICT policy for schools' heads and teachers in providing guideline and a clear goal for the successful integration of ICT was highlighted. The fact that educational reforms related to ICT integration in many countries lacks a solid rationale leads to vague conceptions about the desired outcomes and how to go about them. Setting of goals and the provision of means for achieving the goals are crucial when making ICT policy and planning for schools (Bryderup & Kowalski, 2002).

Lack of Training/ Professional Development Opportunities

Although there are many vital components of successful technology integration in education, perhaps the most important of them, as well as the least emphasized one, is the process of teacher education (Cuhadar, 2018). One of the findings of the study of Pelgrum (2001) was the lack of enough opportunities for teachers to acquire ICT based training. Training institutes should combine the pedagogical content with technology in their training courses in order to train teachers with the use of ICT resources in their respective subjects (Al Mulhim, 2014). The problem sometimes is not the absence of training, but the quality of training offered to pre-service teachers. Training courses offered by some institutions are not meeting the learning needs of teachers. Therefore, inappropriate teachers' training programs are not helping teachers to prepare ICT based lessons and to use these tools effectively in their teaching practice (Balanskat et al., 2006). Promoting pre-service teachers' competencies for educational technology use in an integrated manner is a complex process that demands specific strategies in order to be successful (Agyei & Voogt, 2014). So, the question we ask ourselves is why technology integration is still low despite many efforts by teacher training institutions, like in the case of many countries in the world including Cameroon. Dinh (2015) agreed with BECTA (2004) that the lack of teachers' confidence is due many factors including poor ICT skills of teachers due to lack of training for both technology and pedagogy. Teacher training colleges in Cameroon have been training teacher on ICT related issues, but these were found wanting during the COVID 19 pandemic.

In sum, the search for pedagogical continuity solutions in Cameroon was a "race against time" in a context that had not yet integrated distance technology as an essential training modality. The responses were a patchwork combination of institutional and individual initiatives, learning management systems and information and communication tools (Beche 2020). This shows that the teacher training should be adequate both in terms of quantity and quality, if there must be effective integration of ICT in Cameroon secondary schools.

Lack of Technical Support

Resta (2002) defines technical support as specialised skill personnel who are able to support and assist the educators in implementing technology into instruction. Meanwhile, Dexter et al., (2002) have characterized the technical support as the access, operation and troubleshooting of hardware, software and network resources. While using ICT tools, teachers often face technical problems that discourage them from using ICT. Timely assurance of technical support may help teachers in saving time and smooth delivery of lessons in classes.

This makes them motivated and confident in their work and reduces the fear of failure, which often discouraged them to try technological innovations. According to Sicilia (2005), the fear of breaking down of ICT tool during a lesson might discourage teachers from using ICT in their teaching practice. The maintenance of ICT resources requires the presence of these technical personnel for the swift retrieval of the technical problem (Hew & Brush, 2007).

Technology support has an encouraging impact on educators' own uses of ICT (Moses et al., 2008), and their integration of ICT into the teaching-learning practices as well. For this reason, it is essential to provide guidance, support and services as parts of the technology applications (Haslaman et al., 2008).

Dearth of Funds/Cost of ICT Infrastructure

Acquisition of high cost of ICT infrastructure and maintenance of equipment is a key barrier in the adoption of ICT in schools (Farrell, 2007). Even though digital education is cost effective, especially with the decreasing cost of ICT resources, it is difficult for developing countries with poor economies to bear the cost of hardware/software, maintenance, upgrading and providing ICT training to teachers (Laaria, 2013). Balancing the educational goals with economic realities is a challenging task for poor countries (Hennessy et al., 2010).

Electricity/Internet Issues

Access to electricity and internet is crucial for the effective use of technology in teaching and learning. Power interruption and low-connectivity of internet impedes the teachers' use of ICT in classes (Salehi, & Salehi, 2012). These two factors are interdependent such that without one, the other will not work properly. Since most ICT tools and infrastructure depend directly on electricity and internet connection, their absence will mean that the ICT tools and infrastructure are as good as non-existent. This is one major challenge in most developing countries which are often characterized by shortage of electricity and internet supply.

Cameroon is one good example of a country which suffered severely during the COVID19 pandemic because of shortage of electricity among other things. Cameroon's unreliable electricity supply posed an additional challenge to the "School on TV" project which was the main intervention by the government to ensure continuity of education during the lockdown. According to Brice R. Mbodiam (2019), more than 45% of Cameroonians do not have access to electricity. Rural areas, which include more than 60% of the country, are only 21% covered by the electricity network. Their populations were therefore *de facto* excluded

from “School on TV”. Teacher–student interaction was also hampered by Cameroon’s low internet coverage, which currently stands at 30% overall and only 4% for broadband (Mbodiam 2020). Even urban areas are not immune to fluctuations in the electricity supply, whose high rates of load shedding reach the coast in cities such as Douala, Yaoundé and Bertoua (Onana 2020). Similarly, the children of those 70% of Cameroonians who lack an internet connection were also excluded from access to the digital educational resources provided on the websites of the Ministries of Secondary Education and Basic Education.

Curricula/Language Issues

Curricula and medium of instruction are other major impediments in the effective implementation of ICT in schools. Public and private schools of developed countries follow the same curricula and having the same medium of instruction. Therefore, citizens of these countries receive quality education of the same standard. The situation is quite different in developing countries of the world where there is a prominent difference in the curricula and medium of instruction in public and private schools and providing inequitable quality of education to the citizens of these countries (Salam et al 2018). For example, Research shows that 80% of software and online content are in English language. This is a serious barrier for countries where English is not the first language (Heinich et al., 2001). Since standard software are designed in English, availability of software in the local language and curricula are hampering the successful implementation of ICT (Parvin, 2013).

Intrinsic Impediments

Intrinsic impediments are those related to teachers themselves. They are the second order impediments according to according to Ertmer (1999) and involve such barriers as teachers’ attitude and beliefs, resistance to change etc. Second order barriers ‘are intrinsic to teachers and teaching, and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change’ (Ertmer, 1999 p48).

Lack of Time

Various researchers have found time limitations as a major impediment for using ICT by teachers (Sicilia, 2006; Schoepp, 2005; Al-Alwani, 2005). Many teachers argue that due to insufficient time they are unable to browse internet sites, explore the educational software and prepare the technology interceded lessons. Teachers point out that the preparation of traditional lessons require less time as compared to the lessons aided by the use of technologies (Sicilia, 2006).

Alev (2003) investigated ICT integration and possible challenges faced in pre-service teacher training programs. Among the most challenging issues for ICT integration was lack of time to cover syllabus and use ICT appropriately. The pressure put on them by educational authorities to ensure that the curriculum is covered during the specific allocated duration limits teachers who need a lot of time, first of all to master the use of ICT in teaching, and then to actually prepare and deliver lessons. If teachers' time is strictly fragmented or limited with the number of classes, then teachers are unable to learn new skills and develop new methodologies for teaching (Rogers, 2000). Insufficient time due to the overburdened time table and other school responsibilities hamper teachers to take out time for searching on internet and use of computers teaching aids (Hew & Brush, 2007). It is recommended the class time should be extended and curricula must be reduced so that teachers can get ample time to use ICT tools while delivering their lessons (Al Mulhim, 2014).

Lack of Confidence due To poor knowledge and skills in ICTs

Teachers' confidence about using ICT in classes is an obstacle that impedes the successful implementation of ICT in schools even if ICT resources are available (Salam et al., 2018). The lack of confidence is due to the fear of failure (Beggs., 2000). Johns (2004) in his research found out that most of the respondents were afraid of entering the classroom with limited ICT skills. Limited experience with technology hampers teachers' confidence about using ICT in the class (Osborne & Hennessy, 2003). Studies show that teachers were not enthusiastic about bringing computer into their classes for teaching due to their limited knowledge and skills (Balanskat et al., 2006; Hew & Brush., 2007; Al-Harbi., 2014). Teachers' competence is also another impediment related to the teachers' confidence about the pedagogical use of ICT (Balanskat et al., 2006).

Resistance to change due to Teachers' Attitude and Beliefs

Teachers' attitude and beliefs play a significant role in bringing about didactic change related to the use of ICT for teaching and learning (Salam et al., 2018). Teachers' perception about the use of ICT in the class, ease of the use of available resources and incentive to pedagogical change by the school and policy makers are great hurdles in the integration of ICT in schools (Haggins & Moseley, 2011) especially because these have a direct effect on their beliefs and attitudes towards the change that is required for ICT integration in teaching and learning.

Provision of ICT training to teachers and the availability of digital resources motivate teachers to help their students in the construction of knowledge rather than imparting knowledge. While bringing technology into classrooms, there is an urgent need to change the teachers' attitude towards the use of technologies as teachers are at the forefront when it comes to enhance their teaching practice with the use of ICT. Therefore, teachers' positive attitude can bring about an enhanced learning environment (Jhurree, 2005).

Accessibility to ICT Resources

Accessibility to ICT resources is a very important factor because it connects availability with actual use. Sometimes, teachers do not have access to ICT resources despite their availability in school. In a study carried out by Sicilia (2006), teachers complained about the inaccessibility of computers due to several periods (classes) in a row and could not work on computers as they were shared by other teachers or they were in use by other teachers. Some other factors include poor organization of ICT resources, inappropriate software, non-maintenance of ICT resources inaccessibility to these resources. Sometimes, the resources are present but insufficient, leading to overcrowding which reduces accessibility. For example, in the case of schools where computers are available, but the student-computer ratio is high.

Another example is Technical challenges. In most schools, technical difficulties are a major problem and a source of frustration for students and teachers and cause interruptions in teaching and learning process. If there is lack of technical assistance and no repair on it, teachers are not able to use the computer temporarily (Jamieson-Proctor et al., 2013). Lack of access to technology is inevitably a major barrier in its application, but availability does not necessarily translate into use (Hennessy et al., 2010). When availability and accessibility are handled, the next challenge is probably usability. For example, Research shows that 80% of software and online content are in English language. This is a serious barrier for countries where English is not the first language (Heinich et al., 2001). Since standard software are mostly designed in English, availability of software in the local language and curricula are hampering the successful implementation of ICT (Parvin, 2013).

Models of ICT Integration

Integrating technologies into teaching and learning is a complex endeavour that involves many factors and presents many challenges. To address these issues and ensure a smooth integration of ICT into teaching and learning, theoretical models have been developed (Ngandeu, 2020). Some of the prominent theoretical models conceived by researchers are the

'SAMR model' (Puentedura, 2006), 'a continuum of approaches' (UNESCO, 2004), 'Adoption, Substitution, Progrès, Innovation, Détérioration' (ASPID) (Karsenti, 2014) and 'TPACK' (Mishra & Koehler, 2006). These models serve either as a framework for the integration process by describing the different steps to follow (Substitution, Augmentation, Modification, and Redefinition [SAMR] model) (Puentedura, 2006), as an indicator of the level of a state or an institution in the process of integration (continuum approach) (UNESCO, 2002), or as a framework to describe the different types of knowledge necessary for a successful integration of ITC into education (the technological pedagogical content knowledge [TPACK] framework) (Mishra & Koehler, 2006). We shall focus on the TPACK model in this work.

The TPACK Model

During the mid-1980s, Shulman (1986) theorized that teachers must possess knowledge about the content area of their discipline and also the pedagogical skills needed to teach that content. (Mishra & Koelher, 2006, p.63). Shulman showed that teachers needed a firm grasp of the analogies and also the frameworks that can be used to explain these facts and concepts naming it the *content knowledge* (CK). Content knowledge (CK) has to do with what teachers know about the subject matter or the discipline. 'This knowledge would include knowledge of concepts, theories, ideas, organizational framework, knowledge of evidence and proof, as well as established practices towards developing such knowledge' (Koehler & Mishra, 2009: 64) Added to this, teachers have to be guided by procedures that should be used within this particular discipline or subject content area. He explains that teachers needed knowledge about how to teach known as *pedagogical knowledge* (PK). Pedagogical knowledge (PK) has to do with how the teachers teach. '[It] encompass[es], amongst other things, overall educational purposes, valuesand aims. This generic form of knowledge applies to understanding how students learn, generalclassroom management skills, lesson planning, and student assessment' (Koehler & Mishra, 2009:64). In other words, pedagogical knowledge is related to the mastery of teaching strategies and theories by the teacher.

According to Shulman's model, it is believed that when a teacher can connect the content knowledge with the pedagogic knowledge that is appropriate for teaching that content blending them together, results in the *pedagogic content knowledge* (PCK). *PCK* has to do with 'knowledge of pedagogy that is applicable to the teaching of specific content' (Koehler & Mishra, 2009: 64). This represents the original domain of the teacher knowledge (Shulman, 1986) In other words, the PCK informs the teachers' decisions about the best method to use for teaching specific contents standards to their students (Kennah, 2016). Here, effective teaching

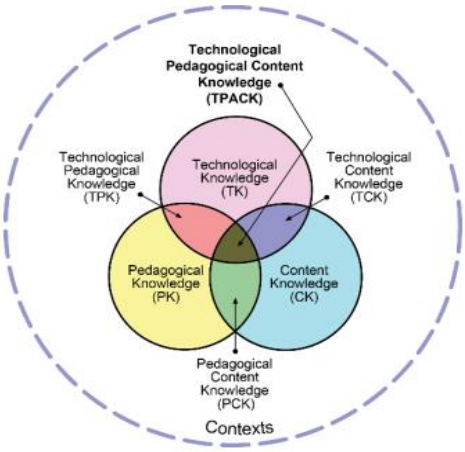
will only take place when the teacher compliments the content knowledge with the pedagogic knowledge. For this to happen, when a teacher has a real mastery of the subject together with a transparent delivery method then teaching is effective. Blending this knowledge together enables teachers to make the connection between the content the wish to teach and the best way to deliver lessons in their daily classroom practices (Shulman, 1986).

Shulman´s PCK model was later improved and extended by Mishra and Koelher (2006), who took into consideration the rapid proliferation of technology of the time. Since Shulman's model was developed around the mid-1980s, at the time technology was not yet popularized, it is obvious why he did not make provisions for the integration of technology in teaching in his PCK model. This is where a new concept was developed by Mishra and koelher, known as the TPACK framework, by including the aspect of technology into Shulman's PCK model. Mishra and Koehler (2006) argued that with regards to a more rapid and technological world we now find ourselves in, technological knowledge needs to be included in addition to the content and pedagogical knowledge for the teaching and learning process to be effective. The integration of technology into learning had added complexity to the fundamental knowledge of what constituted the teachers' professional knowledge base proposed by Shulman (Mishra & Koelher, 2006).

Historically, the technological pedagogical content knowledge (TPACK) framework—which first appeared as TPCK—is an extension of the pedagogical content knowledge (PCK) proposed by Shulman (1986). With the rise and rapid development of information and communication technology (ICT) which is widely recognized as successful in enhancing students' twenty-first century skills, this framework was later expanded to include technology (Mishra & Koehler, 2006). TPACK is an approach that is built on the assertion that teaching is an 'ill-structured' field that requires from the teacher an array of intricate types of knowledge, not only about pedagogy and content as stated by Shulman (1987), but also about technology (Ngandeu, 2020).Theoretically, TPACK is defined as a conceptual framework that emphasizes "connections among teachers' understanding of content, pedagogy, and technology interact with one another to produce effective teaching" (Koehler et al., 2013, p. 101). TPACK is an amalgamation of teachers' knowledge of curriculum content, general pedagogies, technologies, and contextual factors that influence learning (Koehler & Mishra, 2008). In brief, this theory reveals that constructive teaching and learning in the digital era needs to emphasize the complex interaction between content, pedagogy, and technological knowledge (Willermark, 2018).

The key modification of Koehler & Mishra was the insertion of Technological knowledge, which in turn combined with Pedagogic knowledge and content knowledge. Technological knowledge (TK) describes teachers' knowledge as far as technology is concerned. It goes beyond traditional computer literacy and requires that teachers understand ICT broadly enough to apply it productively to better impact students' learning. TK was thus added to the existing PK and CK. These three key domains then further combine to create sub-domains at their intersections: TPK (technological pedagogical knowledge), PCK (pedagogical content knowledge), TCK (technological content knowledge) and TPACK as seen in the figure below.

Figure 2:
TPACK framework and its components



Source: (Koehler, 2012)

As conversations among scholars continued about the TPACK framework, it became evident that contextual knowledge is also important. Thus, the dotted circle surrounding the Venn diagram was added to the TPACK framework to help educators account for contextual influences when teaching with technology, both classroom-based and organizational, and the large number of other dynamic and complex contextual variables that affect technology integration (Su & Foulger, 2019).

TPK (Technological Pedagogical Knowledge) is defined by Mishra and Koehler (2009: 65) as 'an understanding of how teaching and learning can change when particular technologies are used in particular ways. Simply put, TPK enables teachers to choose a technology that will better suit their teaching approaches, strategies and techniques. For example, which technology would be more appropriate for a teacher who adopts a socio-constructivist approach to teaching and learning and who wants his or her students to share their knowledge on a given task by collaborating? (Ngandeu, 2020).

TCK (Technological Content Knowledge) is the 'understanding of the manner in which technology and content influence and constrain one another' (Koehler & Mishra, 2009: 65). Content knowledge combined with technological knowledge enables teachers to have representations of how technology can better support or deepen disciplinary content. For example, WhatsApp may be more suitable to deliver language content than mathematical concepts as it can be used to foster students' writing skills (Ngandeu, 2020).

PCK (Pedagogical Content Knowledge) has to do with 'knowledge of pedagogy that is applicable to the teaching of specific content' (Koehler & Mishra, 2009: 64). PCK is the set of knowledge necessary for the content of a particular discipline. PCK is related to how teachers deliver subject matter through pedagogical reasoning so that it can be accessed by students (Irwanto, 2021).

TPACK, as can be seen in Figure 1, is at the intersection of the three major knowledge domains that constitute the model. TPACK goes beyond knowledge of technology, content and pedagogy. It emerges from interactions among these components and is the basis of effective teaching with technology (Koehler & Mishra, 2009: 66).

Emperical Review

ICT Infrastructure.

ICT infrastructure is one of the basic requirements for the successful integration of ICTs in teaching and learning. The extent to which a country is able to participate and benefit from the electronic communication technology depends on the country's digital divide as well as availability of e-infrastructure and technical knowhow in the country, (UNESCO, 2004). But what is the scope of ICT infrastructure according to researchers?

According to Vanderlinde and van Braak (2010), ICT infrastructure measures the perceived availability and suitability of the ICT tools such as hardware, software and peripheral equipment provided in the school. Pelgrum's (2001) on his part sees ICT infrastructure as the availability of equipment, software, Internet access and other similar resources in the school. We could say the concept of ICT infrastructure denotes all the facilities necessary for effective ICT integration in schools.Such infrastructure includes connectivity to various networks (internet, intranet, and mobile-telephone); sources and reliability of energy (UPS, electricity, standby generators); equipment (computers, radios, videos, television, LCD projectors and

software, e-learning laboratories furniture and stores, and information storage facilities such as flash disks, CD-ROMs, DVDs (Mulwa, 2011).

According to Shiue (2007), teachers will perceive greater control to employ technology into instructional use when they have the necessary hardware and software resources. In their research, Cowie and Jones (2005) reported that when infrastructure was provided, the teachers were able to access school network, the Internet and laptop accessories (printer, digital camera, data projector, large TV screen, scanner and video camera). Hence, the educators have more prospects to utilize instructional technology when the ICT infrastructures are provided in a well manner. Past research studies have shown clearly that ICT infrastructure can be one of the factors that influence the technology use among the teachers (Cowie & Jones, 2005; Shiue, 2007).

There are other intervening factors that are linked with infrastructure. Apart from availability, there are other factors such as, accessibility, usability and actual use. Availability alone is not a guarantee for use, because there are schools which have ICT infrastructure but these cannot be used by students or teachers because of some reason.

Accessibility

Sometimes, teachers do not have access to ICT resources despite their availability in school. ICTs may be locked up by the school's administration or restricted to certain personnel or certain hours of the day which are impractical. For example, If teachers' time is strictly fragmented or limited with the number of classes, then teachers are unable to learn new skills and develop new methodologies for teaching (Rogers, 2000). Insufficient time due to the overburdened time table and other school responsibilities hamper teachers to take out time for searching on internet and use of computers teaching aids (Hew & Brush, 2007). In a study carried out by Sicilia (2006), teachers complained about the inaccessibility of computers due to several periods (classes) in a row and could not work on computers as they were shared by other teachers or they were in use by other teachers. Too often the curriculum in developing countries is rigid and overloaded, leaving little time for innovative classroom practices. National policies need to make more commitment to helping teachers effectively integrate computers and internet technologies into the classroom by aligning curricula, exams, and incentives with the educational outcomes that they hope to gain (Hennessy et al., 2010).

Usabillity

Another important factor is usability. Culture and context must be taken into consideration when choosing and installing ICts. For example, Research shows that 80% of software and online content are in English language. This is a serious barrier for countries where English is not the first language (Heinich et al., 2001). Since standard software are mostly designed in English, availability of software in the local language and curricula are hampering the successful implementation of ICT (Parvin, 2013). (Leach et al., 2005) recommend that those implementing technological solutions need to ensure they are context-specific, and adapted to local needs and conditions. It is also imperative that ICT initiatives are sustainable or effective by ensuring that the technologies embedded within them meet the demands of users in appropriate ways. It is essential that potential users have a sound understanding of how to use new ICTs beneficially, and a cultural view of the relationship between learning and technology.

Actual use

It is possible for ICTs to be available, accessible and usable but not actually used. Several factors can make that happen. For example, according to Sicilia (2005), the fear of breaking down of ICT tool during a lesson might discourage teachers from using ICT in their teaching practice. The maintenance of ICT resources requires the presence of these technical personnel for the swift retrieval of the technical problem (Hew & Brush, 2007). Other factors could include teacher confidence. Teachers' confidence about using ICT in classes is an obstacle that impedes the successful implementation of ICT in schools even if ICT resources are available (Salam et al., 2018). Dinh (2015) agreed with BECTA (2004) that the lack of teachers' confidence is due many factors including poor ICT skills of teachers due to lack of training for both technology and pedagogy. Teachers' competence is also another impediment related to the teachers' confidence about the pedagogical use of ICT (Balanskat et al., 2006). Another example is the challenge of electricity and internet connection. Access to electricity and internet is crucial for the effective use of technology in teaching and learning. Power interruption and low-connectivity of internet impedes the teachers' use of ICT in classes (Salehi, &Salehi, 2012).

In spite of its potential influence on teaching and learning, the mere presence of computer technology hardware does not necessarily lead to student progress (Li and Ma 2010). ICTs do not themselves enhance students' learning capabilities but teachers who use ICTs

thoughtfully do. It's the teaching and learning requirement that need to stimulate ICT intervention, rather than the ICTs themselves (Baylor & Ritchie, 2002).

Program and Course Content.

The content of teacher education programs and the various courses are very important factors that have an effect on the integration of ICT in schools. Aslan and Zhu (2014) found out that pre-service teachers' gains from ICT related courses in their teaching program and their perceived ICT competence significantly predict their ICT integration into teaching practice. For teachers to be able to use technological tools in their classrooms, an effective ongoing professional development program must be put in place to improve their skills (MacDonald, 2009). There are different strategies to develop pre-service teachers' ICT competence. Such strategies can include educational technology courses, method courses and field experience (Mouza et al., 2014). We shall take a look at some common aspects relevant to ICT integration which research throws light on.

Program Content

In the context of this study, program content has to do with the selection of courses and learning activities, their weighting in terms of relevance and importance, their placing in the school timetable and their relevance in terms of research to the integration of ICTs. There are different strategies to develop pre-service teachers' ICT competence. Such strategies can include educational technology courses, method courses and field experience (Mouza et al., 2014). Most teacher training programs around the world are working hard in the area of including technology courses, but still encounter challenges. For example, as Harrison et al., (2002) put it, the challenge is that many teachers who received ICT training as part of their professional development still lack the confidence needed to integrate ICT in the teaching and learning process.

Also, according to the research carried out by Unal and Ozturk (2012) in Turkey, teachers complained about the training courses that these in-service training courses were about the use of ICT tools but lack the requirements of relating ICT tools with didactic contents. That is, ICT courses are mostly designed to help teachers know how to use ICTs, but not how to teach with them. Mishra and Koelher (2006, p. 1033) stated that merely knowing how to use technology is not the same as knowing how to teach with it. A review of literature indicates that for the most part, ICT professional development for teachers has mostly centred on learning about ICT, the main focus being skills development on the use of various computer

applications, such as word processing, spread sheets, email, internet, graphics, etc. (Haris et al., 2009). The designation of ICT as a discrete subject, leads to a dire lack of subject teachers trained to integrate technology into learning in their areas. These are fundamental challenges to be overcome before ICT capacity building can become a reality in African education (Hennessy et al., 2010). Although basic computing skills constitute the cornerstone of ICT knowledge, skills-based courses are not enough to prepare teachers to integrate ICT in classroom instruction as they are usually taught in isolation from a pedagogical context (Haris et al., 2009).

Another aspect to consider is the commonly used One-size-fits-all versus subject specific approach. Professional ICT developments that are general to all subjects, also called 'one size fit all' usually involves giving the same course on technology integration to pre-service teachers of different disciplines, without considering the differences in the specificities of each discipline. These courses are often called 'general courses' because they regroup students from different specialties together learning from the same teacher in one classroom. This approach is being widely criticised. Hennessy et al., (2010) argue that professional development should be tailored in as far as possible to a subject discipline. This will allow teachers to deepen their ICT pedagogical skills and share common practices within their discipline.

Time allocation is one of the key aspects of a training program. It involves how time is allocated and organized for the various courses. Usually, more time is allocated to what the training institution considers the most important courses (usually known as major or compulsory courses) even if it's not evidence based. Generally, there is a yearly allocation of the number of teaching hours of various courses, and also for all the courses put together. For example, Guskey (2000); Supovich and Turner (2000) recommended that for a teacher professional development program to be effective, it should be held for a minimum of 60 to 80 hours annually.

Another aspect is how these courses are organized. The sequencing and placing of various courses in the timetable can be a strong factor enough to hinder or promote the use of ICTs in school. For example, in a study carried out by Sicilia (2006), teachers complained about the inaccessibility of computers due to several periods (classes) in a row. When the time spacing among class periods is small or nonexistent, there is very little chance that teacher educators will be motivated to use them because the timetable is becoming a hindrance.

Course Content

In the context of this study, course content has to do with the selection of content based on the course objectives, as directed by the goals of the program. The course content is an expression of the program content that is to be implemented. Training courses offered by some institutions are not meeting the learning needs of teachers and moreover, they are not updated regularly (Balanskat et al., 2006). The course content must be regularly updated to meet up with the fast pace of technological innovation. There are aspects of breadth and depth of the courses. Sometimes, the courses are too shallow in terms of depth, especially when there is too much content to be covered within limited time.

Too often the curriculum in developing countries is rigid and overloaded, leaving little time for innovative classroom practices. National policies need to make more commitment to helping teachers effectively integrate computers and internet technologies into the classroom by aligning curricula, exams, and incentives with the educational outcomes that they hope to gain (Hennessy et al., 2010). At other times, it is the breadth that is limited. Since information technology is always in active innovation, many new developments need to be added continually to the content of technology courses. Because of such diverse information student teachers need to deal with, it becomes necessary to tailor content to specific disciplines, so they don't get to learn skills that may not be relevant with their specialties. However, there are challenge to this approach, namely the dearth of funds, lack of qualified personnel and nod-adaptation to local contexts. Even if teacher training institutions may have the funds, getting qualified staff is a major challenge especially in a context where demand far exceeds supply in terms of qualified teacher educators.

Course content should always take into consideration the context of the program, the society and the world at large. (Leach et al., 2005) recommend that those implementing technological solutions need to ensure they are context-specific, and adapted to local needs and conditions. This is because sometimes, there is an incompatibility between textbooks for example, used here but with contexts that mostly resemble the context of other countries in the world, especially the English-speaking nations; as most available software online are in the English language.

Teaching – Learning Activities.

These are activities that take place in the classroom. This is where the program and course content are implemented or felt. ICTs do not themselves enhance students' learning

capabilities but teachers who use ICTs thoughtfully do. It's the teaching and learning requirement that need to stimulate ICT intervention, rather than the ICTs themselves (Baylor & Ritchie, 2002). It is important to examine deeper principles of teaching and learning and how teachers integrate technology in pedagogical contexts (e.g., Baker et al. 2018). Classroom activities are what determine to a large extent if student teachers will integrate technology at the end or not.

There are some teaching-learning activities that have been found to yield better results than others. Some of these include:

Modelling by Teacher Educators

Laronde and MacLeod (2012) found that pre-service teachers preferred strategies in which academics modelled various technologically supported teaching methodologies specifically related to curriculum domains. The authors believed this modelling to be important as pre-service teachers tend to adopt the teaching styles they were exposed to during teacher education. However, If the model does not complete the task successfully, the self-efficacy of the observer can be negatively affected (Tilton & Hartnett, 2016), thereby discouraging teachers from integrating ICTs.

While much literature on modelling focuses on the observer being influenced positively through this process (Margolis & McCabe, 2003; Schunk & Pajares, 2002), the findings from their study highlight that, when the model experiences success, their own confidence may also be positively influenced, indicating the benefits of modelling may be reciprocal(Tilton & Hartnett, 2016).

Modelling, which encompasses the observation of similarly skilled individuals in similar contexts, can encourage the observer to attempt similar tasks if they perceive that they could also be successful in similar circumstances (Schunk & Pajares, 2002). If the model does not complete the task successfully, the self-efficacy of the observer can be negatively affected (Tilton & Hartnett, 2016). This implies that teaching learning activities should include many opportunities for pre-service teachers to watch their teacher educators model the use of ICTs themselves. "If we want to encourage the use of technology as a tool for learning and problem solving, it makes sense that we would want teachers to model this activity for students at all levels and in all appropriate contexts" (International Society for Technology in Education(ISTE), 1999, p. 23)

Encouraging Group Work and Collaboration

Teacher's emotional states have been found to significantly predict whether or not to integrate technology. Mood, stress, anxiety may affect a person's beliefs about judgements of related performance. Positive feelings about performance increase people's self-efficacy; in contrast, negative feelings decrease a person's self-efficacy (Bandura, 1994). Many studies have demonstrated that group work might mitigate these feelings of insecurity when teachers need to design technology-related curriculum materials (Tearle & Golder, 2008). This implies that one of the ways to overcome negative feelings that impede the integration of ICTs is by grouping students together to work as a team. In this system, everyone begins to feel secure enough to work with their more knowledgeable peers. Guskey and Yoon (2009) note that collaboration between teachers, who have a clear understanding of critical issues in the subject discipline, and district level personnel, who have a broader perspective on the problems related to the discipline, seems essential to optimise effective professional development.

Shift from Traditional to Transformational Education.

In the digital age of the 21st century, teachers cannot possibly expect to be the omniscient source of knowledge. Their role instead is to inspire and guide their students-as learners. Unfortunately this is not the way most teachers have been educated to teach (Bell, 2016). A new pedagogy of "transformative education" must replace the "transmission model" of teaching and learning that continues as the dominant practice in most schools in the world. Milton and Vozzo (2013, p.76) argued that digital pedagogy has more in common with the constructivist approach to teaching than it does with traditional pedagogy, because it concentrates on how students construct their own knowledge. This view is in line with Sailin and Mahmor (2018, p.144) who argued that the teaching and learning processes should become more constructivist and learner-centered when digital technologies are integrated into teaching. The constructivist and learner-centered approaches are expected to enhance the skills students need in the 21st century (Sailin & Mahmor, 2018, p.146–147). Therefore, learners should become the creators of knowledge themselves by interacting with the environment (Pittman & Gaines, 2015, pp.540, 550).

Making lessons Interesting and Motivating for learners

We can conclude in concurrence with Cox, Preston & Cox (1999) that the factors contributing to on-going use of ICT by teachers include: Making lessons more interesting, more enjoyable for teachers and their students, more diverse, more motivating, and supportive of productive learning. Overall, it is clear that the psychological factors of a teacher's own beliefs

and attitudes to ICT and pedagogical innovation are both primary facilitators and barriers to teacher use of technology in the classroom. Teacher educators must maintain a positive attitude towards the integration of ICTs in teaching and deliberately inspire their students by their own example in real life contexts.

Using the Blended Learning Approach.

Although there is still much ambiguity about the definition of blended learning, we can use the definition of Graham (2006) who defined blended learning a systems combining face-to-face instruction with computer-mediated instruction (p. 5). According to Driscoll (2002) blended learning has taken on several means, such as combining modes of web-based technology, pedagogical approaches, instructional technologies and actual job tasks. His point of view made room for a diversity of modes of learning. This means that teacher educators have to ensure that their teaching-learning activities include as many modes of teaching and learning as possible. For example, modes such as online learning, face-to-face, web-based learning, distance learning, flip classroom, computer-mediated learning, school on TV/ Radio etc.

Since most student-teachers will be required to master and teach through a wide variety of modes, they need to be prepared to use any of these after training. For example, the main intervention of the Cameroon government through the ministries of Basic and Secondary education was the School on Tv program, yet teachers were never trained in the teacher training program on how to prepare and deliver lessons on TV and on Radio. It was only after the covid19 crisis that some teachers were selected and retrained before they could effectively prepare and deliver lessons on TV and Radio. According (Béché, 2020), the search for pedagogical continuity solutions in Cameroon was a “race against time” in a context that had not yet integrated distance technology as an essential training modality. The responses were a patchwork combination of institutional and individual initiatives, learning management systems and information and communication tools.

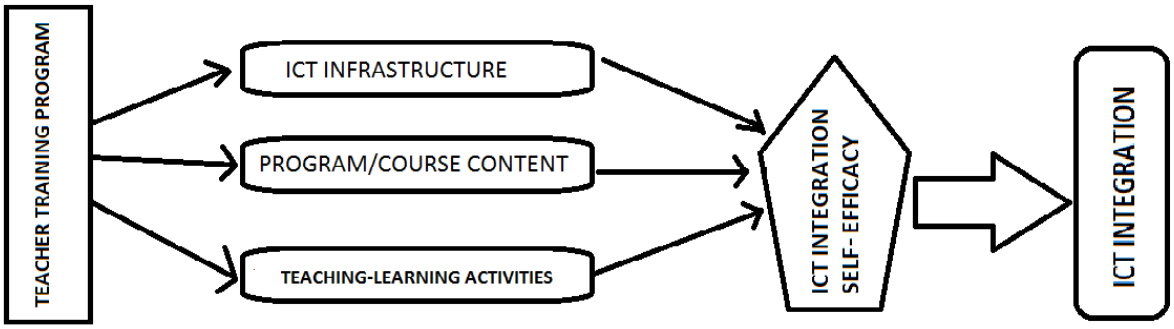
Using the blended learning approach, in this case as an umbrella term, will mean that teacher educators will expose their learners to many different possible modes of lesson delivery so that they will be able to cope with the high demands of the ever-dynamic innovations in educational technology. Teacher educators should not be contented with just uploading notes to websites and sending e-mails, chatting with WhatsApp, but should use other tools like learning management systems, e-libraries, videoconferencing, audio-conferencing; Google

products like (i) Gmail, (ii) Google Forms, (iii) Calendars, (iv) Google Drive, (v) Google Hangouts, (vi) Google Jam board and Drawings, (vii) Google Classroom, etc.

Thematic diagram

Figure 3 summarizes the link between the independent variables and the dependent variable. The way teachers perceive the training program will affect their self-efficacy, which in turn affects whether or not, and the extent to which they will take action in integrating ICTs.

Figure 3:
Relating the effect of Teacher Training Program on ICT Integration



As seen in Figure 3, the three indicators of the teacher training program affect the ICT integration self-efficacy of the student teachers, which in turn predicts the level of integration. High self-efficacy provides greater motivation to meet targets and feel better in coping with adverse situations (Bandura, 1993; Harrison et al., 1997). When people do not believe in their own ability to produce the desired effect through their acts, they are not motivated enough to carry out the action (Schunk and Pajares, 2009). Teachers with high self-efficacy towards ICT integration may apply different teaching methods, digital content using a student-centred approach; contrast, teachers with low ICT self-efficacy are said to have a more teacher-centred teaching tendency in the classroom (Gilakjani, 2013).

PU and PEU are the connection between the self-efficacy theory and the TAM theory. The easier a user perceives technology to be, the higher the self-efficacy associated with its use (Davis et al., 1989). Since this research uses self-reported data, the aspects of PU and PEU are important to consider, given that both PU and PEU had jointly explained about 50% of the variance in BIU according to King and He (2006). Moreso, we have seen other aspects of the program that affect the ICT Self-efficacy of teachers, which go a long way to determine the level of ICT integration in the field.

CHAPTER 3
RESEARCH METHODOLOGY

Research design

A research design can be defined as a plan, format or layout which is used to acquire data relating to a given problem. The research design for this study is the Survey research design, using the quantitative approach. Survey research designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the population. In this procedure, survey researchers collect quantitative, numbered data using questionnaires (e.g., mailed questionnaires) or interviews (e.g., one-on-one interviews) and statistically analyse the data to describe trends about responses to questions and to test research questions or hypotheses (creswell, 2002). Despite the many applications of surveys today, there are still only two basic types of research surveys: cross sectional and longitudinal. In across-sectional survey design, the researcher collects data at one point in time while in a longitudinal survey design; the researcher collects data over time.

For this study the researcher will used the cross-sectional survey design. The quantitative approach was used to collect and analyse the data obtained from all the respondents.

Area of study

The area of study is Cameroon. Cameroon, officially known as the Republic of Cameroon, is a country located in Central Africa. Cameroon is situated between latitudes 1° and 13°N and longitudes 8° and 16°E. Cameroon spans an area of approximately 475,442 square kilometres (183,569 square miles) and has a population of over 27 million people (World Bank, 2023).

Cameroon shares borders with six countries: Nigeria to the west, Chad to the northeast, Central African Republic to the east, Republic of the Congo to the southeast, Gabon to the south, and Equatorial Guinea to the southwest. Additionally, Cameroon has a coastline along the Gulf of Guinea (Atlantic Ocean) to the west.

This study was not specific to a particular location in Cameroon because the teachers are working in so many different places all over Cameroon where they were posted. The focus is on the batch that graduated from the HTTC Bambili in the year 2018.

Population of study

This includes all the teachers of HTTC Bambili, both of the 1st and 2nd cycle who graduated in the year 2018. Belonging to the 'digital native' generation (Prensky 2001), it is expected that this target group should be able to quickly adapt to the online teaching challenges posed by the current situation. Having recently graduated from initial teacher education and having had specific and innovative opportunities to develop digital competence (Jäger-Biela, Kaspar, and König 2020), they are expected to be relatively competent in using online teaching applications.

Target population

The target population was Biology Teachers who are graduates from Higher Training College Bambili and have about 2-3 years of teaching experience. This includes graduates of the first and second cycle of the batch which graduated in the year 2018. The idea is to have people who graduated recently and have worked for a few years since their experiences in their training school will still be fresh in mind, and also their few years as in-service teachers makes them ideal to evaluate their training program.

Pre-service teachers may not be able to give reliable information given that they only practiced for a few months, but new teachers who have been in the field for about 2-3 years are more current on both the situation of the training college and the realities in the field. In addition, they have had the experience of the difficulties imposed by the lockdown that was imposed by the COVID19 pandemic. This makes them ideal respondents.

Sampling technique.

The sampling technique used is simple random sampling. The respondents were randomly selected from the population as they responded to the questionnaire. Simple random sampling is the randomized selection of individuals or members from a whole population where each individual or member of a population has an equal and fair probability of being chosen. The respondents were randomly selected from the population as they responded to the questionnaire.

Sample size

The sample size was determined using the Krejcie and Morgan table for sample size determination. The graduation list of the 1st cycle of Biology teachers shows that they were 53, while those of 2nd cycle were 31. This makes a total target population of 84 respondents. According to the Krejcie and Morgan table for sample size determination, the sample size will be estimated at 70.

Research instrument

Data collection was done using a questionnaire. The questionnaire contains 43 items divided into 2 main sections: Section 1 and Section 2. Section one contains 3 demographic items. Section 2 was further divided into four subsections: Subsections 2A, 2B, 2C and 2D. Subsection 2A, 2B and 2C measure the independent variables.

Subsections 2A evaluates teacher's perception of the effect of ICT infrastructure on the integration of ICTs in Cameroon Secondary Schools. Subsection 2B evaluates teacher's perception of the effect of program/course content on the integration of ICTs in Cameroon Secondary Schools. Subsection 2C evaluates teacher's perception of the effect of teaching-learning activities on the integration of ICTs in Cameroon Secondary Schools. Subsection 2D measures the integration of ICTsin Cameroon secondary schools, which is the dependent variable.

Table 1

Table for Determining Sample Size from a Given Population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354

95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note. – N is population size

S is sample size

Source: *Krejcie* and *Morgan* (1970)

Validation of research instrument

Validity is the extent to which a test or instrument measures what it claims to measure. To ensure that the instrument is valid, the following measures were taken:

- The questionnaire was pilot tested using students from the geology department of the HTTC Bambili. They constituted members of the target population that will not take part in the research. Feedback obtained from them enabled the researcher to improve on the face validity of the research instrument.
- The questionnaire is based on literature that was reviewed. All the items of the questionnaire were constructed by the researcher based on findings and gaps of research related to the various research objectives.

A reliability test was carried out to determine the internal consistency of items in the questionnaire using Cronbach's α reliability test. Cronbach's α coefficient for the pilot questionnaire was 0.802, and the final questionnaire used for the study was 0.859. According to George and Mallery (2003), Cronbach's Alpha value above 0.90 indicates excellent internal consistency, above 0.80 is good, above 0.70 is acceptable, above 0.60 is questionable, above 0.50 is poor, and below 0.50 is unacceptable. Since the Cronbach's α coefficient for both the pilot and the final questionnaire were all above 0.8, we conclude that the questionnaire was reliable.

Mode of data collection

Data was collected online through Google docs and also physical questionnaire documents where necessary. The physical documents were used in case the respondent is not able to fill the online questionnaire or does not have access to a smart phone or computer. The link to the online questionnaire was created, the various class delegates were contacted to send the link to their respective WhatsApp groups and to integrate their groups just for the purpose of communication with the respondents for the period of the research. Once collected, the questionnaires were re-typed to have a digital database of all the responses of the various respondents.

Data cleaning and preparation

Survey data cleaning involves identifying and removing responses from individuals who either don't match your target audience criteria or didn't answer your questions thoughtfully. This is usually done by visually inspecting the data for scores (or values) that are outside the accepted range of scores. Identifying and removing responses from individuals who don't match our target audience criteria or didn't answer our questions thoughtfully. It also involves removing those which were deemed unusable, (due to factors such as data incompleteness) and also those which were detected as outliers from the data set for the data analysis. This leaves us with an improved set of responses that allows us to make better analysis.

Data analysis technique/procedure

Descriptive statistics was used to analyse the collected data and the results presented in the form of tables and charts. Statistical Package for Social Sciences (SPSS version 21) program was used to analyse the data. Simple linear regression was used to test if the three indicators of the training program significantly predicted the integration of ICT in teaching in Cameroon secondary schools.

Ethical considerations

The researcher assured the respondents that their data will be treated with confidentiality and that their identity was protected. The researcher sought the permission of class delegates and classmates to integrate their WhatsApp group just for the research purposes after which he left the groups. No respondent was obliged in any way to answer the questionnaire.

CHAPTER FOUR

PRESENTATION OF RESULTS

This chapter presents and discusses the findings from the field as presented in the research methodology in chapter three. The first part discusses the general information of the respondents, and the second part presents the results on the three objectives and the hypothesis testing for the three hypotheses.

General information

This section details the background information of the participants. It gives information on the response rate of the participants, the distribution of participants by gender, the distribution of participants by age range and the distribution of participants by Cycle of the participants.

Response rate

A total of 67 questionnaires were received, representing 88.2% return rate from 76 questionnaires distributed to teachers. Of these, 1 questionnaire was deemed unusable, due to data incompleteness, and was subsequently dropped from the data set leaving 66 questionnaires for data screening. Of these, 0 questionnaires were detected as outliers and deleted from the data set leaving 66 cases for the data analysis.

Distribution of participants by gender

Table 2

Distribution of Participants by Gender

		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	34	51.5	51.5	51.5
	FEMALE	32	48.5	48.5	100.0
	Total	66	100.0	100.0	

As we can see on Table 2, 51.5% of the respondents were males while 48.5% were females.

Distribution of participants by age range

Table 3

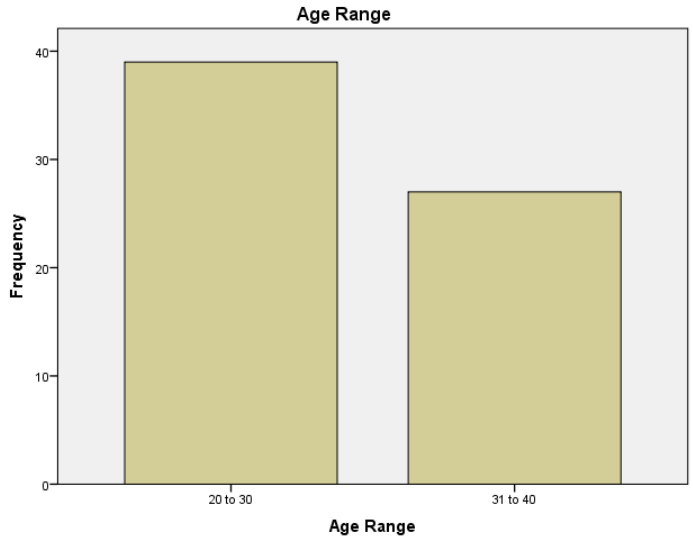
Distribution of Participants by Age Range

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20 to 30	39	59.1	59.1	59.1
	31 to 40	27	40.9	40.9	100.0
	Total	66	100.0	100.0	

The Frequency table shows that 59.1% of the respondents were between the age of 20 - 30 years. 40.9% were in the age range of 31- 40years. There was no respondent with an age range greater than 40 years old. This information is represented in the figure 4 below.

Figure 4

Distribution of Participants by Age-range



Distribution of participants by cycle (1st or 2nd)

Table 4

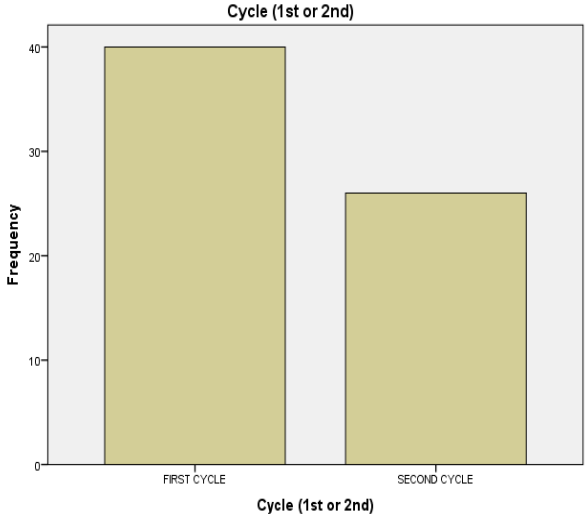
Distribution of Participants by Cycle

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FIRST CYCLE	40	60.6	60.6	60.6
	SECOND CYCLE	26	39.4	39.4	100.0
	Total	66	100.0	100.0	

As we can see in Table 4, 60.6% of the respondents were from the first cycle, while 39.4% were from the second cycle. The information was represented with a bar chart as follows

Figure 5

Distribution by Cycle



Presentation of results according to the research questions

Table 5

Descriptive Statistics on teacher's perception of the effect of ICT-infrastructure on the integration of ICTs in Cameroon Secondary Schools.

Items		Strongly disagree	Disagree	Agree	Strongly Agree
1A	I was satisfied with the infrastructure of my teacher training school because there were enough tools and facilities to support ICT integrated pedagogy.	13 (19.7%)	36 (54.5%)	12 (18.2%)	5 (7.6%)
2A* (R)	The buildings were not constructed in a manner that allows for convenient use of ICTs (that is, we don't find moveable seats and tables; enough electricity sockets, enough space for movement between student's provision of space for ICT equipment etc.)	10 (15.2%)	27 (40.9%)	18 (27.3%)	11 (16.7%)
3A	There was a functional computer laboratory for my department (not a general computer lab)	38 (57.6%)	26 (39.4%)	0	2 (3.0%)
4A	The computer laboratory had enough functional computers for all students	38 (57.6)	20 (30.3%)	6 (9.1%)	2 (3.0%)
5A	Free Internet connectivity of good quality was provided for students on campus	49 (72.7%)	16 (24.2%)	0	2 (3.0%)

6A* (R)	There was no stand-by generator or solar system to take over in times of electricity cuts on campus	26 (39.4%)	22 (33.3%)	13 (19.7%)	5 (7.6%)
7A	Each classroom was provided with an LCD projector and projector boards	37 (56.1%)	26 (39.4%)	2 (3.0%)	1 (1.5%)
8A	We had access to available ICTs in the school campus without any unnecessary restrictions	35 (53.0%)	31 (47.0%)	0	0

As for item 1A, we can see that the great majority of respondents (19.7% + 54.5% =74.2%) were not satisfied with the infrastructure of the institution. Item 2A was reverse coded. It shows that those who agree are about the same as those who disagree: that is, (40.9+15.2=56.1%) for those who disagree and 43.9% for those who agree.

Item 3A shows a very strong impression that there was no functional computer laboratory for the department. More than half (57.6% strongly disagree, while 39.4% disagree that there was a functional lab, making a total of 97%. This is a strong point worth noting.

Item 4A points us to the availability computers in the laboratories for all students. The response was similar to that of item 3, with most respondents (57.6%+30.3% =87.9%). This indicates that there is a serious problem with computers and computer labs.

Item 5A also reveals that more than 90% (72.7% +24.2%) of respondents disagree that free and quality internet connection was provided to students on campus. Among these, up to 72.7% of the respondents strongly disagreed.

Item 6A was reverse coded. It was about the mechanism to ensure that electricity supply is maintained during power cuts on campus by means of solar systems or generators. A greater proportion of the respondents (39.4%+33.3%=72.7%) disagreed that there was no such a system, but rather that there were generators or solar systems to take over electricity supply on campus during power cuts.

Item 7A was about the provision of LCD projectors and projector boards in each classroom. The results show that more than 95% (56.1%+39.4%) do not agree. The remaining less than 5% is proof that only very few classes were probably provided with LCD projectors and projector boards.

Item 8A is about having unnecessary restricted access to available ICTs on campus. The results show that all (53.0% + 47.0% =100%) the respondents disagree to that. In other words, all respondents say that there were unnecessary restrictions that limited their access and use of available ICTs on Campus.

Table 6

Descriptive Statistics on teacher's perception of the effect of program and Course Content on the integration of ICTs in Cameroon Secondary Schools

Items		Strongly disagree	Disagree	Agree	Strongly Agree
1B	The choice of ICT-related courses was very relevant to the competences required in the field	13 (19.7%)	21 (31.8%)	25 (37.9%)	7 (10.6%)
2B* (R)	The ICT courses did not cover the content I was expecting	10 (15.2%)	27 (40.9%)	18 (27.3%)	11 (16.7)
3B* (R)	Most ICT courses were general, that is, the same courses were designed for all the different specialties (not for a particular specialty)	38 (57.6%)	26 (39.4%)	0	2 (3.0%)
4B	The course outline included lessons on how to prepare lessons for presentation on Radio and Television.	38 (57.6%)	20 (30.3%)	6 (9.1%)	2 (3.0%)
5B	The content included lessons on how to teach with social media networks such as Whatsapp, Instagram, Telegram, Facebook etc.	48 (72.7%)	16 (24.2%)	0	2 (3.0%)
6B	Enough time was allocated for field experience of ICT integration so that student teachers practice well enough during their training.	26 (39.4%)	22 (33.3%)	13 (19.7%)	5 (7.6%)
7B	Recommended Text books relevant to integrating ICT in my subject (specialty) were made available by the school and/or lecturers	37 (56.1%)	26 (39.4%)	2 (3.0%)	1 (1.5%)
8B	I am very satisfied with the program and course content because I feel it was effective enough to make me competent in integrating ICT in teaching in the field	35 (53.0%)	31 (47.0%)	0	0

Item 1B shows a nearly fair balance of opinion between those who agree (37.9%+10.6% = 48.5%) and those who disagree (19.7%+31.8% = 51.5%) that the choice of the ICT related courses was very relevant to the competences required in the field. There are probably some factors that may come into play here.

Item 2B was reverse coded. The results resemble that of item 1B in that there was also kind of a balance between those who agree and those who disagree that the ICT courses covered the content expected by the respondents. That is, (40.9+15.2= 56%) for those who disagreed and 44% for those who disagreed.

Item 3B was reverse coded. The results show that almost all respondents (57.6% +39.4% = 97%) believe that most ICT courses were general, that is the same courses were designed for all the different specialties, and not for a particular specialty. Only 3% strongly disagreed.

Item 4B shows that a great majority of respondents (57.6%+30.3% =87.9%) believe that the course outline did not include lessons on how to prepare lessons for presentation on Radio and Television. This is a strong point given that just about 12% do not agree with it. Item 5B was similar in results to item 4B. As for item 5B, almost all the respondents (72.7% +24.2% = 96.9%) disagreed to the fact that the content included lessons on how to teach with social media networks such as WhatsApp, Instagram, Telegram, Facebook etc.

According to the results of 6B, 72.7% (39.4% + 33.3%) of respondents believe that there was not enough allocated time for field experience on ICT integration to enable them practice well enough during their training. Item 7B comes in with another strong point, showing that more than 95% of the respondents believe that recommended text books relevant to integrating ICTs in their subject specialty were never made available by the school and/or lecturers.

Item 8B concludes with all respondents not satisfied with the course content because they feel it was not effective enough to make them competent in integrating ICTs in teaching in the field.

The descriptive statistics on teacher's perception of the effect of Teaching-Learning Activities on the integration of ICTs in Cameroon Secondary Schools.

Table 7

Descriptive Statistics on teacher's perception of the effect of Teaching-Learning Activities on the integration of ICTs in Cameroon Secondary Schools.

Items		Strongly disagree	Disagree	Agree	Strongly Agree
1C	Most of our lecturers modeled (taught by example) the integration of ICTs in their own lessons as examples to us.	13 (19.7%)	21 (31.8%)	25 (37.9%)	7 (10.6%)
2C	Some of our learning activities were done by online video conferencing tools like zoom or Skype	16 (24.2%)	33 (50.0%)	15 (22.7%)	2 (3.0%)
3C* (R)	Most of our lecturers did not create a supportive environment to encourage active participation of all students	21 (31.8%)	34 (51.5%)	7 (10.6%)	4 (6.1%)
4C* (R)	We did not have sufficient opportunities to practice how to work with different technologies.	30 (45.5%)	22 (33.3%)	13 (19.7%)	1 (1.5%)
5C	Our lecturers always encouraged collaboration and group work when it comes to ICT training initiatives	29 (43.9%)	18 (27.3%)	18 (27.3%)	1 (1.5%)
6C	We were taught and practiced how to present lessons using power point.	32 (48.5%)	30 (45.5%)	4 (6.1%)	0
7C* (R)	Our classroom learning activities were not good enough to prepare us to be confident in integrating ICTs in teaching	40 (60.6%)	23 (34.8%)	3 (4.5%)	0
8C	Our lecturers often evaluated us using different online methods	21 (31.8%)	43 (65.5%)	2 (3.0%)	0

Item 1C shows a balance between respondents who believe that most of the lecturers modelled the integration of ICTs in their classroom (37.9%+10.6% = 48.5%) and those who disagreed to this fact (19.7%+31.8% = 51.5%).

The results of item 2C shows that a great majority of respondents (24.2%+50.0% = 74.2%) disagree to the fact that some learning activities were done by online video conferencing tools like Zoom or Skype. Only about 25% of them agree that there were actually some learning activities that were done online by video conferencing tools.

Item 3C was reverse coded. The results show that the great majority of respondents (31.8% + 51.5% = 83.3%) believe that their lecturers did not create a supportive environment to encourage active participation of all students.

Item 4C was reverse coded. The results show that a great majority of respondents (45.5%+33.3%=78.8%) believe that they did not have sufficient opportunities to practice how to work with different technologies.

According to Item 5C, (43.9% + 27.3% = 71.2%) of respondents disagreed with the fact that their lecturers always encouraged group work and collaboration when it comes to ICT training initiatives. In other words, they believe that there was a lack of promotion and encouragement when it came to group work and collaboration during ICT training initiatives.

The results of Item 6C show that almost all respondents (48.5% + 45.5% = 94%) disagree to the fact that they were taught and practiced how to present lessons using power point. Presenting lessons using power points is a basic skill that teachers need to have given the many advantages it offers. For example, it enables students to view videos and other 3D pictures which give a more realistic l life experience, far better than the common chalk boards. This also saves time that would have been used for drawing on the board and keeps the students, who are lovers of technology, always motivated to actively engaging themselves.

Item 7C was reversed coded. The results show that a there is a strong opinion of most respondents that the classroom learning activities were not good enough to prepare the respondents to be confident in integrating ICTs in teaching. 60.6% of respondents strongly disagreed to the claim, while 34.58% simply disagreed. The results of Item 8C are similar to those of Item 7C. Almost all the respondents (31.8% + 65.5% = 97.3) deny the fact that lecturers often evaluated them with different online methods.

Hypothesis testing

Hypothesis 1

$H0_1$: ICT infrastructure does not have a significant effect on the integration of ICTs in Cameroon Secondary Schools.

HA_1: ICT infrastructure has a significant effect on the integration of ICTs in Cameroon Secondary Schools.

Table 8

Model Summary for Hypothesis 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.361[a]	.130	.117	3.468

a. Predictors: (Constant), sum of INFR

R-value represents the correlation between the dependent and independent variable. R-square shows the total variation for the dependent variable that could be explained by the independent variables. Adjusted R-square shows the generalization of the results i.e. the variation of the sample results from the population in multiple regression.

This simple linear regression results as show in the table above indicates that the integration of ICTs in Cameroon secondary schools is influenced by 11.7%, as indicated by the **Adjusted R^2** of 0.117 in the Table 8 above. In other words, 11.7% of ICT integration is explained by infrastructure while 88.3% is explained by other factors. This shows that about $1/6^{th}$ of all the factors that influence ICT integration in Cameroon Secondary Schools. It is required to have a difference between R-square and Adjusted R-square minimum. In this case, the value is .501, which is not far off from .509, so it is good.

Table 9

ANOVA for Hypothesis 1

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	115.198	1	115.198	9.576	.003[b]
	Residual	769.893	64	12.030		
	Total	885.091	65			

a. Dependent Variable: sum of ICTINT

b. Predictors: (Constant), sum of INFR

Analysis of Variance (ANOVA) was carried out to check the level of significance. 95% confidence interval or 5% level of the significance level is chosen for the study. Thus the p-value should be less than 0.05. The results show a p value of .003, therefore the result is significant. The F-ratio represents an improvement in the prediction of the variable by fitting the model after considering the inaccuracy present in the model. A value is greater than 1 for F-ratio yield efficient model. In the above table, the value is 9.576, which is good.

These results estimate that as the p-value of the ANOVA table is below the tolerable significance level, thus there is a possibility of rejecting the null hypothesis in further analysis. This indicates the influence of ICT infrastructure on integration of ICT in Cameroon secondary schools was statistically significant.

Table 10

Coefficients for Hypothesis 1

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.526	2.049		4.649	.000
	sum of INFR	.446	.144	.361	3.095	.003

a. Dependent Variable: sum of ICTINT

Table 10 shows the strength of the relationship i.e. the significance of the variable in the model and magnitude with which it predicts the dependent variable. This analysis helps in performing the hypothesis testing for a study.

Based on the significant value, the null hypothesis is either rejected or not rejected. The value should be below the tolerable level of significance for the study. If Sig. is < 0.05, (for 95% confidence interval in this study) the null hypothesis is rejected. If Sig. is > 0.05, then the null hypothesis is not rejected. If a null hypothesis is rejected, it means there is an effect. However, if a null hypothesis is not rejected, it means there is no effect.

In this case of this study, the P value is .003, which is < 0.05, so we reject the Null Hypothesis, implying that there is a significant effect of ICT infrastructure on the integration of ICTs in Cameroon Secondary Schools.

The strength of the effect is obtained from the Beta coefficient. The simple linear regression model indicates that the independent variable had a positive Beta coefficient. According to Table 10, its value is 0.446. This means that for every increase in one unit of ICT infrastructure (IV), there is a corresponding increase in the DV (Integration of ICTs in Cameroon secondary schools) by 0.446.We can therefore represent the model with the equation $Y = 9.526 + .446X + E$

Where Y=dependent variable; a= the intercept when when X=0; b=the slope of the line; X=the independent variable; E= Random error

Hypothesis 2

$H0_2$: Program/Course Content does not have a significant effect on the integration of ICTs in Cameroon Secondary Schools.

HA_2: Program/Course Content has a significant effect on the integration of ICTs in Cameroon Secondary Schools.

Table 11

Model Summary for Hypothesis 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.453[a]	.205	.192	3.316

a. Predictors: (Constant), sum of PCCT

Table 11 provides the details about the characteristics of the model with respect to PCCT (Program and course content). These indicate that the integration of ICTs in Cameroon secondary schools is influenced by 19.2%, as indicated by the **Adjusted R^2** of 0.192. In other words, 19.2% of ICT integration is explained by PCCT while 80.8% is explained by other factors.

Table 12

ANOVA[a] for Hypothesis 2.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	181.277	1	181.277	16.484	.000[b]
	Residual	703.814	64	10.997		
	Total	885.091	65			

a. Dependent Variable: sum of ICTINT

b. Predictors: (Constant), sum of PCCT

The F-ratio represents an improvement in the prediction of the variable by fitting the model after considering the inaccuracy present in the model. A value is greater than 1 for F-ratio yield efficient model. In the above table, the value is 16.484, which is >1.

Table 13 shows us coefficients for Hypothesis 2. Based on the significant value, the null hypothesis is either rejected or not rejected. The value should be below the tolerable level of significance for the study. If Sig. is < 0.05, (for 95% confidence interval in this study) the null hypothesis is rejected. If Sig. is > 0.05, then the null hypothesis is not rejected. If a null hypothesis is rejected, it means there is a significant effect. However, if a null hypothesis is not rejected, it means there is no significant effect. According to the table, the P value is .000, which is < 0.05, so we reject the Null Hypothesis. This implies that there is a significant effect of Program and Course Content on the integration of ICTs in Cameroon Secondary Schools.

Table 13

Coefficients for Hypothesis 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.037	1.938		4.148	.000
	sum of PCCT	.523	.129	.453	4.060	.000

a. Dependent Variable: sum of ICTINT

The strength of the effect is obtained from the Beta coefficient. The simple linear regression model indicates that the independent variable had a positive Beta coefficient. According to table 13, its value is 0.523.This means that for every increase in one unit of Program and course Content (IV), there is a corresponding increase in the DV (integration of ICTs in Cameroon secondary schools) by 0.523. We therefore represent this model with the linear equation Y = 8.037 + .523X + E where Y=dependent variable; a= the intercept when when X=0; b=the slope of the line; X=the independent variable; E= Random error

Hypothesis 3

$H0_3$: Teaching-Learning Activities do not have a significant effect on the Integration of ICTs in Cameroon Secondary Schools.

HA_3: Teaching-Learning Activities have a significant effect on the Integration of ICTs in Cameroon Secondary Schools.

Table 14 provides the details about the characteristics of the model with respect to TLACT (Teaching-Learning Activities). This simple linear regression results as show in Table

14 indicates that the integration of ICTs in Cameroon secondary schools is influenced by 30.4%, as indicated by the $\mathbf{R^2}$ of 0.304 in the Table 14. In other words, 30.4% of ICT integration is explained by infrastructure while 69.6% is explained by other factors.

Table 14

Model Summary for Hypothesis 3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.551[a]	.304	.293	3.103

a. Predictors: (Constant), sum of TLACT

Table 15

Model Summary for Hypothesis 3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.551[a]	.304	.293	3.103

a. Predictors: (Constant), sum of TLACT

The simple linear regression results as show in Table 15 indicates that the integration of ICTs in Cameroon secondary schools is influenced by 29.3%, as indicated by the **adjusted $\mathbf{R^2}$** of 0.293 in the table above. In other words, 29.3%, of ICT integration is explained by infrastructure while 76.1.6% is explained by other factors.

Table 16 shows the coefficients for Hypothesis 3. The strength of the effect is obtained from the Beta coefficient. The simple linear regression model indicates that the independent variable had a positive Beta coefficient. According to the Table 16, its value is 0.620. This means that for every increase in one unit of Teaching-Learning Activities (IV), there is a corresponding increase in the DV (integration of ICTs in Cameroon secondary schools) by 0.620.

Table 16

Coefficients for Hypothesis 3

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.035	1.874		3.220	.002
	TLACT	.620	.117	.551	5.282	.000

a. Dependent Variable: sum of ICTINT

Table 17

Summary table for Hypothesis Testing of all three Independent Variables

Independent Variable	Sig value	Hypothesis Testing Result at 95% confidence interval	Interpretation
Teacher's perception of of ICT infrastructure	.003	Null Hypothesis Rejected (.003 <.05)	ICT infrastructure has a significant effect on the integration of ICTs in Cameroon Secondary Schools. This is because of the Sig. value is 0.03, which is less than the acceptable limit of 0.05. The strength of the effect is obtained from the Beta coefficient. The simple linear regression model indicates that the independent variable had a positive Beta coefficient. According to the table, its value is 0.446. This means that for every increase in one unit of ICT infrastructure (IV), there is a corresponding increase in the DV (Integration of ICTs in Cameroon secondary schools) by 0.446 units
Teacher's perception of the program/course content	.000	Null Hypothesis Rejected (.000 <.05)	Program/Course Content has a significant effect on the integration of ICTs in Cameroon Secondary Schools. The Sig. value is 0.000, which is less than the acceptable value of 0.05. The strength of the effect is obtained from the Beta coefficient. The simple linear regression model indicates that the independent variable had a positive Beta coefficient. According to the table, its value is 0.523.This means that for every increase in one unit of Program and course Content (IV), there is a corresponding increase in the DV (integration of ICTs in Cameroon secondary schools) by 0.523 units
Teacher's perception of teaching-learning activities	.000	Null Hypothesis Rejected (0.000 < 0.05)	Teaching-Learning Activities have a significant effect on the Integration of ICTs in Cameroon Secondary Schools. This is because the Sig. value is .000 which is less than .05. The strength of the effect is obtained from the Beta coefficient. The simple linear regression model

	indicates that the independent variable had a positive Beta coefficient. According to the table, its value is 0.620.This means that for every increase in one unit of Teaching-Learning Activities (IV), there is a corresponding increase in the DV (integration of ICTs in Cameroon secondary schools) by 0.620 units.

From the results in Table 17, we can conclude that all three independent variables had a significant effect on ICT integration in Cameroon Secondary Schools, with the strongest of them being Teaching-learning Activities, which has a Beta coefficient of 0.620, then followed by Program and Course Content with a value of 0.523 and then ICT Infrastructure with a value of 0.446. We can see from this analysis that there is a significant effect of the Teacher Training Program on the integration of ICTs in Cameroon secondary schools.

CHAPTER 5
DISCUSSION OF RESULTS, CONCLUSIONAND RECOMMENDATIONS

INTRODUCTION

In this chapter, we shall discuss the results presented in chapter 4 and then we shall look at the conclusion, limitations, implications, recommendations about the teacher training program that could hopefully lead to improvement in the initial professional development of student-teachers. We shall also make some suggestions for further research.

Discussion of results

The purpose of this study was to evaluate teacher's perception of the effect of the teacher training program (of Higher Teacher Training Colleges) on the integration of ICTs in Cameroon Secondary Schools. In this chapter we shall focus on discussing the results from which we shall draw conclusions and make any necessary recommendations. The discussion will be done based on the three objectives.

Objective 1:

Objective 1 was to evaluate teacher's perception of the effect of ICT infrastructure on the integration of ICTs in Cameroon Secondary Schools. We could say the concept of ICT infrastructure denotes all the facilities necessary for effective ICT integration in schools. Such infrastructure includes connectivity to various networks (internet, intranet, and mobile-telephone); sources and reliability of energy (UPS, electricity, standby generators); equipment (computers, radios, videos, television, LCD projectors and software, e-learning laboratories furniture and stores, and information storage facilities such as flash disks, CD-ROMs, DVDs (Mulwa, 2011).ICT infrastructure is one of the basic requirements for the successful integration of ICTs in teaching and learning. The extent to which a country is able to participate and benefit from the electronic communication technology depends on the country's availability of e-infrastructure (UNESCO, 2004).

Results show that the great majority of respondents were not satisfied with the infrastructure of the institution. This is a strong signal to the stake holders given the great effect of ICT infrastructure on the integration of ICTs. Another critical indicator of ICT integration was internet connectivity. The descriptive statistics results reveal that more than 90% of respondents disagree that free and quality internet connection was provided to students on

campus. Knowing that many students cannot afford continual internet connectivity, internet connectivity cannot be guaranteed for all students. Considering how much this is important for successful training of teachers, its absence virtually means teacher educators will not be able to effectively model and instruct student teachers on how to integrate ICTs in teaching. The issue of connectivity is also problematic because of unnecessary restrictions on campus, and by the Network providers who often provide poor quality network to the institution and usually at high cost.

Another issue was about the provision of LCD projectors and projector boards in each classroom. Virtually all the respondents claimed this was not the case. One of the basic ICT tools every teacher should know how to use is the projector, because it helps the teacher to display what cannot be easily represented on the chalkboard. These results also agree with the problem of computers and computer laboratories on campus. The results show that there are problems of availability, accessibility and usability. In other words, all respondents say that there were unnecessary restrictions that limited their access and use of available ICTs on Campus. This is mind blowing, given that it was a 100% opinion. This is a very serious issue given that all ICT infrastructures may be as good as non-existent if unnecessary restrictions prevent students from making use of them. Most respondents claimed that most of the computers in the computer labs were non-functional they needed repairs and replacements where necessary.

The results show a significant effect of ICT infrastructure on the integration of ICTs in Cameroon secondary schools. The effect of ICT infrastructure was a positive and a strong predictor of ICT integration in Cameroon secondary schools. This is not a strange thing because research has always proven an increase in the use of technology once the needed resources are made available. For example, a similar study was carried out by Cowie and Jones (2005), who found that with ICT Infrastructure provided, the teachers were able to access school network, the Internet and laptop accessories (printer, digital camera, data projector, large TV screen, scanner and video camera). Hence, the educators have more prospects to utilize instructional technology when the ICT infrastructures are provided in a well manner. Past research studies have shown clearly that ICT infrastructure can be one of the factors that influence the technology use among the teachers (Cowie & Jones, 2005).

Despite the fact that 100% of Teacher Training Colleges teach ICTs to student teachers, a greater part of the training is still theoretical due to the chronic lack of resources and

infrastructure (ERNWACA-Cameroon 2010; Ndonfack N. 2010). This is in agreement with the findings of this work, that show clearly that there is still a long way to go in terms of ICT infrastructure if we hope to see an increase in the level of ICT integration at the level of secondary schools.

According to UNESCO, 2004, ICT infrastructure is one of the basic requirements for the successful integration of ICTs in teaching and learning. The extent to which a country is able to participate and benefit from the electronic communication technology depends on the country's availability of e-infrastructure. Even though this is very important, there is a major challenge which is funding.

Acquisition of high cost ICT infrastructure and maintenance of equipment is a key barrier in the adoption of ICT in schools (Farrell, 2007). Dearth of funds has always been a major factor hindering ICT integration in education in developing countries like Cameroon. Another possible challenge is when policies only focus on ICT infrastructure. For example, Gülbahar and Güven (2008) claim that just equipping schools with the essential ICT tools does not improve the quality of instruction and does not create more effective learning environments. This implies that stake holders need to do more than just providing the ICT tools if effective ICT integration must take place. In South Africa, the procurement of computing devices is outpaced teacher training, and yet, these devices are, as Cuban (2009 p. 179) notes, "oversold and underused".

Objective 2:

Objective 2 was to evaluate teacher's perception of the effect of program/course content on the integration of ICTs in Cameroon Secondary Schools. In the context of this study, program content has to do with the selection of courses and learning activities, their weighting in terms of relevance and importance, their placing in the school timetable and their relevance in terms of research to the integration of ICTs.

The results show a nearly fair balance of opinion between those who agree and those who disagree that the choice of the ICT related courses was very relevant to the competences required in the field. This is a bit disturbing given that the teachers are given the same tasks after training and have worked for at least two years. We would have expected them to be more unanimous concerning many things, especially when it comes to evaluating the relevance of the content of their training program and courses. This difference in opinion may be explained

possibly by the different levels of entry qualifications or other factors in the field related to the status of its location, availability and accessibility of ICT infrastructure etc. another important factor may be support from senior experience colleagues, which may tend to blind the inadequacies of their previous training because of their current effectiveness. To say that virtually all these teachers had difficulties to teach during the Covid19 lockdown should have meant that they would have unanimously agreed to the fact that the program and course content was inadequate to equip them for effective ICT integration.

The results also show that most respondents believe that most ICT courses were general; that is, the same courses were designed for all the different specialties, and not for a particular specialty. Professional ICT courses that are general to all subjects, also called 'one size fit all' usually involves giving the same course on technology integration to pre-service teachers of different disciplines, without considering the differences in the specificities of each discipline. These courses are often called 'general courses' because they regroup students from different specialties together learning from the same teacher in one classroom. This is usually a big problem that usually arises because school authorities are usually understaffed with competent instructors and also because of lack of funds to employ them.

This approach is being widely criticized. Hennessy et al., (2010) argue that professional development should be tailored as far as possible to a subject discipline. Each subject has its unique specificity which also requires a unique way of teaching it with ICTs. This will allow teachers to deepen their ICT pedagogical skills and share common practices within their discipline. Teaching each subject has its unique techniques relevant to the nature of the content as prescribed by the curriculum in force.

The results also show that a great majority of respondents believe that the course outline did not include lessons on how to prepare lessons for presentation on Radio and Television. This is a definitely a problem. Teachers are required to master and teach through a wide variety of modes of lesson delivery, hence, they need to be prepared to use any of these after training. This is especially true with Radio and Television which is more widely available and usable over the entire national territory compared to internet connectivity and also in terms of affordability, availability and usability. We should remember that the most pertinent intervention by the ministers of education to ensure the continuity of schooling during the COVID19 period was 'School on Radio and Television,' meanwhile virtually all the respondents claim they had never been trained on how to prepare and deliver lessons on TV

and on Radio. This was the main method by which learning could still be made possible. It was only after the covid19 crisis that some teachers were selected and retrained before they could effectively prepare and deliver lessons on TV and Radio. According (Béché, 2020), the search for pedagogical continuity solutions in Cameroon was a “race against time” in a context that had not yet integrated distance technology as an essential training modality. According to him, the responses were just a patchwork combination of institutional and individual initiatives, learning management systems and information and communication tools.

The results also show that the majority of respondents believe that the program and course content did not include lessons on how to teach with social media networks such as WhatsApp, Instagram, Telegram, Facebook etc. In an interview given to CRTV on 20 March 2020 entitled “Can digital technology ensure the continuity of university courses?” (CRTV 2020a), the Minister of Higher Education listed the tools used for this purpose: learning management systems, WhatsApp, e-mail and mobile phones. For distance conferences and meetings, he listed Skype and Zoom. Given that social media apps were among the tools recommended by the Minister of Higher Education, it becomes necessary to include in the program and course content, how to use them pedagogically to reach students. Mishra and Koelher (2006, p. 1033) stated that merely knowing how to use technology is not the same as knowing how to teach with it. In other words, the fact that most teachers know how to use these tools for their social purposes, this does not translate into their ability to teach pedagogically with them.

Time allocation was another important factor. According to the results, most respondents believe that there was not enough time allocated for field experience on ICT integration to enable them practice well enough during their training. Time allocation is a critical factor when it comes to the integration of ICTs. There is a need to practice a lot when it comes to using ICTs while in the training school. Mastery experiences (which come by adequate and constant practice) are the most influential source of information to contribute to the development of self-efficacy, with success generally raising self-efficacy and failure lowering it (Bandura, 1982; Schunk & Meece, 2005). This shows that there is a need to revise the timetables and the weighting of courses to allocate more time for ICT-related courses.

One other strong point is about textbooks. According to the results, virtually all the respondents believe that recommended text books relevant to integrating ICTs in their subject specialty were never made available by the school and/or lecturers. One possible explanation

for this may be the fact that ICT integration is a relatively new concept in the context of the Educational system in Cameroon. This however is no excuse. The newness is more reason why there is urgency in the need to develop textbooks relevant to the contextual realities of Cameroon, and also specific to the various specialties. Lecture notes are not enough by themselves, so students need additional resources to help them study more effectively.

The results show a significant effect of Program and course content (PCCT) on the integration of ICTs in Cameroon secondary schools. This does not come as a surprise because it agrees with research which shows that the program and course content predicts whether or not teachers will develop a positive attitude towards ICT-integration. For example, Aslan and Zhu (2014) found out that pre-service teachers' pedagogical knowledge and their gains from ICT related courses in their teaching program significantly predict their ICT integration into teaching practice.

The effect of Program and course content was found to be stronger in this study than ICT infrastructure. This suggests that although they are both necessary, improving on the Program and course content has more influence on the integration of ICTs compared to Infrastructure. This also means that investing more in this area by revising and improving on the program and course content will be more productive. With the fast pace of technological innovations, it becomes challenging, but necessary to modify, update and improve the Program and course content to suit the realities of the current technological trends.

Objective 3:

Objective 3 was to evaluate teacher's perception of the effect of Teaching-Learning activities on the integration of ICTs in Cameroon Secondary Schools.

Respondents show from the results that there were opposing opinions as to whether or not their teacher educators effectively modelled the integration of ICTs in their own lessons. This implies that the level of modelling on the part of the lecturers was weak. Modelling is one of four main sources of information which influence self-efficacy judgments (Schunk & Pajares, 2002). Modelling, which encompasses the observation of similarly skilled individuals in similar contexts, can encourage the observer to attempt similar tasks if they perceive that they could also be successful in similar circumstances (Schunk & Pajares, 2002). This is a very critical issue according to Laronde and MacLeod (2012), who found that Pre-service teachers tend to adopt the teaching styles they were exposed to during teacher education. If the teacher

educators themselves do not model the integration of ICTs in during their teacher education, it will be hard for the students to have the motivation and confidence needed to also do what is required of them in the field.

The results show that the great majority of respondents believe that their lecturers did not create a supportive environment to encourage active participation of all students. We know that coaching is one of the influencers of the attitudes and motivation of students. According to Schunk & Meece (2005), verbal persuasion by a coach or trusted individual (for example, encouragement to use particular mobile apps) can also have some effect on motivation to try new or challenging tasks. Fear often tends to discourage teachers from relating in any way with ICTs. Johns (2004) in his research found out that most of the respondents were afraid of entering the classroom with limited ICT skills. Limited experience with technology hampers teachers' confidence about using ICT in the class (Osborne & Hennessy, 2003). It is therefore imperative to create a supportive environment to help slow learners and those who have a fear of technology to be to take active part in class. Anxiety, for example, often results in avoidance behaviour and Hesitancy about using computers can be an indicator of this anxiety, and subsequent avoidance may mask low technology self-efficacy (Celik & Yesilyurt, 2013). Teacher educators should also always encourage group work and collaboration when it comes to ICT training initiatives. The results show that there was a lack of promotion and encouragement when it came to group work and collaboration during ICT training initiatives. Collaboration also helps to motivate learners and make them see that they can also do what they see their mates doing.

One strong point we can see about the results is the fact that most respondents believe that the teaching-learning activities were not good enough to prepare them to be confident in integrating ICTs in teaching upon graduation. This is probably discouraging to students who have to face the challenge of adapting to the ever-growing and diversifying technological advancements in the field. According to Buckenmeyer (2010), the challenge is not getting appropriate technology into classrooms but getting those in classrooms prepared to use those technologies and facilitating greater willingness to incorporate changing technologies as they emerge. If those in the classroom are not prepared to use technologies and be motivated and willing to incorporate changing technologies as they emerge, we cannot be sure that they are truly ready to effectively integrate ICTs in teaching.

The simple linear regression model indicates that teacher's perceived Teaching-Learning activities had a positive and very strong effect on the integration of ICTS in Cameroon secondary schools. According to the Table 16, its value is 0.620. This value is very high, and it's also the highest when compared to the other two independent variables. In other words, teacher's perceived Teaching-Learning Activities (TLACT) was the strongest predictor of ICT integration in Cameroon secondary schools. This means that what is actually going on inside the classroom between the teacher-educators and learners has the highest effect on ICT integration. This is understandable, given that the contact point between the curriculum and the learners is in the lessons in class.

De Clercqand Shalem (2014) explain that to teach well, teachers need a particular knowledge of what they teach, a broad sense of diverse methods of teaching, and, more specifically, ways of explaining and representing the specific content they teach. Teacher educators have the responsibility to ensure that this is should be reality in their daily lessons. On their own part, Cox, Preston & Cox (1999) showed that the factors contributing to ongoing use of ICT by teachers include: Making lessons more interesting, more enjoyable for teachers and their students, more diverse, more motivating, and supportive of productive learning. The teacher educator must understand that the learners come with a lot of fear and discouragement, so the affective domain must be considered in order to change the attitude, beliefs and motivations of the learners. Also, lessons must be more diverse to accommodate a wide variety of possibilities that ICTs can offer, and the learners should develop the ability to adapt to the constant change that characterizes.

Professional development that is designed to facilitate change should be teacher specific and focus on the day-to-day activities at the classroom level (MacLaughlin, 1990; Weatherly & Lipsky, 1997 cited in Guskey, 1994).

Considering the strong effect of teaching and learning activities, it is therefore necessary that stake holders invest in this area to have a cost-effective intervention that will greatly improve the integration of ICTs in Cameroon secondary schools.

Conclusion

The findings of this work show that:

- According to teacher's Perception, ICT Infrastructure has a significant effect on ICT Integration in Cameroon secondary schools.
- According to teacher's Perception, Program/Course Content has a significant effect on ICT Integration in Cameroon secondary schools.
- According to teacher's perception, Teaching-Learning Activities has a significant effect on the Integration of ICTs in Cameroon Secondary Schools.

The results also show that the strongest predictor among these three independent variables was Teacher's perceived Teaching and Learning Activities, which predicted ICT integration in Cameroon secondary schools by 62.0%, within the 95% confidence interval. This shows that what is happening in the classroom has a stronger effect than even the ICT Infrastructure and the Program/course content.

Considering the responses to some important items on the questionnaire, we identified that most respondents agree to the fact that there is an urgent need to improve on the quality training offered in the teacher training colleges because they believe that the training they received was not good enough to make them competent to integrate ICT in teaching upon graduation. The results of item 7C for example show that a there is a strong opinion among respondents that the classroom learning activities were not good enough to prepare the respondents to be confident in integrating ICTs in teaching. In fact, 60.6% of respondents strongly disagreed to the claim, while 34.58% simply disagreed, making a total of about 95% of the respondents.

Implications of the study

- Teacher education should be taken more seriously if the government must solve and see improvement its present and future educational problems in the area of ICT in education. This is the key to sustainability.
- There is a need for improvement on the ICT infrastructure in the teacher training institutions. The infrastructure should be available, accessible, usable and used. Unnecessary restrictions should be removed to allow free access to students.
- The program and course content should be revised and improved to meet up with the realities in the field. The content should prepare teachers to be able to, for example, prepare and deliver lessons on Radio and Televison. It should also include teaching with social media platforms such as WhatsApp, Facebook, etc. it should also prepare

teachers to be able to use learning management tools such as MOODLE and Google Classroom.

- More time should be allocated to ICT related courses and field practice in the area of ICT integration.
- Lessons should be made interesting and attractive to target teacher's attitudes towards using ICTs. This is because when teacher's attitudes are positive towards using ICTs, they will be more motivated to implement what they have learnt in their own classroom in the field upon graduation. It is not enough that teachers have the competence, but they must also have a positive attitude towards ICT integration.
- Teacher educators themselves should model the use of ICT in their ownlessons. Students tend to teach as their teacher educator taught them.
- Since dearth of funds is one of the major obstacles of ICT integration, budgeting should be done in a manner to Prioritize classroom activities, since it was found to predict ICT integration the most. What goes on in the classroom predicts ICT integration more than the infrastructure and the content.
- There should be regular trainings organised for in-service teachers to update their skills and to motivate them to actively engage in integrating ICTs.

Limitations of the study

- The study was carried out only on biology teachers who graduated from HTTC Bambili in the year 2018. The research was cross-sectional and not longitudinal. It did not include other departments of the training college.
- The research focused on the level of secondary schools, therefore the results cannot be generalized to include the situation at the level of pre-school, primary school, university etc.
- Also, as a survey design, there will be limitations coming from the fact that the data collected is self-report data, that is, it comes from teacher's own self-judgement, which could be subjective in most cases.
- More so, the questionnaire was mostly filled online, and so respondents who did not want any form of inconvenience probably just stayed silent. The online method had to be preferred because the posting of teachers extend to all the national territory of Cameroon.

Recommendations

Based on the findings of this research, the following are some recommendations

- Teacher training institutions should be provided with the entire ICT infrastructure needed to aid the training of teachers in the area of ICT integration. They should also ensure that they are not only available, but also suitable, accessible, usable and used.
- Internet and electricity supply should readily available and free of charge for all students on campus, to encourage them to engage in using ICTs to improve their skills
- Teacher educators should collaborate with teachers in the field to find out their shortcomings after training so as to modify or improve the training program accordingly to meet with the ever-changing demands of technological advancements.
- In-service training programs should be organised for those on the field to keep them refreshed about various ways to integrate ICTs in their teaching. In-service training should also be offered to all the teacher educators, so that they themselves can model the integration of ICT in their classrooms.
- Pedagogic inspection and supervision should be carried out to ensure, monitor and evaluate the integration of ICTs at the classroom and school levels, in order to provide feedback and support to those who need it.
- Teachers who engage themselves effectively should be motivated by being recognized and rewarded. Their example can be an inspiration for many other teachers to engage themselves.

Suggestions for further research

- A similar study should be carried out but with a wider scope to includeall the other departments and also all the teacher training colleges in the ten regions of Cameroon.
- Similar research to examine other factors that predict the integration of ICTs in classrooms should be carried out.
- A comparative study should also be carried out to see the differences and similarities between the various teacher training colleges in Cameroon.

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APPENDIX

RESEARCH QUESTIONNAIRE

Dear respondent, my name is Tumabang Emmanuel Shu. I am a final year masters student of the Faculty of Education in the University of Yaounde 1.

I am carrying out a research for my dissertation titled: TEACHER TRAINING PROGRAM AND THE INTEGRATION OF ICTs IN TEACHING IN CAMEROON SECONDARY SCHOOLS.

Through this work, I hope to contribute to helping policy makers to improving the quality of teacher training with respect to ICT integration in teaching.

This Questionnaire is to collect data ONLY FROM BIOLOGY TEACHERS WHO GRADUATED FROM ENS BAMBILI IN THE YEAR 2018 (BOTH FIRST AND SECOND CYCLE) and no one else.

I assure you that all the information you enter here is solely for the purpose of research, and as such will be treated with confidentiality.

SECTION A

To evaluateteacher's perception of the effect of ICT infrastructure on the integration of ICTs in Cameroon Secondary Schools

Item number	Items	Strongly disagree	Disagree	Agree	Strongly Agree
1A	I was satisfied with the infrastructure of my teacher training school because there were enough tools and facilities to support ICT integrated pedagogy.				
2A* (R)	The buildings were not constructed in a manner that allows for convenient use of ICTs (that is, we don't find moveable seats and tables; enough electricity sockets, enough space for movement between student's provision of space for ICT equipment etc.)				
3A	There was a functional computer laboratory for my department (not a general computer lab)				
4A	The computer laboratory had enough functional computers for all students				
5A	Free Internet connectivity of good quality was provided for students on campus				

6A* (R)	There was no stand-by generator or solar system to take over in times of electricity cuts on campus				
7A	Each classroom was provided with an LCD projector and projector boards				
8A	We had access to available ICTs in the school campus without any unnecessary restrictions				

SECTION B

To evaluate teacher's perception of theeffect of program/course content on the integration of ICTs in Cameroon Secondary Schools.					
Item number	Items	Strongly disagree	Disagree	Agree	Strongly Agree
1B	The choice of ICT-related courses was very relevant to the competences required in the field				
2B* (R)	The ICT courses did not cover the content I was expecting				
3B* (R)	Most ICT courses were general, that is, the same courses were designed for all the different specialties (not for a particular specialty)				
4B	The course outline included lessons on how to prepare lessons for presentation on Radio and Television.				
5B	The content included lessons on how to teach with social media networks such as WhatsApp, Instagram, Telegram, Facebook etc.				
6B	Enough time was allocated for field experience of ICT integration so that student teachers practice well enough during their training.				
7B	Recommended Text books relevant to integrating ICT in my subject (specialty) were made available by the school and/or lecturers				
8B	I am very satisfied with the program and course content because I feel it was effective enough to make me competent in integrating ICT in teaching in the field				

SECTION C

To evaluate teacher's perception of the effect of teaching-learning activities on the integration of ICTs in Cameroon Secondary Schools					
Item number	Items				
1C	Most of our lecturers modelled (taught by example) the integration of ICTs in their own lessons as examples to us.	Strongly disagree	Disagree	Agree	Strongly Agree
2C	Some of our learning activities were done by online video conferencing tools like zoom or Skype				
3C* (R)	Most of our lecturers did not create a supportive environment to encourage active participation of all students				
4C* (R)	We did not have sufficient opportunities to practice how to work with different technologies.				
5C	Our lecturers always encouraged collaboration and group work when it comes to ICT training initiatives				
6C	We were taught and practiced how to present lessons using power point.				
7C* (R)	Our classroom learning activities were not good enough to prepare us to be confident in integrating ICTs in teaching				
8C	Our lecturers often evaluated us using different online methods				

SECTION D

To evaluate integration of ICTs in Cameroon Secondary Schools					
Item number	Items				
1D	Based on my training, upon graduation, I could set up a computer and projector to display my lessons by myself	Strongly disagree	Disagree	Agree	Strongly Agree
2D	Based on my training, upon graduation, I could effectively choose the various ICT tools that are suitable for teaching a specific topic.				

3D	Based on my training, upon graduation, I could use multimedia such as graphics, texts, audio, and video to design my lesson.				
4D	Based on my training, upon graduation, I could effectively teach online using video conferencing tools like Zoom				
5D	Based on my training, upon graduation, I could teach my students during the COVID19 lock down using ICTs				
6D	Based on my training, upon graduation, I could manage my classroom activities using Learning Management software like Google Classroom or MOODLE				
7D	Based on my training, upon graduation, I could effectively search for the resources I need online (e.g. textbooks, e-Libraries, videos, websites etc.) by myself to prepare my lessons				
8D	Based on my experience in the field after training (especially during the COVID19 lock down), I feel there is an urgent need to improve on the quality of teacher training program with respect to ICT integration in teaching in Cameroon secondary schools				

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****
DEPARTEMENT OF CURRILUM AND EVALUATION
****

The Dean

N° 496 /21/UY1/FSE/VDSSE

AUTHORISATION FOR RESEARCH

I the undersigned, **Professor MOUPOU Moïse,** Dean of the Faculty of Education, University of Yaoundé I, hereby certify that **TUMABANG Emmanuel Shu** Matricule **19Y3673,** is a student in Masters II in the Faculty of Education, Department: **Curriculum and Evaluation**, Specialty: **Curriculum Developer and Evaluator.**

The concerned is carrying out a research work in view of preparing for a Master's Degree, under the supervision of **Dr. KIBINKIRI Eric Len (CC).** His work titled:

"PRE-SERVICE TEACHERS'S PERCEPTION OF THE EFFECTIVENESS OF TEACHER TRAINNING PROGRAM IN PREPARING THEM FOR INTEGRATING ICTS IN TEACHING IN CAMEROON SECONDARY SCHOOLS: THE CASE OF SOME SELECTED DEPARTMENTS OF HTTC BAMBILI."

I would be grateful if you provide him with every information that can be helpful in the realization of his research work.

This Authorisation is to serve the concerned for whatever purpose it is intended for.

Done in Yaoundé..... 20 AVR 2021

For the Dean, by order

Le Vice-Doyen
GO Etienne
Professeur