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Digital Infrastructural Disposition and the Effectiveness of Distance Learning in the Ministry of Secondary Education in Cameroon

A Dissertation of a Master's Degree of Education defended on 12th July 2024

Educational Management
Specialty: Conception and Evaluation of Educational Projects.

By

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Declaration

I hereby declare that this dissertation is my original work and has never been submitted to any University or institution of higher education for an academic reward.

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Certification

This is to certify that this work entitled: ***Digital Infrastructural Disposition and the Effectiveness of Distance Learning of the Ministry of Secondary Education*** was carried out by Ndipewah Vandaline Bih (Registration No. 21V3029) under my humble supervisor.

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Dr. Shaibou Abdoulai Haji

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Dedication

To my son, Khan Nibright Khan-Junior

Acknowledgement

This research work has been successful with the aid of many people whose efforts contributed greatly towards its realisation. I received moral, financial, intellectual and emotional supports from many people and I remain indepted to them though only a few will be mentioned. My deep and sincere gratitude goes to my supervisor, Dr. Shaibou Abdoulai Haji, who despite his tight programme in the Department of Curriculum and Evaluation, spent much time reading through this work. His immense advice and criticisms gave me confidence and encouragement to complete this work.

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A special thanks to my coursemates and family members for their constant love, material, financial and moral support that formed the basis of what I may be today

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List of Abbreviation and Accromyms

AU:	African Union
CESA:	Continental Education Strategy for Africa
CMS:	Content Management Systems
COVID19:	Corona Virus 2019
DLC:	Distance Learning Center
DOI:	Diffusion of Innovation
DSL:	Digital Subscriber Line
ECW:	Education Cannot Wait
EFL:	English as a Foreign Language
ETSSP:	Education Training Sector Strategic Paper
GDP:	Gross Domestic Product
GER:	Gross Enrolment Rate
GESP:	Growth and employment strategy paper
GPRS:	General Package Radio Service
GSM:	Global System for Mobile Communication
HSDPA:	High Speed Downlink Packet Access
ICS:	International Correspondence Schools
ICT:	Information and Communication Technology
IDP:	Internally Displaced Persons
IMM:	Internet Multimedia
IOJET:	Online Journal of Education and Training
ISP:	Internet Service Provider
LCMS:	Learning Content Management Systems
LMS:	Learning Management Systems
MDG:	Millennium Development Goals
MINESEC:	Ministry of Secondary Education
NDS30:	National Developmwnt Strategy 2020/2030
ODL:	Open and Distance Learning
OECD:	Organization for Economic Co-operative and Development
PDA:	Personal Digital Assistance
PEOU:	Perceived Ease to Use
PPP	Point to Point Protocol
PU:	Perceived Usefulness
RNTU:	National Emergency Telecommunication Network
SDG:	Sustainable Development Goals
SLIP:	Serial Line Internet Protocol
TAM:	Technology Acceptance Model
UN:	United Nations
UNESCO:	United Nations Educational, Scientific and Cultural Organizations
USA:	United States of America
WA:	WhatsApp
WHO:	World Health Organisation
WLAN:	Wireless Local Area Network
WPAN:	Wireless Personal Area Network
WWAN:	Wireless Wide- Area Network
WWW:	World Wide Web

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Abstract

The phenomenon of Distance education has become a reality in sub-Saharan Africa. The advent of the COVID19 accelerated the adoption of distance learning as an appropriate method of teaching and learning in the Cameroon education system. Thus, this study examines the impact of digital learning infrastructures on the effectiveness of distance learning of the Ministry of Secondary Education. To achieve this, the mixed method research approach was adopted based on a cross sectional research design. The population of study consisted of pedagogic inspectors and teeachers. This study was conducted in the distance learning center located in Yaounde III sub division. For the data collection process, a closed ended questionnaire constructed basing on the likert scale was used for the quantitative data while a semi-structured face-to-face interview was conducted for the qualitative part. Through the simple random and stratified sampling technique, a sample size of 157 participants for both quantitative and qualitative data. Three major theories were convoked in this study such as the technology acceptance, the diffusion of innovation and the transactional theory. The data collected from the field was analysed throught descriptive and inferential statistics, using SPSS version 2021. For quantitative data meanwhile, content analysis was used to analyse the qualitative data of the study. The findings of the present study reveal that learning management system with a variance of ($F(1.152) = 45.772$, $p\text{-}v = 0.000<0.05$, is a strong predictor of the effectiveness of the distance learning center of Yaounde of the ministry of secondary education. This result proves that learning management system has an impact on the effectiveness of the distance education. The results of the findings also reveal that Internet connectivity with a variance of ($F(1.152) = 10.438$, $p\text{-}v = 0.000<0.05$, is a positive predictor of the effectiveness of the distance learning center of the ministry of secondary education. The results of the findings once again reveal that the digital learning devices with a variance of ($F(1.152) = 79.792$, $p\text{-}v = 0.000<0.05$, is a strong predictor of the effectiveness of the distance learning center of the ministry of secondary education. As such, all the alternative research hypotheses were validated which implies that distance learning infrastructures has a significant impact on the effectiveness of the distance learning center of the ministry of secondary education in particular and distance education in general. Based on the above the findings of this study, we therefore recommended that LMS, internet connectivity and digital learning devices must be carefully handled by the educational community since there are strong predictors of the effectiveness of distance learning.

***Keywords**: Digital infrastructure, distance learning, effectiveness, learning management system, internet connectivity, digital devices.*

Resume

Le phénomène de l'enseignement à distance est devenu une pure réalité dans les pays du désert saharien. L'avènement du COVID19 a accéléré l'adoption de l'enseignement à distance comme méthode appropriée d'enseignement et d'apprentissage depuis que les contacts physiques ont commencé à exister Ainsi cette étude propose d'examiner l'impact des infrastructures d'apprentissage numérique sur l'efficacité de l'enseignement à distance du ministère des Enseignements secondaires. Pour y parvenir, une approche de recherche à méthodes mixtes a été adoptée pour cette étude, basée sur une conception de recherche transversale. La population étudiée était composée d'inspecteurs pédagogiques et d'enseignants. Cette étude a été menée au centre d'enseignement à distance situé dans l'arrondissement de Yaoundé III. Pour le processus de collecte de données, un questionnaire fermé construit sur la base de l'échelle de Likert a été utilisé pour la partie quantitative de l'étude tandis qu'un entretien face-à-face semi-structuré a été mené pour la partie qualitative. Grâce à la technique simple d'échantillonnage aléatoire et stratifié, un échantillon de 160 participants a été sélectionné pour l'étude grâce au conseiller de recherche tandis qu'un échantillon de 3 participants a été retenu pour la partie qualitative de l'étude. Trois théories majeures ont été convoquées dans cette étude telles que l'acceptation de la technologie, la diffusion de l'innovation et la théorie transactionnelle. Les données collectées sur le terrain ont été analysées grâce à la technique d'analyse des données statistiques (statistiques descriptives et inférentielles), en utilisant SPSS version 2021 pour les données quantitatives, tandis que l'analyse de contenu a été utilisée pour analyser les données qualitatives de l'étude. L'analyse nous a permis d'arriver aux résultats suivants : Les résultats de la présente étude révèlent que le système de gestion de l'apprentissage avec une variance de ($F(1,152) = 45,772$, $p\text{-}v = 0,000<0,05$, est un puissant prédicteur de l'efficacité du centre d'enseignement à distance de Yaoundé dele ministère de l'enseignement secondaire. Ce résultat prouve que le système de gestion de l'apprentissage a un impact sur l'efficacité de l'enseignement à distance. Les résultats révèlent également que la connectivité Internet avec une variance de ($F(1,152) = 10,438$, $p\text{-}v = 0,000<0,05$, est un prédicteur positif de l'efficacité du centre d'enseignement à distance du ministère de l'enseignement secondaire. Les résultats révèlent une fois de plus que les dispositifs d'apprentissage numérique avec une variance de ($F(1,152) = 79, 792$, $p\text{-}v = 0,000<0,05$, sont un puissant prédicteur de l'efficacité du centre d'enseignement à distance du ministère du secondaire. Éducation. Ainsi, toutes les hypothèses de recherche alternatives ont été validées, ce qui implique que les infrastructures d'enseignement à distance ont un impact significatif sur l'efficacité du centre d'enseignement à distance du ministère de l'enseignement secondaire en particulier et de l'enseignement à distance en général. Sur la base des résultats ci-dessus de cette étude, il a donc été recommandé que les LMS, la connectivité Internet et les dispositifs d'apprentissage numérique soient traités avec précaution par la communauté éducative, car il existe de puissants prédicteurs de l'efficacité de l'enseignement à distance.

Mots clés : *Infrastructure Numérique, Enseignement À Distance, Efficacité, Système De Gestion De L'apprentissage, Connectivité Internet, Appareils Numériques.*

Chapter One

Introduction

In a world characteirsed by rapid globalisation and industrialisation especially in the field of technology, the use of technological devices has become an indispensable tool for the realisation of the sustainable development goals (Alemnge 2018). The effect of this industrialisation has resulted to the introduction of e-learning or distance learning in various educational systems worldwide (Oz & Ozdamar 2020). The use of distance learning as an option to facilitate the teaching and learning process came as a result of the numerous crisis affecting the educational sector coupled with the inability of some people to attain physical lectures. There are a number of factors which affects the effectiveness of the distance learning in both the developed and less developed countries among which include digital learning infrastructures. Therefore, for any smooth distance learning, there is the need for digital learning infrastructural components such as learning management sytems, digital devices and good minternet connections. The status of digital infrastructures therefore becomes very necessary in determining the effectiveness of distance learning.

It is believed that the use of technology and the subsequent start of online learning is not as a result of the outbreak of COVID 19, although it anticipated the actions of nations worldwide. The outbreak of this pandemic rather led to the shifting from face-to-face class to distance or online learning (El-Soussi (2022). Just like the infrastructures needed for face-to-face classes, there is need for digital infrastructures in order to start an online class. The movement from face-to-face learning to distance learning brought about a drastic change in all the sectors in the economy with the educational sector being one of the most affected. The various stakeholders started facing huge problems which ranges from infrastrcutures to the contents, quality, assessment, management and administration of education (Allam & Aligarh 2021). The problem of distance learning related to digital infrastructure is therefore very necessary. It becomes very impossible to have a smooth and effective distance learning without a well develop digital infrastructures. Hence, this study seeks to assess the impact of digital learning infrastructures on the effectiveness of distance learning in the educational centre of Yaounde.

This chapter thus, focusses on the background of the study (historical, contextual, conceptual and theoretical), the statement of the problem, the research purpose, questions and hypotheses.

The chapter also cut across the significance, the delimitation, the presentation of the study as well as the definition of key concepts of the study.

Background of the Study

The background to the study presents the art of the educational situation and nature in a given country, regional or locality. It equally presents the conceptual and theoretical backgrounds which build up the study. In this study, we present the conceptual background which deals with the global educational policies, continental educational policies and national educational policies and practices which inform distance education. Also, the conceptual and theoretical backgrounds trace the conceptual and theoretical evolution of the selected concepts and theories in order to give implications and new orientations in the present study.

Contextual Background to the Study

Towards the end of the 20th century and the dawn of the 21st century, the world has witnessed tremendous transformation in educational policies and practices. Technological innovation and disruption are some of the major changes of this century which has affected educational practices across the world. International development agencies dealing with educational policies and planning have equally been adapting these new developments in education through international policy orientions in education in order to align knowledge and competences development to international d evelopment and competitiveness. The first international strategic policy orientation of the 21st century was the millliniun development of goals (MDGs 2000-2015).

In the implementation of framework of the sustainab le development goal 4, the international community major objective in technological demain is to promote the use of ICT, particularly mobile technology, for literacy and numeracy programmes. In order for this to be reality, countries must ensure the availability of digial infrastructures that can contribute to the development of new learning practices in their respective countries. This is the operationalisation of the international guidelines on distance learning (SDGs 4, 2-2015-2030).

They highlighted that they are further commited to ensuring that all youth and adults, especially girls and women, achieve relevant and recognized functional literacy and numeracy profciency levels and acquire life skills, and that they are provided with adult learning, education and training opportunities. They are also ocommitted to strengthening science, technology and

innovation. Information and communication technologies (ICTs) must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision (Incheon declaration, 2015). These are lofty strategic objectives at the international level. Translating these at the continental and countries level require enonous resources for these digital infrastructure and distance education to be fully integrated.

In a world marked by globalisation and competition, adapting to the changing nature of technology in the society has become paramount for all the aspect of the society. As such, most educational systems in both the developed and less developed countries are providing innovations in the field of education which is aimed at improving the performance of students and the overall internal and external efficiency of these educational systems. In this line, distance learning has been seen by experts, policy makers, governments and educational stakeholders as an appropriate method to enhance education in the mist of crisis (political, economic, social and health crisis) affecting the world at large.

The Agenda 2030 for Sustainable Development Goals outlines the importance of building a resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation (Goal n09). This aimed to develop quality, reliable, sustainable and resilient infrastructures including regional and transborder infrastructure, to support economic development and human wellbeing, with a focus on affordable and equitable access to all (Agenda 2030). The goal number 4 of the 2030 Agenda seeks to ensure incluvsive and equitable quality education and promote lifelong learning opportunities for all (Agenda 2030). This is in accordance with the United Nations reforms on education which stipulate that Education Cannot Wait (ECW). The e-learning systems used can be as simple as a projector or an interactive board to a complex and sophisticated system like a learning management system or an online portal (Abouzahra, 2011). The number of students who participates in distance education has been increasing steadily in recent years. This is justified by the work of Weidlich & Bastiaens (2018), who stated that the rate of students in the higher education benefiting from distance education courses was 25.9%, 27.1%, 28.3% and 29.7% in 2012, 2013, 2014 and 2015 respectively. This situation shows that the number of students increased by 17.2% from 2012 to 2016. However, despite the innovative developments in distance education in recent years, typical problems remain.

Consequently, Sub Saharan African is one of the region which still faces resources challenges in the implementation of distance learing education. But in recents years many governments and international bodies within the region are putting in great effort to achieve this development as a means of providing access, equitable quality and inclusive education for all children of Africa (CESA, 2015-2025).

Notwithstanding, notable gains between 1999 and 2012 when Gross Enrollment Rate (GER) rose from 24% to almost 50%, access to secondary education in Africa is on the whole constrained by lack of opportunities and limited investment. Demand for secondary education outstrips the supply leading to stiff competition for the available opportunities. Private sector has a niche here but the response has not been commensurate with the growing demand. The development of digital infrastructure and effective promotion of distance education will contend some of these educational challenges in the continent (CESA, 2015-2025).

On average, access to both lower and upper secondary education in low income African countries (as measured by GDP and where data exist) is very low (44.7 and 23.2% respectively) (CESA, 2015-2025). Moreover, the completion rates for both levels are also very worrisome as only 29.5% and 13.9% of those accessing the lower and upper secondary level respectively complete them. There is also the issue of those who complete both levels but lost to the system as they do not access the subsequent level. At the end of the lower level, 6% is missing at the enrolment at the upper level and of the 13.9% who complete the upper level, only 6.1 % access tertiary education (CESA, 2015-2025).

In terms of Quality and Equity it shows that there **is** limited data on learning outcomes at the secondary education level, proxy data such as completion rates and examination results show that quality is a concern. In low income African countries, the completion rates for lower and secondary education are very low as only 29.5% and 13.9% of those accessing the lower and upper secondary level respectively complete them. In most countries, the transition from primary to secondary works to the advantage of boys which leads to the enrolment imbalance of girls that stands between 30 and 35% of the total enrollment. Girls' performance in math and science is poorer than boys due to limited facilities combined with classroom (and societal) culture which tends to discourage girls. These imply that distance learning at the community levels could be a strategic tool in mitigating educational challenges in Africa. Therefore, the

diferrent stakeholders must work to ensure the effective privsion of digial infrastructural dispositions that effectively response to needs of the African communities (CESA, 2015-2025).

While it is now established that quality and relevant secondary education can significantly address abject poverty in Africa as it increases chances for gainful employment, the capacity to accommodate graduates of primary education at the secondary level is very limited as it stands at 36% (UNESCO, 2011). In this light, distance education is a resolution to improving quality education and reduce proverty in the African communities. Therefore, increasing opportunity, especially for marginalized communities and urban poor and girls remains critical through education technology and distance learning. The relevance of secondary education remains a concern as it relates to employability, technical and vocational training and articulation with tertiary education. Math and science at this level are critical to the development of a well-equipped human capital capable of competing in increasingly science and technology driven world as well as the foundation for knowledge-based economies (CESA, 2015-2025).

The African Union (AU) through its educational strategy believes that number of initiatives in technological progress must ne taken into consideration. Some of these strategic orientations include: Harnessing the capacity of ICT to improve access, quality and management of educationand training systems. Formulate policies for ICT integration in education and training. Build ICT capacities of learners and teachers to take full advantage of the potentials of technologies. Build capacities of education managers and administrators on the use of ICTs in the planning, implementation, monitoring, strategies and programs. Promote the development of online contents taking into account African and local specifcities. Capitalize on existing and successful ICT-driven initiatives that enhance access including the Pan-African E-University. Provide appropriate and suffcient equipment facilities (e.g. connectivity, power) and services. Create mobile and online education and training platforms and accessibility to all students regardless of their circumstances (CESA, 2015-25).

According to World Bank (2018) Cameroon is a lower-middle-income country with an estimated population of 23.4 million (2016). Cameroon's average annual gross domestic product (GDP) growth, in real terms, ranged between 5.5% and 5.9 percent between 2013 and 2015, with GDP per capita estimated at US$1,429 in 2014. This implies that resources allocation in terms of public spending is still very lower. Over the last decade, the pace of economic growth has been too slow to drive significant poverty reduction, or promote shared

prosperity in a socially and environmentally sustainable way. Between 2001 and 2014, the incidence of poverty declined marginally from 40.1% to 37.5%, with the poorest 40% of the population becoming poorer over the same time. 40% of the population still at the poverty line is really high and affect infrastructural development. This also has effects on financing education given that almost half of the population lives within the poverty line. Even though a significant endowment of natural resources (including oil, high-value timber, and agricultural products) and a comparably well-educated workforce, the pace of economic growth is stymied by poor infrastructure, an unfavourable business environment, and weak governance. Furthermoere, the current stock of skills in the labour force is poorly aligned with labour market demand. These factors contribute to a challenging environment for poverty reduction). (World Bank, 2018).

The impact of the refugee crisis has reinforced existing patterns of spatial inequity. As of November 2017, Cameroon was host to 338,505 refugees, over 70% of whom originated in the Central African Republic 28% in Nigeria, and 0.5% in Chad, with the remainder originating in other African countries. In general, there are two distinct refugee situations in Cameroon: approximately 248,000 Central African Republic refugees live along the eastern border, the majority of them in the East region and the rest in the Adamawa region, who fled violence in the country and approximately 91,000 Nigerian refugees who fled violence in north eastern Nigeria live in the Far North region. The destabilizing impact of refugee populations in the Far North region is compounded by the presence of 242,000 internally displaced persons (IDPs) (World Bank, 2018).

Digital infrastructural disposition requires the involvement of socio-professional circles in the elaboration of technical, technological and vocational education training programmes. Its engagement will enhance sustainability in the development and management of digital infrastructure and distance learning centres in Cameroon (GESP. 2010-2020). Technologies of information and communication are commonly-used pedagogic tools of schools with a Multimedia Resource Centre up by at least 30%. Stakeholders still need to invest heavily in technological development in order to boost the sustainability (ETSSP. 2013.2020).

The country's 2035 vision of development calls for a major redefinition of the tasks assigned to schools as well the adoption of fundamental principles of governance. Schools remain responsible for developing citizens, fostering: individuality, economic understanding,

collective responsibility, moral values, intellectual ability, political and civic understanding. Reforming curricula: A consultation platform bringing together individuals from all sub-sectors (from preschool to higher education) will review all curricula. Focus will be placed on strengthening bilingualism, citizenship and environmental education and the spread of ICT (ETSSP. 2013.2020). Promoting innovative teaching methods: stimulating pedagogical practices should be used to promote teacher professionalism and improve student learning. There will be a focus on the use of ICT and the analysis of class practices. This can only be effective if educational stakeholders provide efficient digital infrastructure to foster extensive and holistic distance education in Cameroon (ETSSP. 2013.2020).

Also, the government in the strategic document indicated that the expansion in the use of ICT in education and training, education and training will be modernised through the integration of ICT. This signifies that information and communication technologies are indispensable in the education practices today. Moreover, strengthening the capacity of teachers and support staff to use computer tools and digital teaching resources is imperative; Promote new opportunities and new training tools (e-learning, distance learning, tutorials etc.); improve the learning environment in schools. All these objectives where highlighted in the strategic document (ETSSP. 2013.2020). Government has to now engage in the digital infrastructural transformation for distance education to be a reality in the Cameroon secondary school.

In this light many studies have been done regarding the nature of digital access, utilization of ICT, and e-learning in Cameroon. Farinkia (2018) surveyed 350 Form Four students and 18 teachers from 6 government general education schools in the Fako Division in Southwest Cameroon, with the goal of determining what limits ICT implementation in secondary schools. For this analysis, government schools were selected as they already have ICT in their facilities, typically computer laboratories. Through their research, the author determined seven factors hindered ICT implementation in schools within the region: in order of descending frequency these were “inadequate number of computers…unreliable internet connectivity…absence of trained support personnel…shortage of teachers to teach computer, lack of accessories such as uninterrupted power supply unit, frequent interruption of electricity supply and unsupportive rules and regulation (Solidarity and Development Initiative, 2021)

Penard et al (2015) research on the usage and adoption of internet in Africa found a two-level digital divide that helps explain the differences and similarities discussed in Haji et al. (2017),

Bediang et al. (2013) and Farinkia (2018). Penard et al. (2015) analysed household survey data from 2,650 individuals, representative of the populations of Douala (Littoral Region), Limbe and Buea (Southwest Region) in Cameroon. The researchers found that older generations were less likely to access the internet: "young and educated individuals are more likely to use the Internet in Cameroon. The probability of using the Internet is also higher for male, as well as for English-speaking and computer savvy individuals." The difference between Farinkia (2018) and Bediang et al. (2013) can be explained through existence of two levels of a digital divide expressed in Penard et al. (2015): there is "a first-level divide between those who have already adopted information technologies and those who (still) have not (i.e. an accessibility divide); and a second-level divide within the adopters, between those able to master use of these technologies and those with a skills deficit in operating these technologies (i.e. a usage divide)" (Solidarity and Development Initiative, 2021).

Furthermore, existing research suggests that there is an interest in utilizing ICT in schools in Southwest Cameroon, but lack of training and support makes overcoming pedagogical differences challenging; teachers are reluctant to implement new technologies with which they are unfamiliar. Infrastructural challenges, inadequate supplies of digital hardware, software, and other technologies further inhibit the implementation of ICT in schools. Digital access is limited which restricts a child's right to education in the modern, global economy (Solidarity and Development Initiative, 2021).

In a world characteirsed by rapid globalisation and industrialisation especially in the field of technology, the use of technological devices has become an indispensable tool for the realisation of the sustainable development. The effect of this industrialisation has resulted to the introduction of e-learning or distance learning in various educational systems worldwide (Oz & Ozdamar 2020). The use of distance learning as an option to facilitate the teaching and learning process came as a result of the numerous crisis affecting the educational sector coupled with the inability of some people to attain physical lectures. There are a number of factors which affects the effectiveness of the distance learning in both the developed and less developed countries among which include digital learning infrastructures. Therefore, for any smooth distance learning, there is the need for digital learning infrastructural components such as learning management sytems, digital devices and good minternet connections. The status of digital infrastructures therefore becomes very necessary in determining the effectiveness of distance learning.

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In spite of, the long awaited reform leading to the new and harmonisation secondary schools' curriculum and programmes found expression within the general reform movement (GESP, 2010). This was a holistic strategic document whose main objectives were to transform and develop the national economy from producing and commercialising primary products to an emergent one by 2035. The document advocated effectiveness, efficiency and quality education. Therefore, innovation and technological development could only emerge if the necessary curriculum implementation approaches were put in place for better school system.

The transformation of local primary products will add value to its products by transforming them into finished or semi-finished good before commercialisation. To this end, the new curriculum is guided by the desire to produce the human resources that will be imbued, with the required skills, knowledge, attitudes and creativity to be able to transform the society to achieve emergence by 2035 (GESP, 2010). Therefore, the integration of information and communication technologies into the education polies in the early 2000s calls for technological innovation in the curriculum and this technological innovation turn to have a significant contribution to institutional management in terms of teaching and learning as well as content management. This these technological innovations in the Cameroon educational system started build the spirit of digital literacy which continue to contribute greatly to the development of digital economic and sustainable macro-economic transformation.

Historical background of the study

The introduction of technologies in the field of education can be traced as far back as the late 1800`s. It is argued that one of the first forms of distance education was correspondence course study (Anderson & Simpson 2012). According to Mathews (1999), Sir Issac Pitman was the first exponent of distance education in England. He later on founded the Sir Issac Pitman`s Colleges in the middle of the 1840`s. During this period, correspondence courses gradually took advantage of the traditional method of delivery handouts to learners through mails and other platforms. For Mathews (1999) the introduction of correspondence courses in schools and colleges in England provided an opportunity for students and graduates to work independently using the materials and handouts provided by instructors. Thanks to the work of Sir Issac Pitman in England, correspondence courses were developed in other part of the world in countries such as Germany, Canada, Australia, the Soviet Union, Japan, as well as the United States (Mathews, 1999).

In the United States, William Rainey Harper (1856-1906) is considered as the early exponent of distance education. During his reign as the president of the University of Chicago, he helped established the first college-level correspondence courses through mail. He executed an extension program at the University of Chicago thereby creating the first world distance education program for universities. During this period, students who enroled for distance learning education were primarily students found in the rural and remote areas where access to higher institutions was not favorable. According to Sherron and Boettvher (1997), the members of the military equally constituted the distance education population. They further argued that the number of correspondence courses or distance education courses significantly increased after World War II as a result of the fact that many war veterans hurried to complete the courses they had missed while in the war front. This drastically led to the emergence of distance education in the United States as an auxillary for traditional or classical method of teaching and learning.

In Australia, due to the wide spread of the population over large distances, for example in communities such as Queensland, the first officially registered branch of distance learning was in the year 1920 after the Australian popoulation started taking distance learning courses at the International Correspondence Schools (ICS) in the small city of Pennysylvania found in USA

(White 2009). A department of Correspondence Studies was established in the University of Queensland that offered a Corespondence based program for the population of Australia. The creation of this institution permitted many citizens to gain access to education at a distance especially those residing in rural areas. Family status or the geographical location was no longer a major problem for the achievement of individual qualifications. Years later, many other Universities such as University of Western Australia also joined in the practicing of distance learning and several other Correspondence Programs were created across the national territory and distance learning programs could offer education at different levels of Education in 1965 (White 2009).

With the rapid advance in the field of technologies, coupled with numerous crisis that affected the society, looking for alternative means to overcome these crisis became the proirity of governments and policy makers worldwide. These crisis served as a permanent threat to practically all the domains in the society including education. By so doing, policy makers and governments saw no other alternative means other than introducing distance learning in education. The aim here was not to replace the traditional method of acquiring knowledge but most importantly to serve as a remedy to numerous problems which the educational sector was facing. Sherron and Boettcher (1997) argue that early distance education courses in countries such as U.S.A, England, Canada, Japan etc. made used of the first and second generation communication technological tools. The first generation (1850s-1960) were predominantly tools such as print, radio and television. The second generation (1960-1985) consisted of audiocassettes, videocassettes, fax, print, televisiovn and radio. Mathews (1999) pointed out that learning materials (text, audio, and visuals) were sent to students by mail and supplemented by broadcast radio and television.

In Cameroon, the ministries at the various levels of education through several initiatives such as the initiation and promotion of the one teacher, one computer policy which aimed at improving the skills of the teachers and enabling them owned a computer, has contributed to the development of distance education (Alemnge 2018). Also, following the National Forum on Distance Education which was jointly organized by the Ministries of National, Technical and Vocational Training and higher Education, under the umbrella of the Common Wealth Learning, held in Yaounde from the 16th to the 19th of September 2003, has as objective to open dialogue among all stakeholders on the national needs, priorities and challenges in the design and implementation of Open and Distance Learning (ODL) in Cameroon and to make

possible suggestions to the government elements of a national strategy or a road map for the implemetation of distance learning (Alemnge 2018). It was after this conference and the enactment of the higher education law on distance learning No.005 on 15th April 2001 that state universities in Cameroon started initiating and gathering experiences on how to implement distance learning programmes.

Cameroon is not left aside in this move. The law of orientation of 1998 (law 1998) serves as the backbone for the educational system in Cameroon. This law outlines the vision, missions and objectives of the Cameroonian system of education. The vision of Cameroon come 2035 as stated by the president of the Republic, Paul Biya advocated for an emergernce Cameroon in 2035. In order to make Cameroon an emergent and industrialised country, the National Development Strategy 2030 (NDS30) aims to undertake structural transformation of the economy by making fundamental changes in economic and social structures so as to promote endogenous, inclusive educational development while preserving opportunities for younger generations (NDS30). This paper is aimed to make Cameroon a new industrialised country.

As such, the NDS30 pursued a number of objectives among which the establishment of conditions favourable to economic growth and accumulation of national wealth and ensure that the structural changes indispensable for the industrialisation of the country are achieved (NDS30). In terms of digital technology, the NDS30 consist of (i) reconfiguring the national digital ecosystem, in particular by restructuring the sector by strengthening the management of a digital infrastructure heritage company; (ii) building the required digital infrastructure; (iii) securing the networks generally. In the same line, the government is considering the creation of digital parks and technological complexes with a view to (iv) develop digital content production; (v) increase and diversify digital uses and services; (vi) develop the manufacturing and assembly of digital parts and devices (NDS30). The desire of the government to make Cameroon a more industrialised country by introducing digital learning in to the educational system outlines the necessity of possessing digital learning infrastructures capable of ensuring an effective distance education throughout the national territory. Flexibility and convenience are some of the benefits students enjoyed with the introduction of distance learning in most levels of education.

In the domain of telecommunications infrastructure, the aim of the NDS30 is to facilitate access to ICTs for the greatest number of people by ensuring high performance and secure digital space

with an average access index above 0.4 (NDS30). In a specific manner, this will consist of the development of a latest-generation digital ecosystem by completing laying works for the optical fibre, in particular, the National Broadbang Network II Project, the National Emergency Telecommunication Network (RNTU) project and the Central African Backbone project, as well as the continued deployment of the hinterland optical fibre network to enable users to be connected to the infrastructure already completed and protects data transactions. There is therefore the need to create and set up digital infrastructures considered to be indispensable for the effectiveness of distance learning in Cameroon.

The digital infrastructures guaranteed effective distance learning as it ensures interactions between the teacher and the student from afar. Dascalu, *et al*. (2014), asserts that it also encourages interactions and collaboration with students and teachers from different schools. According to Buhari and Roko (2017), improved distane learning systems introduced in schools allows new learning materials to be uploaded online and give room for one-on-one interaction with the lecturer by creating an avenue for the students to ask questions and get responses online. Nevertheless, the introduction of distance learning in most developing countries encountered a great number of challenges amongst which include inadequate elements such as infrastructure, electricity, computers, required skills and the actual contributions of learners and instructors. Despite the limitation of time and facilities, distance learning can compensate the drawbacks of the traditional education methods in most secondary institutions and allows instructors to communicate information to a reasonably large number of students.

Conceptual background of the study

Digital learning infrastructures

Infrastructure has become an important aspect in the success and economic growth of every nation. With the rapid change in information and communication technology, the term infrastructure has been attributed to a lot of dimensions with some of its hybrid integrating both the physical or digital aspects around the world. In this study, we will be discussing the digital aspects of infrastructures and how there are becoming more important than ever in the educational sector. Digital infrastructure is now a primary source of competitive advantage amongst educational systems around the globe. According to Atkinson *et al* (2016), infrastructure refers to a wide array of physical assets while digital refers to information technology systems that collects electrically, process and transmit information electrically as

well. Therefore, defines digital infrastructure as those infrastructures where at least one aspect of it contains information technology (Atkinson *et al* 2016). As such, this distinctive aspect of digital infrastructure consists typically of an ecosystem of connected devices that exchanges information with each other.

Distance learning

Distance learning refers to education of students who may not always be present at school or where the learner and the teacher are separated in both time and distance. It is education of students using distance learning devices that allows learning without the physical presence of learners. According to Rahman *et al* (2020), distance education also known as online learning, distance learning, e-learning and online learning is an emerging technology driven form of education where its main characteristics include the physical separation of the teachers and students in the teaching process and the use of various technologies to promote the communication between teachers and students and between students and students. To these scholars, traditional distance education focused on students who cannot physically take part in courses in schools. To Reed *et al* (2015), these set of students are either full time workers, students who reside in remote areas and individuals who are unable to attend lectures due to other personal reasons.

According to Bruselic (2012), distance learning is a contributing force to social and economic development in the society. It is fast becoming an essential part of the mainstream of educational systems in both the developing and the developed countries. The globalization of distance learning provides many opportunities for countries for the realization of the goals of their various educational systems. The growing needs for the continual skills upgrading, retaining and the technological advances have led to an explosion of the interest on distance learning.

Theoretical background of the study

According to Thomas (2017), « a theory is an integral part of scholarly research that provides both guidance and exploration of the relationship among phenomena. Theoritical background therefore refers to the various theories the researcher uses to address a particular phenomenon or the studied phenomenon. Since the theoritical background is an indispensable part in a scientific work, the researcher is obliging to select theories that will permit the researcher to have an in-depth understanding of the studied phenomenon. We will use the following theories

through out this study; the theory of diffusion of innovation (DOI) by E.M. Rogers, 1962, the theory of technology Acceptance Model (TAM) by Fred Davis 1989 and Richard Bagozzi of 1992 and the theory of transactional distance by Dr. Micheal G. Moore, 1997.

The theory of diffusion of innovation

The theory of diffusion of innovation developed by E.M. Rogers in 1962, is among the oldest social-science theories. This theory uses communication as the principal element that determines how and over time an idea diffuses through a specific population or social system. The main aim of this theory of diffusion is that people should be able to adopt a new idea or behavoir as a social system. It is only when an individual perceived the idea or behaviour as new that diffusion becomes possible. Rogers defined diffusion as « the process in which an innovation is communicated through certain channels over time among the members of a social system ». From the above definition, it is oberved that the theory of diffusion of innovation is based on four main principles which are; innovation, communication channels, time and social system: Innovation: Rogers (2003), defines innovation as « an idea, practice, or project that is perceived as new by an individual or other unit of adoption ». An innovation might have been into existence over many years but might still be an innovation for the individual depending on how they perceived it as new; Communication channel: Rogers went further to define communication channel as "a process in which participants create and share information with one another in order to reach a mutual understanding; Time: the aspect of time in the theory of diffusion of innovation refers to the period of diffusion of a technology to the users; Social sytem: this constitutes the last element in the diffusion process. Rogers (2003), defines it as "a set of interrelated units engaged in joint problem solving to accomplish a common goal. Rogers developed five categories of adopters that constitute the target population when promoting innovation; the innovators, the early adopters, the early majority, the late majority and the laggards.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Fred Davis in the year 1989 and its one of the widely used models that explains the behavior of user acceptance to technology. Davis (1986, 1989) introduced four principles or contructs in relation to Technology Acceptance Model. These constructs are as follows; perceived usefulnes (PU), perceived ease of use (PEOU), attitude and behavioral intention to use. He went further to explain that these

constructs are interrelated and one can be used to predict the other. The constructs PU and PEOU form an end-user's beliefs on technology which turns to predict the attitude of an individual towards technology and attitude turns to predict the acceptance.

From the above analysis, it is observed that the model of technology is based on the following principles: Perceived ease to use, Perceived technology usefulness and Attitude towards technology use

The theory of transactional Distance

This theory was postulated **by** Dr. Micheal G. Moore, 1997. This theory seeks to explain the relationship that exist between instructor and learner when they are separated over space and time. The learner and teacher are separated by a learning environment which serve as a communication media between them. This communication medium is interrelated with the quality of dialogue that exists between the instructor and the learner. This theory takes into account three principal factors which are termed the principles of the theory. These are; dailogue, structure and the learner autonomy. The dialogue deals with the interraction that exists between the learner and the teacher, the structure refers to the nature of the institutional programs offered while the learner's authonomy simply means the nature and degree of self directedness of the student.

The Justification or the Rational of the Study

The study is a motivation of the research experience in the field where challenge was witness when it comes the lack of digital infrastructure and disposition of distance learning in Cameroon. This aspect is highly limitated due to resource in the effective implementation of distance education. This approach can go a long way to boost the socio-economic development of the Cameroon educational system.

This work is also to fill the gap of limited literature on digital infrastructures and distance learning in Cameroon and specifically in the national distance learning center in Yaounde. In this light, the conceptualisation of the digital infrastructure in the terms of learning management systems, digital device and internet connectivity are the veritable factors in improving distance education in Cameroon. The Cameroon nation needs educational transformation and integrations of new learning approach through technological infrastructure to enhance

knowledge and competence development. Digital infrastructural provision and effective distance education improve quality education and equity in the secondary sector of education.

This will help us understand to what extent digital infrastructure and distance learning in Cameroon through the development of learning approaches in the terms of human resource development and material investments that will enhance quality education which in the development of educational resources. The integration of these concepts will create a better environment and conditions for students and teacher and ascertain educational achievement at the school level and provide skills for the students to face real life challenge in the technological evolutionary age.

Statement Of the Problem

Over the past decades, the political, economic, social and health situations in the developed and less developed countries have raised a major concern to world leaders and policy makers. The heavy industralization and globalisation in the global economy has greatly affected the trend and life of individuals and nations. In this regard, countries inorder to provide lifelong learning opportunities for all, demands a number of efforts from policy makers which consist of introducing digital learning in education (Agenda 2030). The goal number 9 of the Agenda 2030 of the United Nations Organizations argues that the building of the resilient infrastructure, promotion of inclusive and sustainable industralisation and fostering innovation will go a long way to develop quality, reliable, sustainable and resilient infrastructure including regional and transborder infrastructure. So as to support economic development and human wellbeing, focusing on affordable and equitable access to all (Agenda 2030).

The effectiveness of distance education strongly depends on a number of factors among which we have digital learning infrastructure. Digital learning infrastructure considerably affects the success of distance learning. The NDS30 aims to reconfigurate the national ecosystem thereby building the required digital infrastructure and also securing the networks generally (NDS 30). Also, the NDS 30 aims to develop digital content production and increase diversity in digital uses and services. This further traces the importance of digital learning infrastructures. This is because in the 21st century, technology has become the focal point for individuals to perform learning activities. As such, receiving lectures and attaining classes is not more essentially being present in classrooms but simply by accessing learning platforms.

The development of digital learning infrastructures therefore seeks to solve this problem. This consist of developing an effective learning management system, ensuring good internet connectivity as well as the proper usage of the availble digital devices. Despite the above mentioned importance of digital learning infrastructures, it is observed that the state of digital infrastructure and the ecosystem in Cameroon still have a lot to be desired. This could be as a result of poor management of digital learning systems, poor internet connectivity and ineffective usage of digital devices. This study therefore aims to examine the impact of digital learning infrastructures on the effectiveness of distance learning of the ministry of secondary education.

The purpose of this study is to investigate the impact of digital learning infrastructures and the effectiveness of distance learning Centre in Yaounde.

Specific research objectives of the study

i) To analyze the impact of the use of learning management systems on the effectiveness of distance learning.
ii) To examine the importance of the use of digital devices on the effectiveness of distance learning.
iii) To assess the impact of internet connectivity on the effectiveness of distance learning.

Main research question

To what extent does digital learning infrastructure influences distance learning in the ministry of secondary education?

Research questions of the study

i) What is the impact of the use of learning management systems affects distance learning?
ii) To what extent does the availability and use of digital devices influences the effectiveness of distance learning?
iii) To what extent does internet connectivity affect the effectiveness distance learning?

General research hypothesis

Ha: Digital infrastructural disposition has a significant influence on the effectiveness of distance learning.

H0: Digital infrastructural disposition has no significant influence on the effectiveness of distance learning.

Specific Research Hypotheses

Ha1: The use of learning management systems has an impact on the effectiveness of distannce learning.

Ho1: The use of learning managment system has no impact on the effectiveness of distance learning.

Ha2: The use of digital devices has an influence on the effectiveness of distance learning.

Ho2: The use of digital devices has no influence on the effectiveness of distance learning.

Ha3: Internet connectivity is statistically significant with the effectiveness of distance learning.

Ho3: Internet connectivity is not statistically signifcant with the effectiveness of distance learning.

Significance of the study

The significance or implication of this study refers to the contribution of the study to a particular domain or discipline. In this present study, we are going to discuss the practical and scientific significance of the study.

Scientific significance of the study

Digital learning infrastructures permits the educational system and the society at large to connect to large scale networks and integrate to large amount of data in the system of operation. Such infrastructures has become a primary source of competitive advantage to the educational sector nowadays. Thus the role and function will always be emphasized since it serves as a driving force behind the growth and development of the educational system and increases the overall performance of schools and universities in general. Therefore the scientific significance lies in the fact that this study will help to enrich the already existing literature and knowledge on digital learning infrastructures and how it can be used to enhance the effectiveness of distance learning center in particular and distance learning in general. Since digital learning infrastructures is a challenging factor in the educational sector in Cameroon, due to the

insufficient resources coupled with poor quality of internet connection, this study will provide a literature review that will help the younger generation who intend to dwell in the field of digital infrastructures. This is because of many draw backs observed in its implementation and overall educational sector that shows the need to address issues related to pedagogic digital learning infrastructures.

Practical significance of the study

In terms of practical implication or significance of the study, the results of this study will be useful to a number of people. The results of the findings will serve as a basis on which effective digital infrastructures can be acquired. Therefore, this study will be important to the following people.

To the government

The results of the findings in this study will enable the government, policy makers, educationists, digital leaders and all those involved at the strategic or top management level to make more informed decisions and develop effective strategies through which more digitalized platforms, sophisticated digital devices and good internet connectivity can be created to achieve the goals and objectives of the educational system with ease. This study is expected to provide the different ministries especially the Ministry of Secondary Education with information that can be used to establish proper policy guidelines in regards to distance learning as a whole and digital learning infrastructures in particular in Cameroon. It will equally identify areas which needs improvement, maintenance and those areas where actions must be taken since digital infrastructures is an indispensable tool in IT system towards the achievement of the overall goals and objectives of education in Cameroon.

To private stakeholders

The results of this study will equally be useful to the digital private stakeholders who are number one partners of the government of Cameroon in the provision of educational facilities. This will permit them to execute their functions with ease simplicity. Since the world is gradually becoming a digital world, this study will permit digital experts to build platforms that meets the increasingly challenging infrastructures and will be able to satisfy the future needs of the world's population tomorrow in terms of connectivity. This is because there have an

important role to play in achieving quality education for all and sustainable community development since they must make sure that the types of platforms and connections adopted at the strategic level are well implemented at the operational level to improve the quality of education. They equally have an obligation to forward the challenges identified in the field for further action.

To the managers of the resource Centres

This study will be important to the technical team of the resource centres in Cameroon especially that of Secondary education in that it will permit them to know the quality and type of digital infrastructure to use in the day to day operation of their activities. It will equally permit them to be able to manage, operate and maintain these devices for greater output. They will also have the ability to connect to internet on wider scales and integrate large amounts of data in to the system. Since technology is constantly changing, they will have the opportunity to change to newer forms of technology and seize the opportunity to become more advanced and productive.

To the teachers and all those interested about digital infrastructures

This study will enable teachers in public and private schools in Cameroon and elsewhere to be aware of the necessity of performing their jobs properly through the use of digital infrastructures. It is believed that teachers are the pinnacles of education and that behaviour directly affects the results and performance of the teaching and learning worldwide. Therefore, this study will help expose teachers to digital infrastructures that permit them to gain access to new materials to be able to accomplish this task and inform them of their role of achieving quality education and sustainable community development and direct their efforts towards the realization of educational goals and objectives.

Delimitation of the Study

This study is titled “digital learning infrastructural disposition and the effectiveness of distance learning” has been confined and studied in two perspectives: content wise and geographical wise. To the formal, that is geographical wise, the study is limited in scope. It shall focused only in the center region of Cameroon specifically on the stakeholders involve in the practice of distance learning.

Content or subject wise, this study is limited only in the educational domain. This is because the educational sector appears to be the most affected area in the practice of distance learning. The researcher's choice of environment and subject is because of a good number of factors. First, because of the availability of the respondents, proximity to data and information as the projects headquarter is in the Center region and the next because of interest and convenience in the subject area.

The Structure of the Dissertation

This work is made up of five chapters: Chapter one is the introduction to work containing contextual background, conceptual and theoretical backgrounds, justification, and statement of the research problem, significance delimitation and summary of the methodology; Chapter two deals with literature review- conceptual literature, theoretical literature and empirical literature; Chapter three is the research methodology, handles the research approach , research design, area of the study, population sampling and sampling techniques, validity and reliability, data collection, data analysis, ethical consideration operationalization of the variables; Chapter four presentation and interpretation of results; Chapter five discussion of findings. Recommendation, suggestion for further research, limitation of the study and educational implication of the overall results of the study

Definition of key terms

Internet Connectivity.

Nowadays, the simpliest definition of internet is that the internet comprises the largest computer network that connects millions of computers together. According to Amponsah (2022), « the internet is a world wide network system that connects a diverse set of commercial, public, business, academic and government networks to enable global communication and access to data resources ». Siraj *et al* (2015), and Yebowaah (2018), argued that the internet is the most important information and communication technology that has caused a global shift in the quality of information. Rose and Fernlund (1977), indicated that the internet is knowledge pool that offers an atmosphere in which millions of people communicate and participate in creating and sharing of information due to its capacity to act as a support medium for several functions. A group of two or more computers linked together is known as network.

When the term internet is used, most individuals mostly think of the World Wide Web. Even thou these two terms are often used interchangeably, there exist a difference among them. While the internet is the physical network of computers all over the world, the World Wide Web (WWW), is a virtual network of web sites connected by hyperlinks or simply links. Since web sites are stored on servers on the internet, the World Wide Web is therefore a part of the internet (Tchopedia, 2020). It is an internet based service that uses set of rules commonly known as protocols to distribute documents across the internet in a well defined way. Internet Connectivity therefore refers to the way people get involve with the use of the internet. This can be through dial-up telephone lines, wireless devices or through broadband connections.

Digital devices

These are devices or instruments that permits an individual to gain access online either by use of a personal computer or smart phone and are able to record and transmit data. Examples of digital devices include; cameras, video recorders, smart phones, computers, tablets, note books, personal digital assistance (PDA) etc.

Learning management systems (LMS)

Turnbull *et al* (2020), defines learning management systems as technologies that facilitate the provision of courses over long distances. They considered LMS as web-based software platforms that provide an interactive online learning environment and facilitates the administration, organization, delivery and reporting of educational content and learner's outcome. Bradley (2021), stated that an online learning classroom is provided by LMS that reinforces the learning process. Learning process involves the transmission of knowledge from teachers to students in a well-organized way. As such, Jung and Huh (2019), stated that a standard LMS constitute an interceding structures that promote online collaborative groupings, professional training, discussions and communication that is supported by an inclusive learning environment for academic progress. Learning management systems provides learners with information concerning their performance and permits them to become independent in their study. These LMS also allow learners to register for classes, track their grades and check updates and course announcement (Al-Fraihat *et al* 2020).

Chapter Two

Literature Review

The purpose of this study is to investigate the impact of digital learning infrastructures and the effectiveness of distance learing in Cameroon. This chapter focuses on the conceptual literature, theoretical framework and related empirical literature. This is to bring to clarity of various concepts to this study. These concepts are carefully selected to establish the framework that suits the vision of this study. Equally, the theoretical framework is presented. These theories are suitable for the examination and explanation of the phenomenon under research. The empirical literature gives an understanding of the current state of knowledge and debates within digitalisation and distance education in Cameroon. Base in these perspectives in evaluation makes as contribution to educational management in Cameroon. This literature has associating effects on local, national and international stakeholders in secondary education.

Conceptual Framework

Digital Infrastructure Disposition

There has been no precise definition of the term infrastructure in recent times. According to Buhr (2003), "infra" stems from the Latin Language, meaning below, thus, "infrastructure" can be taken to express foundation. Timbergen (1962), distinguishes between infrastructure (for example, roads and education) and superstructure (manufacturing, agricultural and mining activities). However, Nijkamp (2000) regarded infrastructure as material public capital (roads, railways, airports, pipelines, etc.) and superstructure as immaterial public capital (knowledge networks, communication, education, culture etc.). Neither of these definitions provide sufficient details or precise definitions of these terms. Torrisi (2009), in his work stated that the reason for these unsatisfactory definitions could be as a result of the need for simultaneous realization of the three analytical objectives to; the formulation of the concept of the term "infrastructure", the incorporation of theoretic approaches (for example the theory of public goods) and the description of the reality of infrastructure provision.

Jochimsen (1966) went further to define infrastructure as "the sum of material, institutional and personal facilities and data which are available to the economic agent and which contribute to realizing the equalization of the remuneration of corporate inputs in the case of suitable allocation of resources, that is complete integration and maximum level of economic activities."

This definition has the disadvantage of not making factor price equalization concrete and that Jochimsen understands material infrastructure to be an enumeration of essentially public facilities characterized by specific attributes. Buhr (2003). However. A dictionary defines infrastructure as basic physical and organizational structures and facilities such as buildings, roads, electricity, needed for the operation of something (Oxford English Dictionary 2002). Anthropologists view the term infrastructure to be a sought of social norms that are fixed in material form. These are two contrasting definitions because there failed to identify those elements that are physical as well as the social aspects that needed to be put in place to make what is known as infrastructure.

The Organization for Economic Co-operative and Development (OECD), lays more emphasis on the physical characteristics that make up an infrastructure: "the system of public works in a country, state or region, including roads, utility lines and public buildings" (OCED, 2002). The investment world takes a different approach by focusing on infrastructure's unique financial and economic characteristics (Frykholm & Toresson, 2022).

Categories of infrastructure

Jochimsen (1996), distinguished between 3 categories of infrastructure. Institutional infrastructure Institutional infrastructure "comprises the grown and set norms, institutions and procedures in their reality of constitution, in so far as it refers to the degree of actual equal treatment of economic data, excluding meta-economic influences. It determines the framework within which economic agents may formulate their own economic plans and carry them out in co-operation with others" Jochimsen, (1996). From this definition, it can be said that institutional infrastructure originates from the term "econo mic institutions" and can be considered as the manner in which norms are implemented in the market economy in institutional basis. Buhr, (2003). Therefore, institutional infrastructure has been assigned the function of social integration of values is the object of economic and legal policy. Tossiri, (2009). In the case of the Federal Republic of Germany, constitutions include regulations on the type of tasks the government is supposed to carry out and also ways to distribute such government obligations to different state institutions. In every government expenditure, there must be a task to be accomplished and these expenditures are in tend covered by government revenues. Political bodies such as parliament, administrative authorities, courts, are assigned a

specific task from the government because these bodies are well placed to good examples of concerted effects of the different categories of infrastructure.

Personal infrastructure

Jochimsen (1996), defines personal infrastructure as the number and the qualities of people in the market economy characterized by the division of labour with reference to the capabilities to contribute to the increase of the level and the degree of integration of economic activities. Personal infrastructure in the sense of human capital is defined by OECD (2001) as "the knowledge, skills, competences and attributes embodied in individuals that facilitates the creation of personal, social and economic wellbeing." Buhr (2003), brought out three references to personal infrastructure in the field of economics: in terms of population theory (for example, raising children today presupposes the existence of sufficient material infrastructure), labor economics (problems of labor organization and of fulfilling management functions) and economics of education (problems of schooling or adjustment of education to labor demand) and growth theory (traditional theory on human capital and unskilled and educated labor). Buhr went further to say that personal infrastructure has the role of determining the quality of the economic agents values (achievement motivation productive capacity, value integration) results in three essential approaches; the task of the economic agents in the economic process (entrepreneurial guidance, unskilled and qualified labor, teaching etc.), the importance of personal infrastructure for the individual (short-term and long-term consumption of education) and the social relevance of personal infrastructure (integration effect of education).

Material infrastructure

Buhr, (2008) defines material infrastructures as "those immobile, non-circulating capital goods that essentially contribute to the production of infrastructure goods and services needed to satisfy basic physical and social requirements of economic agents and unavailable to the individual economic agents (households, firms etc.) for production and cost reasons so that mass production is economically cogent".

Types of infrastructure

According to Gladun et al (2009), infrastructure can be classified into hard and soft infrastructure. Soft infrastructure provides services that are necessary to boost the productivity

of an individual and at the same time achieving social goals. Meaning that, soft infrastructure in one way or the other indirectly contributes to the economic development of a country. Bouyle (2022), on his part stated that soft infrastructure represents the human capital and institutions that are necessary to maintain an economy that delivers certain services to the population. Examples of such institutions that helps in the economic development of an economy and considered as soft infrastructures include; healthcare, financial institutions, government offices, law enforcement and education amongst others. This implies that, unlike other services in an economy, the essence of soft infrastructure is based on delivering specialized services to people and investing in soft infrastructure targets the daily participatory rate and development of an individual. According to Kavanagh *et al* (2022), soft infrastructure includes elements like relationships, safe spaces, trust and hope, self-efficacy and world view. Soft infrastructure plays an important complementing role in the physical or hard infrastructure by laying the foundation for the proper functioning of infrastructural systems. Failures of the soft infrastructure effectively reduces the macroeconomic impact of an infrastructure project in an economy (Gu, 2017).

Hard infrastructure on the other hand are the tangible physical assembly of structures such as roads, bridges, tunnels, railways. Hard infrastructures are the physical systems needed to run a modern industrialized nation or economy (Boyle 2022). Kapur (2019), in his study laid emphasis on school infrastructures and listed out hard infrastructures in school such as school buildings, provision of clean water, library facilities, provision of classrooms amongst others. He stipulated that the provision of these facilities enables an increase in the enrolment rates of students and also helps the help the members to carry out appropriate duties and most especially in achieving the educational goals and objectives.

Unlike Gladun et al, in the investment world, infrastructure is classified into two broad categories; the economic infrastructure which includes transport, communication and utilities and social infrastructure such as health care, education and correlational facilities (Fryholm & Toresson, 2022). Basically, it is assumed that the economic and social infrastructures are unavoidable for the unhindered development of a country (Stevens, 2007). While some studies have included infrastructural-related sectors or associated industries in this definition, others include natural resources and green investments (Panayiotou, 2017) (Inderst, 2020).

Bottini et al (2012), viewed economic infrastructure as investment in network utilities such as transport, communication, power and water system that improve the marginal utilities of other types of physical infrastructure while social infrastructure consist of investment that cause the marginal product of human capital such as schools. This therefore means that physical infrastructures enables producers to access markets for the sale of goods and services effectively. It also allows labor to move from one city to another and to places to find appropriate jobs. Infrastructure offers the foundation on which factor inputs interrelate with each other to produce output (Sabi & Shamsgir, 2020). Several studies have shown that government expenditure on economic infrastructure has a direct impact on the long-run development and economic growth of a country. Moreover, human and social capital infrastructure pinpoints the importance of government spending on education and health in the enhancement of human capital development. Therefore, an increase in government spending on infrastructure that is required on global scale is not only to support economic growth globally but also to fulfil the United Nations (UN) sustainable development goals (SDGs) on infrastructural development.

Digital Learning infrastructures

Wikipedia (2010), defined infrastructure as those organizational and physical structures that are necessary for the day to day functioning of an enterprise, or those facilities and services needed for the functioning of an economy as a whole. Digital infrastructures on the other hand according to Tilson *et al* (2010), is defined as "those basic information technologies and organizational structures, along with the related services and facilities necessary for an institution, enterprise or industry to function". Hanseth and Lyytinen (2010), when further to define digital infrastructures as "shared, unbounded, heterogeneous, open and evolving, sociotechnical systems comprising an installed base of diverse information technology capabilities and their user operation, and design communities".

Preqin (2022), stated that infrastructures are those facilities and services that are considered to be very important to the functioning and economic productivity of every society. Learning infrastructure can therefore refers to those technological structures such as applications, systems or networks needed for the effective operation of an institution. Since the transformation of formal method55 of learning to distance learning, several educational institutions were able to adopt online learning due to the type of e-learning infrastructure that was available. According

to Al-Ansi (2021), the different types of e-learning used for online studies include; e-learning management system, digital devices and internet connectivity.

Learning Management Systems (LMS)

Watson & Watson (2012), argued that LMS sterms from the word Integrated Learning Systems. Technology has transformed the way education is delivered across the globe. The traditional concept of formal learning that takes place in a single physical environment is becoming less relevant we now live in an interconnected world. Modern learners are becoming more dissatisfied with traditional leaning approach and the stand and deliver approach that dictates elements such as the attendance time, learning venues and modes of participation. The emergence of new sophisticated ways of communication technologies and mobile devices has enabled the new generation of learners to be able to satisfy their demands for knowledge without necessarily meeting in a defined and physical environment.

According to Haji (2020), learning management system is seen as a software application that plays a vital role in the educational system. Apart from supporting the individual learning process and connecting educational resources at the disposal of learners, the LMS also serves as a platform that provides learning materials and facilities for interractive discussions, promoting interrative peer learning and enables both face-to-face learning and interractive online learning between instrcutors and learners (Haji 2020). This system has been embraced by software vendors, open source developers and educational institutions in order to facilitate the management of courses and engagement with students remotely. LMS is one of the technologies that help to facilitate the provision of courses over long distances. LMS can be defined as web-based software platforms that provide an interactive online learning environment and automate the administration, organization, delivery and repo rting the educational content and learner's outcome.

Terms such as content management systems (CMS), Learning Content Management systems are often used in confusion with LMS. The term CMS is often associated with two distinctive software applications content management system and course management system. Meanwhile, the content management system is often associated with software applications designed for the creation and management of digital content in a collaborative environment. Course management on the other hand according to Watson (2007), are software applications used for

blended learning, supporting the placement of course materials online, associating students with course, tracking student performance, storing student submissions and mediating communication between the students as well as the instructor. Some academic users prefer to use the word learning content management system (LCMS) in place of learning management system. The difference between these two terms is that, learning content management system is broader in scope and has the ability to track the progress of its learners through online courses.

According to Turnbull *et al* (2020), it was the creation of Sidney Pressey's learning machine, a device that could administer questions through a window prompting the user to select response out of four choices that led to the development of the first ever learning management systems that existed. According to these same authors, the LMS is categorized into two broad categories; the proprietary system and the open source system. Many school organizations are faced with the challenge of choosing between proprietary and open learning management systems. The choice often depend on the available resources and the knowledge or level of expertise of the LMS users within the school environment. Kimmons *et al* (2019), argued that a proprietary system uses an exclusive code where schools organization purchase a subscription or license to access and use the LMS features. Examples of proprietary systems include; blackboard, PowerSchool, school wires, Edline, eSchool view and school pointe. One of the earliest proprietary system was WebCT, developed at the University of British Columbia in 1995.

The primary objective of the invention of WebCT as an online learning platform was inspired by research suggesting that academic performance could be enhanced by provision of web base resources. At the height of its use, webct was the mostly widely used LMS globally with over 10 million users in 80 countries (chugh & juk 2020). The blackboard cooperation later on acquire the webct phasing out the webct name in favor of the blackboard brand. Meanwhile, a group of software specialist jointly developed a view of making the open source code available to organizations and users free of charge. Users have access to free licensed open source system at no cost. Some universities and colleges could readily down load source codes and adapt it to their own environment and built their own tailored LMS solutions. Examples of open source systems include; Moodle, word press and Drupal. (Quinn and Gray, 2020).

Moodle is one of the most prominent example of the open source system that is globally operated in the world today. The first version of Moodle was developed by Martin Dongiamas in 2002 and has as acronym "Modular Object Oriented Dynamic Learning Environment".

Krouska *et al* (2017), defined a Moodle as "a LMS designed to provide educators, administrators and learners with a single, robust, secure and integrated system to create personalized learning environment. It is a wide range of standard and innovative features for supporting teaching and learning process. Moreover, it allows for extending system functionality using community sourced plugins." Turnbull *et al* 2020, argued that Moodle is the most popular open source system used in the world today with almost 100000 registered sites in 229 countries.

According to Bradley (2020), LMS provides teachers and students with an online classroom that reinforces learning processes. In online classrooms environment, LMS reinforce teachers and students in the learning process. Learning processes is the manner in which knowledge is being transformed from teachers to students and the way an educator combines the various elements within the process to identify and establish the learning objectives, develop teaching resources and implement teaching and learning strategy (Munna and Kalam 2021).

The instructor sends information to LMS users which they could access it through asynchronous and synchronous settings. Alzahrani (2019), argued that asynchronous method supports one way communications such as e-mail, discussion groups, video and audio lectures, articles and power point presentations. This mode of delivery allows learners to commune with each other at their pace without the aspect of being separated through distance and time. This method is favorable to learners because it allows them combine learning alongside other commitments and responsibilities at the same time. It is the must adopted method of online learning as stated by Perveen (2016) because learners are free to respond or access material at their own leisure time. It permits learners to think deeply about the problem pose and develop divergent thinking by using their higher order learning skills. Synchronous method on the other hand is a method of delivery through online learning. With this method of learning, learners are able to see their instructors through video, online discussions, live chats, in addition to presentations and word files. The aspect of video conference communication through synchronous structures facilitates interactions between learners and their instructors. Learners are allow to speak with the instructors face-to-face, ask questions and receive answers directly.

However, both methods are similar in that, they both use an LMS to provide learners with lessons and facilitate learning. The difference between them is that asynchronous do not provide learners with instant feedback while synchronous is essential for developing a student's

critical reflection abilities by providing direct or instant feedback. Hrastinski (2008), went further to say that the synchronous method of learning is more of a social method and avoid frustration between instructors and learners by asking and answering questions in real time. This allows learners feel like participants rather than isolates. However, isolation in this case can be overcome by continuous communication between the participants or users of the synchronous method. This permits them to be more interactive and shares common ideas and provide immediate solution to problems. This method also permits instructors and learners to become aware of themselves as members in a community rather than isolated individuals communicating with the computer.

Role of LMS in Distance Education

Haji (2020), in his work stated that « LMS is a software application that has played a significant role in Education ». The LMS helps schools maintain the integrity of their educational programs by enabling educators to effectively and efficiently develop courses, deliver instructions, facilitate communication, foster collaboration between student success and provide other learning resources for support. LMS serves as a smart alternative to schools because instructors are allowed to deliver customized content, leverage various pedagogical models and engage their students much better than previously possible. In order therefore to deliver online lessons effectively and efficiently, it is imperative for teachers who teach online classes to have broad knowledge on new technologies available that can facilitate the process (Alias and Zainuddin 2005). For students to become information age providers, they must be able to conduct research and make use of other technological resources around the LMS setting in which the teachers are the facilitators and are responsible in providing a conducive learning environment. For teachers to make announcements in class, communicate with each other, submit assignments and share instructional materials among learners, it is imperative for them to make proper use of the available learning management systems and the school portal (Haji 2020).

The performance of students using the LMS varies significantly. Students who do not master the LMS very well may find it difficult in meeting deadlines when submitting assignments unlike students who master very well the LMS. Al-Fraihat *et al.* (2020), argued that a challenge for LMS instructors is to make managerial and pedagogical adjustments from a homogenous plane of deficiency to a classification of progress to support all learners. Instructors should be able to communicate exactly what is expected of students so that it can enable them have access

to LMS and a better mastery of the software application. While LMS helps instructors in monitoring learner progress (Clayton et al 2014), providing continuous knowledge to learners and equally evaluating them, it equally allows learners to check their educational progress, access their learning materials and also acquire online skills from their instructors.

Digital Devices (DD)

In recent times, technology has been diversified. Notebooks, personal digital assistants (PDAs), smartphones and e-book readers are among these technologies (Sung *et al* 2017). With these technological resources put in place, students are able to have access to large amounts of online resources and information which allows and encourages them to carry out their own research and more independent in their studies. Through instructional videos and audio streams, technology simplifies learning by making complex concepts more digestible for different learning styles. Educators are provided with variety of teaching methods and materials through the rapid growth of new technologies. These new educational materials and methods makes the learning process much more interesting and engaging for both students and teachers. A rapid development in electronic devices has made these devices an indispensable parts of our lives. These devices have been attached to the educational system and has become a crucial component of the education experience more than over a decade. These devices became prominent mediums for online education during the outbreak of the Covid-19 pandemic.

According to Hodges *et al.* (2020), the out-break of this pandemic caused most educational institutions have a global cancellation of face-to-face practice of public health and education and adopted a new form of distance education system called "emergency remote education"(ERE). However, Russell (2020), asserted that this ERE was adopted due to the Covid-19 pandemic at the time when most institutions and most instructors were unprepared. According to him, one of the most affected field and the focus of the current study was learning English as a foreign Language (EFL) which is a communicative practice by its nature were learners' needs to listen, analyze, produce and practice when required. Hence, with the advent of online classes, electronic devices are therefore very important tool used to facilitate the learning process of these learners. Electronics does not only help to fulfill individuals needs but also help in the growth of the economy as a whole because of the growing advent of technology, also comes innovation and modernity and that's where electronics play a great role.

Al-Ansi *et al*. (2019), asserted that electronic devices and applications are known as hard ware and software. Personal notebooks and cellphones are the most useable device in distance learning in addition to PCs and tablets. He went further to say that technological devices used in distance learning are of great significant since it contributes to high complexity of study and students competence. Through the use of electronic devices, knowledge of distance learning is transformed in to video, audio, text, images and data. Distance learning permits educational content to be delivered to learners through gadgets such as computers, laptops, tablets or smartphones. It does not only save time but open many doors for interactive learning. According to Florida *et al. (*2012), gadgets are small electronic devices that have special functions in each type to make work and human needs more practical and efficient. Such are seen as educational or learning media that permits learners in remote areas to have access to learning materials at any given point in time.

Internet Connectivity(IC)

Regardless of our location, the internet is an important part of life for all of us. Internet opens all endless possibilities to access almost any information and communicate with anyone around the world. Internet dramatically increases the speed of information gathering and provides written communication faster than postal mail. The internet is seen as an integral part of the society and seen as the largest computer network in the world since it connects billions of computers in the world. The internet has many interesting and fascinating things to discover. Any information on an array of topics can be searched and gained access to with the availability of internet connections. According to Amponsah (2022), "the internet is a worldwide network system that connects a diverse set of commercial, public, business, academic, and government networks to enable global communication and access to data resources". Even thou the terms internet and World Wide Web are often used interchangeably, there exist a difference between these two terms. There are not synonymous. The internet is worldwide communication system which include hardware and infrastructure that connects several devices together while the web is just a part or just one of the services provided through the internet. (Techopedia, 2020). The internet has caused a global shift in the quality of information and it's thus considered as the most important information and communication technology in the world today.

Akbar *et al (*2018), argued that the advent of the glaobal pandemic provided a devastating effect to all educational sectors nationwide and one of the biggest challenges regarding learning is the

availability of technological gadgets and internet connectivity that had to be addressed. Asio *et al* (2021), comments that Internet connectivity therefore became the most important tool that can enhance the online learning at the moment without which the practice of online learning will still be at a stand by.

Hossain and Rahman (2017), stipulated that students from their studies need to enhance their internet usage and further suggested that the university should provide internet facilities and an environment for students. Internet connectivity permits students to easily take learning materials anywhere without being limited by time and space. It equally permits them to learn and discuss with experts about things there are interested in. Learning materials are uploaded by instructors on time and students can have access to learning materials at any time or corner around the world regardless of where the students study.

However, Diyayana, (2017), stated that these opportunities still face challenges from the aspect of costs, readiness of information technology infrastructure, the community, and regulatory support for distance learning including gadgets owned by students and internet facilities and infrastructure. Lecturers can study with students at the same time using groups on social media, such as WhatsApp (WA), Telegram, Instagram, Zoom Meeting Cloud or other media as learning media. With the availability of internet connectivity, instructors ensures that students can take lessons simultaneously despite being in different places. However, lecturers must be able to limit the scope of the material and choose a suitable application for the learning material and method (Ibrahim, 2019).

According to Wildana *et al.* (2020), the availability of the internet and the cost of internet packages determine the continuity of online learning. However, in practice, this study found that students experienced limited internet access because of their geographical location, or as a result of limited finances with which to purchase internet packages. Students' level of literacy, and their ability to access online learning, is also crucial to the effectiveness of online learning. Hazwani *et al. (*2020) found that internet connection was the most significant factor to influence the effectiveness of distance learning and that management personnel need to improve dormitory areas to provide all students with access to the internet.

Internet connection must be moderate or good in order to suffice. Internet based learning increases learning satisfaction as a very mediating role. Siraj (2015), stated that the internet serves as the key information and communication technology that led to worldwide

revolutionary change in the information scenario. Students are able to interact and gain different perspective on a problem by sharing one's own learning activities with other learners into problem solving strategies. Internet availability is almost everywhere. It permits students to have access to internet on their cell phones and are able to broaden their academic information, research and assignments by accessing information worldwide and also allows easy communication to the academic community.

Akin Adaeamola (2014), asserted that the activities of various age groups in the society are being served through the development of the internet platform. The internet is a technology that has become an enormous part in peoples' daily life. It has the ability to act as a support medium to perform different functions for which people use it. Internet connectivity has improved tremendously over the last decades and is available everywhere such as homes, offices, travels and schools. Internet permits access to information that can influence not only the academic performance of students but also the community at large. Courses which requires an academic review of literature, a greater internet resource is of greater importance for this academic study.

Types of internet connections

It is of great importance to understand the different types of internet connections. Each type permits to access connections base on an individual's location. It is necessary to consider elements such as speed, price, technical support and means of installation when choosing a service provider (Battersby and Farivar 2004). There exist several types of internet connections amongst which we have; dial-up, digital subscriber line (DSL), cable, wireless, satellite and fiber optic.

Dial-up

This was the first widely used and the most basic form of internet connection. It consist of a modem that uses a telephone line to connect PC to the internet. The modem works as an interface between the PC and the telephone line. Every time the dial-up wants to connect to the internet, the modem must dial to the telephone. Internet connections got started with this form of connection called dial-up. Dial-up when connected produces a beeping and buzzing noise and can be disrupted when someone is trying to make an incoming call. Dial-ups are usually less expensive and has much slower speeds. It is best for reading text-only documents and emails but does not supports downloaded documents. Dial-up internet connections are available

everywhere and persons in remote and rural areas can typically be connected to dial-ups. This form of internet connection is disadvantageous in that it does not deliver high-speed internet and the time wait to load a single webpage can be longer. Dial-up connections uses either serial line internet protocol (SLIP) or point to point protocol (PPP).

Digital subscriber line (DSL)

The speed of digital subscriber line is much faster than that of dial-up internet connection. It is a form of broadband connection as it provides connections over ordinary telephone line at a very high speed. This mood uses the phone line to carry digital signals directly and allows continuous connections to the internet. It has sufficient connection for common uses such as web browsing and video streaming and permits households to connect to the web and talk to their landline simultaneously. This form of internet connection is disadvantageous in that, it is only available at limited distances from the provider and so many homes do not have access to DSL since it's more costly than dial-ups.

Cable internet connections

This form of internet connection uses a special type of cable known as coaxial cable which is capable of transferring data at much higher speed and a modem which is used to access this service provided by the cable operator. This form of internet connection via cable does not rely on phone line but rather delivered to homes by cable television lines. Most cable companies provide a modem and a network card that must be installed to the computer. The cable companies are mostly the internet service providers of this form of internet connections.

Wireless internet connections

According to Salazar (2017), wire networka are « netwrks that use radio waves to connect devices without the necessity of using cables of any kind ». It uses radio frequencies to connect to the internet and offers a very high speed. It is an always on connection and can be used on cell phones. Wireless is a convenient internet service as it provides coverage more easily when cell phone coverage exists. This service is more costly than DSL and cable network connections. Salazar (2017), classified wireless networks under four main categories which include; wireless personal-area network (WPAN), wireless local-area network (WLAN), wireless metrepolitan-area netwoks and wireless wide-area network (WWAN).

The wireless wide area network often uses licensed frequencies and usually extends beyond 50 kilometers (Salazar, 2017). This type of wireless network constitute what is known as cellular telephone networks and satellite. The cellular network is often divided into cells and since early 1980s different cellular generations have been developed. The cellular generation that has ever existed constituted was was known as 1G network and was purely designed for analog networks designed purely for voice calls with an average speed of up to 2.4kbps (Salazar 2017). The ever second generation cellular network was known as the 2G network which was based on digital technology and mostly network infrastructure (GSM). This form of network enabled text messages with an average data speed of 64kbps (Salazar 2017).

With the advancement of technology over time, the development of the 2.5G network fell within the second and the third generations. This was en enhanced version of 2G which was sometimes referred to as 2G+ GPRS and has an average speed estimated at 144kbps (Salazar 2017). As time went on leading to the changing nature of technology, the year 2000 was the period when the third generation network known as 3G network was introduced and has a speed 2Mbps. Overtime, an enhanced version of the 3G network which was the 3.5G later came into existence and uses the HSDPA to speed up the rate of data transfers to up to 14Mbps (Salazar 2017). The fourth generation network known as 4G later came to replace the 3.5G network. This network which is the current network nationwide is capable of providing up to 1Gbps speed and it's capable of providing any kind of network service at any time depending on the users' requirement anytime and anywhere (Salazar 2017).

Satellite internet connections

Satellite connections covers a wide area over the earth surface. This form of connection is very useful to users in the local remote areas (Salazar 2017) since it is equipped with transponders that is made up of a transceiver and an antenna. This is a more expensive form of internet connection and is good for people who live in areas where other internet options aren't available. The satellite internet connection connects the computer to the internet with a modem and a satellite dish. A phone line is not require in this form of connections because a satellite dish is connected to the computer and not the phone line. The speed of satellite internet connection is relatively slower than other forms of connections because poor weather often affects the signal path and poor quality internet is observed during windy or rainy weather.

There exist two types of satellite internet connections; one way and two way satellite internet connections (Salazar 2017). One way connection can only download data and requires a dial-up connection access through internet service provider (ISP) over a telephone line to upload while two way internet connection can download and upload the data by the satellite with the use of a dial-up connection.

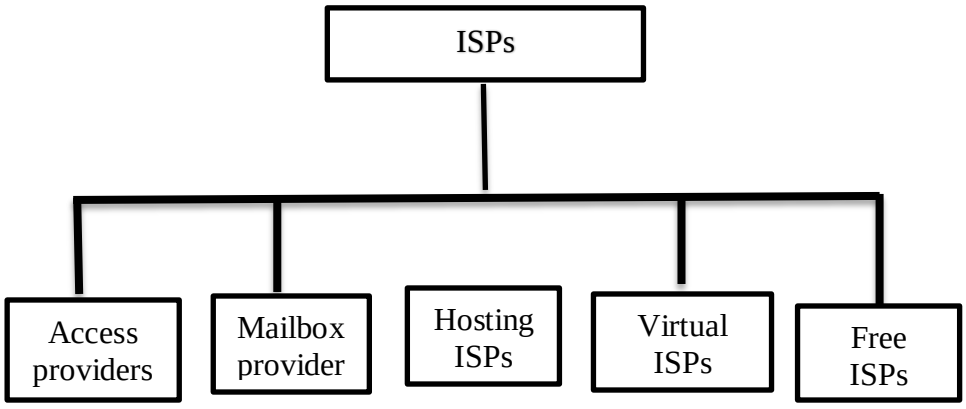
Fiber optic internet connections

With this form of internet connection, data is delivered through light signals by way of small, flexible glass wires. Fiber is often the glass wires inside the larger protective cable. Optic refers to the way the data is transferred through light signals. This form of internet connection is very fast and the fast speed permits multiple use of devices at home without the download and upload time being compromised. Optic fiber internet connections does not rely on electricity and so there is often little down time with internet connection. Also not available in all areas and more expensive than DSL.

Types of internet service providers (ISP)

Internet service provider (ISP) are companies in charge of offering access to internet. There offer various services such as internet access, domain name registration, dial-up access and leased line access. There are intermediaries which give access to internet by used of specialized lines and using a number which is entered by a modem which enables connection to be established. ISP can broadly be classified into five categories as shown in the diagram below;

Figure 1: Types of service providers



Source:http://www.tutorialspoint.com/internet-technologies/internet-connectivity.htm

Access providers; provide access to internet through telephone lines, cables, Wi-Fi or optic fiber.

Mailbox providers: such providers offer mailbox hosting services
Hosting ISPs: offers emails and other web hosting services such as virtual machines and clouds.
Virtual ISPs: such ISPs offers internet access via other internet service providers
Free ISPs: do not charge for internet services

Role of digital learning infrastructure in Education

The globalization of technology and the out- break of the COVID-19 pandemic has necessitated the application of digital technologies in the educational sector. The need for digital learning infrastructures is therefore necessary for sharing resources and managing the day to day activities of the educational institution. Digital infrastructures or technologies are therefore powerful instruments that helps improve the functioning of the educational system in many ways. Either through making it easier for instructors to generate quality instructional materials and providing new ways of learning and collaboration among learners. According to Calvahor *et al* (2022), technology serves an essential role in providing education to learners outside the classroom and the educational sector is in an era of internet and several intelligent devices connected to it. It is therefore the place of educational leaders and instructional designers to build up the educational system and to provide effective and efficient education to everyone and everywhere through the use of these advanced digital infrastructures. The availability of these learning infrastructures renders education to become more interactive, ease knowledge sharing, fosters creativity and gives students a sense of success by encouraging them to learn and think outside traditional techniques.

Instructors should be able to adapt with today's technological growth and learn to manipulate devices such as learning platforms, smart phones, tablets or computers to become effective in online learning. When the use of these resources are used effectively and for instructional reasons, students become interested and the educational sector experience a greater improvement**.**

Overview of distance learning

The end of the 20th century was marked by the transition of global economy from the old into a new virtual economy. This new form of virtual economy is highly characterized by globalization and economy networking. Today, this form of economy shows that there has

being a great increase in knowledge development which has become a fundamental economic resource. The reason behind this rapid increase in new knowledge is through education. Some areas around the world are not fortunate to benefits from the profits that comes with the availability of this new knowledge simply because education is not available to a large number of population around the world because of geographical distances and the level of development across these areas. According to UNESCO (2010), adult literacy rate in Southern Asia was at 62%, Oceania at 66%, Saharan Africa at 63% and Northern Africa by 67%. Because of these significant changes that existed across several national territories, it is therefore necessary to make education available to every body and motivate people to get engaged in the process of education. Distance education therefore can be of significant help for education to spread all over the world.

According to Buselic (2012), new methods of education were created because of the rapid development in information and communication technology. The teaching and learning process became for enhanced by the technology-mediated distance learning. He therefore defined distance learning as the process of teaching and learning that involves the implementation of various technological applications. Distance learning has therefore become one of the most rapidly growing fields of education and training that contributes to the social and economic development in the society and has as mission to provide greater dimensions of openness and flexibility either in terms of access, curriculum or other elements of the society (Buselic 2012).

Evolution of distance learning

The aspect of distance learning dates back to the 1700s and 1800s with the egalitarian approach to education and was classified under ages and generations which were structured and determined by the dominant communication technology that was adopted by distance learning. Each generation of distance learning undergone changes in line with technological innovations and the pedagogical innovations of its age (Saykili, 2018). There existed a strong link between pedagogy and technology in distance education because distance education depends greatly on communication technologies that helps to bridge the gap between the geographical and the temporal learners and instructors including the learning resources. This therefore means that the pedagogy and technology are related to each other depending on the generational reign. The history of distance learning at the macro level was classified under three ages and at the micro level, classification was done under five generations.

Just as in other countries around the world, Bozhurt (2019), stated that the first age of distance learning was characterized by correspondence study whose content was mostly delivered by mail. At this time, several institutions offered different names to correspondence study. For example the early profit schools and called it home study while Universities called it independent study. The learners of correspondence study at this time where mostly adults who were committed either to occupation, social or family commitments and decided to carry on with correspondence courses. The most prevailing technology that existed at this macro stage of correspondence education was the print technology, which marked the first generation of distance learning. Anderson and Simpson (2012), laid emphasis on the fact that the first generation of distance learning had as objective to expand the scope of education in order to include the less privileged who had limited or no access to educational resources or institutions.

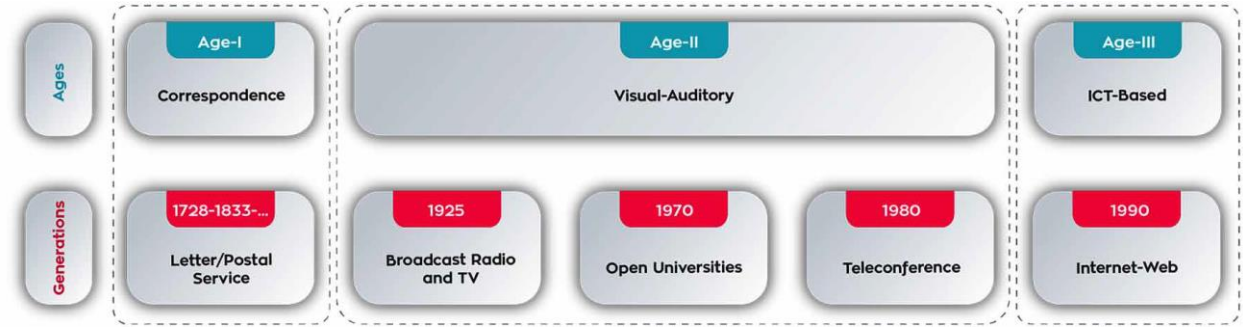
The second generation was characterized by the introduction of radio and television which was driven primarily by broadcast technologies. These broadcast technologies facilitated open doors interactions between the teachers and learners thus keeping them at a minimum (Anderson and Simpson, 2012). Boshurt (2019), argued distance learning at this age was mostly done through the radio which offers audio auditory. Due to the advancement in technology, the learning system was switched to visual auditory technology which was mostly delivered through the television. These dominant technologies at this time facilitated and accelerated the speed of communication and interaction between the teacher and the learner. During this age, it became possible for education to reach a mass number of the population throughout the national territories, thus leading to an increase in educational research on instructional design (Casey, 2008). Bozhurt (2019), further stated that the instruction at this age was mostly teacher centered but learners could gradually gain independence and autonomy through the advantages offered by new communication technologies. Most research was then focused on new technologies that could offer better communication technologies and new delivery methods of instruction between learners and teachers.

The third generation of distance learning marked the beginning of digital knowledge and network in the society. Saykili (2018) and Bozhurt (2019), argued that the third generation of distance learning was characterized by a two-way communication possibilities such as, synchronous and asynchronous computer mediated communication or audio and video conferencing. At this age therefore, the prominence of the teacher-centered method of teaching was diminished and replaced by the student-centered education. This generation also led to the

introduction of new learning models such as e-learning, mobile learning and ubiquitous learning which enabled rich and interactive learning content to learners and teachers. This generation of distance learning was focused more on teaching rather than learning and the idea of lifelong learning was promoted and attributed great importance.

According to Bozhurt (2019), the introduction of technology has been able to defined and shape the landscape of distance education. As these technologies keeps on evolving, more possibilities and opportunities of the method of delivery of distance education keeps on developing. This led to the introduction of the fourth and fifth generations of distance education. The fourth generation of distance learning is characterized by a more flexible learning model while the fifth generation was characterized by a more intelligent flexible learning model. These two generations of distance education had similar technological developments thou the fifth generation was more advanced than the fifth. There were characterized by internet multimedia (IMM) online systems, internet based access to WWW resources and computer-mediated communication, using automated response systems (Bozhurt, 2019). Thou these two generations possessed similar attributes, the only difference was that the fifth generation was more advanced and uses campus portal access to institutional processes and resources for an effective distance learning.

figure2: Ages and generations of distance learning.



Source: Bozhurt, A. (2019), p. 253.

Introduction of distance learning in Cameroon

The advent of internet led to technological innovations is several parts of the world. Cameroon being one of these countries that benefitted from such innovations, experience changes in areas such as the communication sector, the research sector, the political sector and the economy as

a whole. The educational sector was one of the main sectors that benefited greatly with the introduction of these new technologies. The adoption of the information and communication technology in the sector of education provided substantial benefits in the field of training by rendering it simpler and easier (Beche, 2013). The use of ICT has become an indispensable such that policies makers and educational analyst could not talk of training without the use of ICT. According to Alemnge (2015), the three state Universities of Cameroon; the University of Buea, Yaounde and Douala were the first universities in Cameroon to use the distance learning method as a mode of delivering course programs to learners. This was done following the enactment of the higher education law of distance education No. 005 on April 16th 2001 by the Minister of Higher Education.

According to Kolyang (2006), distance learning was released through the then school of agronomy in the 1980s which is now known as the University of Dschang. This method of distance learning moved from traditional based approach to postal services. Over the years, this form of postal services became outdated in Cameroon at the time when the internet has not become functional and has not replace it thus rendering this type of teaching less effective and the University of Dschang could no longer practice distance learning. He went further to explain that the National Advanced school of Polytechnique of Yaounde on April 2002 was the first institution to organize a seminar on E-learning and distance learning with the presence of actors such as the Ministry of Higher Education, the world Bank and many others. Beche (2020), stated that after the first officially confirmed case of the COVID 19 pandemic in Cameroon, the various ministries especially the Ministry of Secondary Education decided to continue teaching using distance teaching and learning tools such as television, radio, storage tools, communication tools and digital platforms. In the main time, according to World Health Organization (2020), following the Prime Ministerial order of March 18, 2020, the closure of 31,851 schools and over 7 million children and youths of the school going age were affected following the outbreak of this pandemic. Over 4,200 community learning centers were shut down across the national territory.

Akumbu *et al* (2020), stated that, due to the increase in the spread of the disease across the national territory, the government of Cameroon and other educational authorities in an attempt to avoid a blank school year, adopted the method of distance learning in order to continue providing quality, inclusive and continuous education as stated by sustainable development goal number 4 (SDG 4).

Theoretical under pinning of the study

According to Thomas (2017), « a theory is an integral part of scholarly research that provides both guidance and exploration of the relationship among phenomena. Theoretical background therefore refers to the various theories the researcher uses to address to particular phenomenon or the studied phenomenon. Since the theoretical background is an indispensable part in a scientific work, the researcher is oblige to select theories that will permit the researcher to have an in-depth understanding of the studied phenomenon. We will use the following theories throughout this study; the theory of diffusion of innovation (DOI) by E.M. Rogers, 1962, the theory of technology Acceptance Model (TAM) by Fred Davis 1989 and Richard Bagozzi of 1992 and the theory of transactional distance by Dr. Michael G. Moore, 1997.

The Diffusion of Innovation Theory

The theory of diffusion of innovation developed by E.M. Rogers in 1962, is among the oldest social-science theories. This theory uses communication as the principal element that determines how and over time an idea diffuses through a specific population or social system. The main aim of this theory of diffusion is that people should be able to adopt a new idea or behavior as a social system. It is only when an individual perceived the idea or behavior as new that diffusion becomes possible. Rogers defined diffusion as « the process in which an innovation is communicated through certain channels over time among the members of a social system ». From the above definition, it is observed that the theory of diffusion of innovation is based on four main principles which are; innovation, communication channels, time and social system.

- Innovation: Rogers (2003), defines innovation as « an idea, practice, or project that is perceived as new by an individual or other unit of adoption ». An innovation might have been into existence over many years but might still be an innovation for the individual depending on how they perceived it as new.
- Communication channel: Rogers went further to define communication channel as “a process in which participants create and share information with one another in order to reach a mutual understanding.
- Time: the aspect of time in the theory of diffusion of innovation refers to the period of diffusion of a technology to the users.

- Social system: this constitutes the last element in the diffusion process. Rogers (2003), defines it as "a set of interrelated units engaged in joint problem solving to accomplish a common goal.

Rogers developed five categories of adopters that constitute the target population when promoting innovation; the innovators, the early adopters, the early majority, the late majority and the laggards.

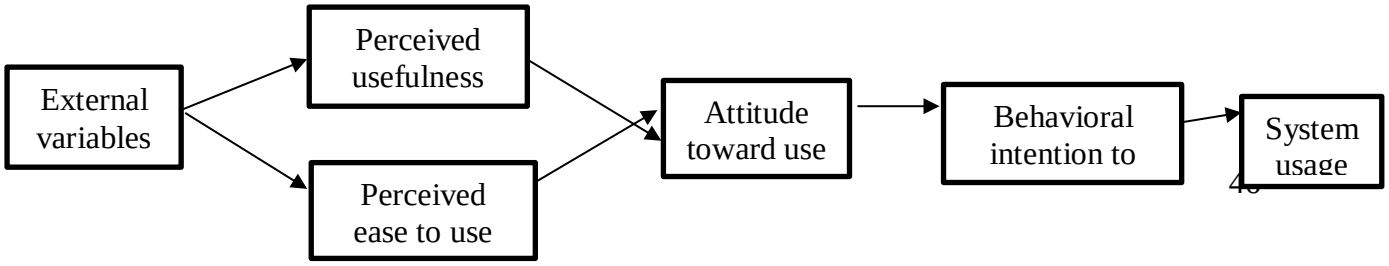
Implications of the theory of diffusion of innovation to the present study

The theory of diffusion of innovation put forward by Rogers is essential in modern day's organizations, including educational institutions. Using this theory to substantiate educational events and phenomenon appears to be the best way to address the interactive relationship between teachers and learners. There is a global significant difference in the degree of diffusion or adoption of the internet across institutions. This theory will help us understand the process through which internet diffuses across the institutions and its usefulness to its users. It will also help us to know how the presence or absence of internet connectivity affects the user's ability to learn effectively.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Fred Davis in the year 1989 and its one of the widely used models that explains the behavior of user acceptance to technology. Davis (1986, 1989) introduced four principles or constructs in relation to Technology Acceptance Model. These constructs are as follows; perceived usefulness (PU), perceived ease of use (PEOU), attitude and behavioral intention to use. He went further to explain that these constructs are interrelated and one can be used to predict the other. The constructs PU and PEOU form an end-user's beliefs on technology which turns to predict the attitude of an individual towards technology and attitude turns to predict the acceptance. This interaction among the constructs can be represented on the diagram below.

Figure 3: The technology acceptance model



Source: Ma & Liu, (2005), p.61.

From the above analysis, it is observed that the model of technology is based on the following principles.

- **Perceived ease to use**: individuals are bound to accept and use a technology if they find it easy to use. According to Tarhini et al (2015), perceived ease to use is when an individual uses less or no efforts in operating a system of technology.
- **Perceived technology usefulness**: this also aligns with the acceptance of technology. The technology is accepted when the user beliefs that acceptance change or increases the user's productive output.
- **Attitude towards technology use**: the higher the user's attitude the use of the technology, the higher the usage of the technology.

Implications of the technology acceptance model to the present study

The technology acceptance model will be useful to the present study. LMS is a software application for the administration and reporting through analytics of educational programs and modules (Botha *et a*l 2018). According to this model, educational institutions are adopting new ways of enhancing their traditional ways of teaching to modern and easy ways by using more flexible tools that a capable of supporting greater dimensions in the learning environment. LMS alone can fulfill this requirement of enablement depending on its usefulness and the way lecturers and students perceive its usefulness and easy to use. Thou most lecturers and students perceive LMS as a means that augments their learning experiences, relatively few uses the more advances features and even fewer are able to use these systems to their full capacity. In order to bridge these gaps, the digital learning environment will develop ways to make users aware of the system features, provide integrated training and support, setting standards for use and prioritizing the user-friendliness of the system interface.

This theory will therefore permit us to know how the users' perceive the usefulness of LMS, know whether the various communication channels such blackboards or the open source LMS such as Canvas and modules are easy to manipulate in order to meet users' needs and expectations and also to know the attitude of the users' towards the use of the LMS.

The Transactional Distance Theory

This theory was postulated **by** Moore, 1997. This theory seeks to explain the relationship that exist between instructor and learner when they are separated over space and time. The learner

and teacher are separated by a learning environment which serve as a communication media between them. This communication medium is interrelated with the quality of dialogue that exists between the instructor and the learner. This theory takes into account three principal factors which are termed the principles of the theory. These are; dialogue, structure and the learner autonomy. The dialogue deals with the interaction that exists between the learner and the teacher, the structure refers to the nature of the institutional programs offered while the learner's autonomy simply means the nature and degree of self-directedness of the student.

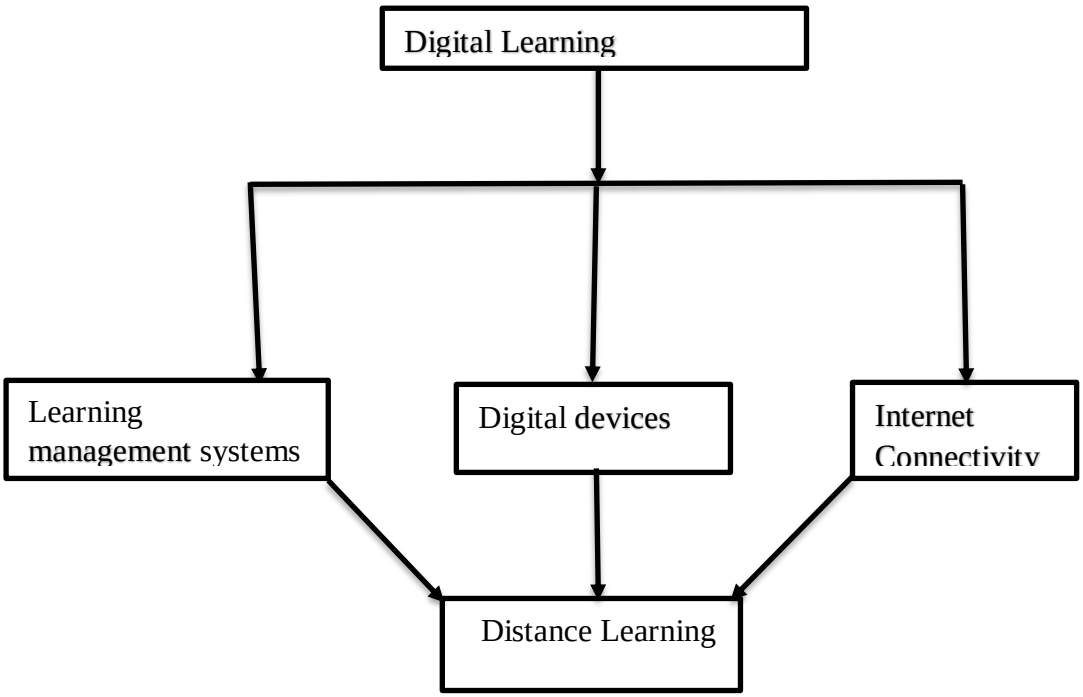
Theoretical contribution to the study

With transactional distance being the principal issue addressed in this theory, learners and instructors must be well equipped with sophisticated digital devices that will permit them to communicate effectively across the distance that exist among them. This theory will therefore help us to under the importance of the various digital devices needed to facilitate the online learning process between the learners and the instructors over a transactional distance.

Empirical framework

The empirical literature review of this work shall be developed under the main variables of the study. The independent variable, digital learning infrastructure, further operationalized to have learning management systems, digital devices and internet connectivity as its main indicators. And as far as the dependent variable being distance learning is concerned, it can be measured from the perspective of designing, performance, implementation and quality performance. The views of other authors to support our findings on the ground shall subsequently be generalized to the study population.

Figure 4: Empirical literature review



Source: Researcher 2023

Learning Management Systems and Effectiveness of distance Learning

Yawisah *et al* (2022), defined learning management system as a software designed to distribute and manage learning content delivery. They argued that learning to use LMS offers advantages obtained through various solutions and each module of the learning system has different possibilities. LMS therefore help teachers to plan and manage learning materials and other needs related to the teaching and learning process amongst which include; e-books, animated videos, sounds, articles and exciting learning videos to make the learning process funnier and innovative (Yawisah *et al* 2022). The study of Alias and Zainuddin (2005), shows that it is essential for teachers to who teach online classes to know about technology or use new technologies that can be delivered in online learning effectively and efficiently.

Yawisah *et al* (2022), conducted a research on the implementation of the learning management system in the New Normal period using a qualitative research design with a descriptive approach under two main themes advantages and disadvantages of LMS applications and using a written interview as a collection technique with 10 lecturers and 50 students were used as a sample population using the content analysis technique. The findings from this study shows that using the LMS requires strong network support throughout the region. They also found out

that the LMS application is required to update its capacity to send lecture assignments in the form of videos and photos so that learning is maximized. It was also discussed that interactive learning between lecturers and students is needed to support learning. This is seen by the role of the LMS in helping lecturers plan and create a syllabus, manage learning materials, manage distance lectures activities and recapitulate students grades and attendance.These scholars went further to recommend that the government of Indonesia needs to consider supporting policies related to cooperation with the private sector to build Internet access throughout the territory. Furthermore, the stakeholders must focus on the availability of LMS support facilities, providing alternative offline classroom software program based on technology in order to reach better higher education.

Conde *et al* (2014), laid down six LMS features to support the online learning process.

- A user interface that is easy to use and attractive.
- Online registration with various payment methods according to the ability of the user.
- virtual classes in which distance learning processes are presented without having to make physical contact and provide video conferencing features
- Online quizzes and exams in which the need to create questions and distribute them to students online is supported.
- A discussion room regarding the subject matter that has been studied by students independently.
- And a report feature with which it is easier for teachers to track the progress of their students.

Akay and Gumusoglu (2020), uses a mixed method design with a qualitative data collected from 321 students and qualitative data gathered from interviews with 30 randomly selected students and found out that the although LMS has an effect on both midterm exams and proficiency exams, the impact on midterm exams is much greater than that of proficiency exams. The results conducted during interview shows that participants has positive attitudes towards the use of LMS as they thought it contributed to their language learning processes. The results of this study went further to show that the more hours spent on learning management system, the better the results compared to those who spent less hours on LMS. The study conducted by Karim (2022), explains that various platforms have different advantages and disadvantages, educators and students are generally satisfied with online interactions considering their learning needs.

According to the study conducted by Amua –Sekyi & Nti (2015), the results of the study shows that student's weak background in English contributed to student's poor performance in the English examinations. This is in line with a similar study conducted by Aydin (2012), in Turkey who investigated the role of English proficiency level of students from the state University and found out that students who had high proficiency level achieved better scores in English proficiency exams. Another study conducted by Govender & Grayson (2008) and Hardy *et al* (2005), proved that there is a positive correlation between the use of LMS and student's achievement level.

To achieve the aims and objectives of distance learning, the effective planning and management of LMS must be required. The teachers in charge of delivering lessons to student through the use of LMS must be well trained to be able to manipulate and operate the platforms in order to deliver quality lesson to students. Teachers who spent more time in LMS performed better than those who spent less hours in manipulating the LMS platforms. According to the findings of Ningtyas (2022), LMS was the most widely used online application during the pandemic because it was considered effective in helping students during distance learning process. Meanwhile, another study conducted by Deiniatur (2021), reveals that, LMS enable students to learn independently in completing tasks given to them by lecturers. Thou the LMS is used to support learning, it still experienced a lot of obstacles such as poor network connections, low student learning focus, and low lecturer competence (Bustomi *et al*, 2021).

Bradley (2021), argues that a standard LMS supports an inclusive learning environment for academic progress with interceding structures that promote online collaborative-grouping, professional training, discussions and communication among other LMS users. He went further to state that instructors should balance active learning with the use of learning management system technological resources and the use of guidelines from qualified curriculum. The results of his work shows that LMS allows instructors to facilitate and model discussions, plan online activities, set learning expectations, provide learners with options and assist in problem solving with process for decision making. His work also stipulates that an instructor's presence within a LMS creates an engaging learning environment. This permits students to retain their autonomy, enthusiasm and motivation with the use of LMS.

Hardy *et al* (2005) and Govender and Grayson (2008), shows that there is a positive correlation between the use of LMS and student's achievement level, meaning that students who performed well in exams used LMS almost twice as much as others. This is why Kimmons et al (2019), in his study stated that when selecting LMS, school organizations can choose a proprietary system or open-source system. The decision of selection depends on the resources available and the knowledge or the level of expertise of members within the school organization. These group of scholars went further to say that a proprietary system uses an exclusive code were schools purchase a license or subscription to access and use the LMS features. Open- source systems use a free license with no cost where users have the freedom to access and use the system (Quinn & Gray 2020).

Digital devices and effectiveness of distance learning

Florida *et al. (*2012), gadgets are small electronic devices that have specific functions depending on the type and make human works and needs more practical and efficient. Such are seen as educational or learning media that permits learners in remote areas to have access to learning materials at any given point in time**.** Li and Chiang (2021), conducted a longitudinal study and found out that students using tablets in class performed better than students using computer and students' utility value and cognitive cost towards the eschoolbag will change over time. Li and Chiang (2021), defined eschoolbag or electronic school bag as an enhanced one-on-one computing environment compatible with various digital devices. This eschoolbag provides instructors with an intelligent teaching management system and offers student's highly interactive environment. This study is in line with the study of Xie (2015), who viewed eschoolbag as «an intelligent and learning system integrated with electronic textbooks, subject related cognitive tools, administrative function and digital resources.

Li and Chiang (2021), shows that in the context of the classroom, each student is in possession of an eschoolbag that permits them to gain access to learning resources and also permits them to participate in different learning activities while teachers can only gain access to the administrative functions. The server-side of the electronic school bag permits teachers to up load electronic text books, supplementary resources and teaching plans. Learning activities can also be designed by teachers and distributed to students later using the built in applications.

Berei and Pusctai (2022), on learning through digital devices, with the purpose of examing the risks of learning through digital technology and to design the individual and academic

responsibilities with a total of 2210 higher education students from five different European countries participated in quantitative study and analysis of the data was based on the advanced statistical test carried out with the SPSS program. The results of this study shows that regardless the country of origin, majority of the students come from families that possess essential digital devices such as personal computers (PCs), notebooks and smartphones with a strong internet connection. The results further proves that the learning strategies of the students is mixed and that they use both the virtual and the real environment in studying. In this study, more than half of the population stated that they never learn by listening to audio recordings or watching tutorials while more than a third of the population declared that they usually spent more time online. However, some added activities such as gaming and communicating on social networks are those elements which states the reason why most of these students spent much time in a virtual environment. This is confirmed by the study of Allam and Aligard (2021), who conducted a study on the availability of digital infrastructure for online learning and found out that the digital infrastructures are available for distance learning but not satisfactorily to all and for a quality online teaching and learning.

Baker *et al* (2012), investigated the perceptions of faculty and students regarding the use of cell phones and other electronic devices in the classroom and found out that students differ markedly from faculty, with students exhibiting much greater acceptance of in-class use of technology. The study also shows that gender affects perceptions and that male students specifically accept the in-class use of technology than the female students. Skolnik and Puzo (2008), also study the perceptions of students and faculty and argued that the use of laptop computers enhances instruction through spreadsheet skills and also gives the opportunity to record notes electrically. They also find out that academic dishonesty in classrooms increases because of the use of laptops in class. This is because an average of 15% of students are often carried away by other computer applications and lose focus on the class topic.

While the use of new technologies such as laptops, game console, music players and cell phones keeps us connected, we are also constantly distracted by these same devices (Bugeja, 2008). The findings of Wagner (2005), reveals that the most important hardware issue trending on most campuses these days are laptops, cell phones and note book computers and brings out the characteristics of these devices to interfere with deeper learning, inhibit critical thinking and effective communication.

Bozkus (2021), using the ex post facto co-relational causal research design, shows that the infrastructure of digital devices within the school affected PISA 2018 reading, math and science scores more than teachers' capacity using digital devices. The results also revealed that there was a strong relationship between the infrastructures of digital devices within the school and teachers' capacity using digital devices, and developing the infrastructure of digital technologies could provide practical benefits for students.

Internet connectivity and the effectiveness of distance learning

Amponsah (2022), "the internet is a worldwide network system that connects a diverse set of commercial, public, business, academic, and government networks to enable global communication and access to data resources". Yebowaah (2018), argues that there has been a global shift in the quality of information thanks to the internet which is seen as one of the most essential information and communication technology. This is supported by the work of *Siraj et al* (2015), who conducted a similar study and reveals that the internet is one of the main primary information and communication technology that has also led to a quality shift in the situation of information globally. The use of internet permits its users' to view the vastness of the world surrounding them. They are able to carry out activities, communicate and pass on information more easily to their counterparts when connected to the internet.

Amponsah (2022), reveals that, school ICT labs, mobile phones, internet facilities for families and public internet cafes are the internet outlets available for SHS students. In addition, this study was conducted using a questionnaire and data was gathered using a population of 105 second- and- third- year students through random sampling and was later analyzed using descriptive statistics and an independent sample t- test used. The results further shows that the academic standards among students in influenced by the accessibility of internet facilities as the academic performance of those who have access to internet is higher than those without internet. In a similar manner, the results of this study also shows that different internet use has no impact on academic performance and the presence of several sources of internet connectivity does not guarantee immediate access to them all. It further recommended by this study that the heads of institutions should work in collaboration with stakeholders to provide proper internet facilities with support management. This study also recommends that in order to supports student's research, the ICT laboratories of various schools should be well equipped with internet facilities and experts should be recruited to train students on how to use search engines to search academic materials online.

Asio *et al* (2021), shows that 70% of the students have access to internet at home and that smartphones top the list of the learning devices that are available for learning for students. The study concluded that institutions should implement a flexible learning plan for the students most espcially in times of crisis.

Idenfication of Research Gap

From this review there is limited literature on ditigal infrastructure and distance learning in Cameroon. Most of the works are in USA and Asia. This indicate that digital infrastraucture education has not yet received much scholarly attention in Cameroon. Preparation to become an emerging economic in 2035 demands great technological transformation in which distance learning is mainstreamed this digital infrastructural development. Our task will be examining digital infrastructure through the learning management systems, digital devices and internet connectivity as distance learning disposition in Cameroon secondary education. Theoretical the discrepancy. Therefore, we adopt this these theoretical philosophies to explain digital infrastructural dispistion and the effectiveness of distance learning at the secondary level in the Cameroon educational system.

This chapter therefore handles conceptual framework, theoretical literature to explain digital infrastructural disposition and distance learning centre in Cameroon. The empirical literature which focus on digital infrastructure on distance learning and how it influences educational outcomes. It equally identifies gaps in the literature as means of establishing the position of the present study. From the present literature we underscore that there is no or limited scientific literature on digital infrastructure and distance learining. Therefore, focusing on this area will create awareness and equally inform the policy makers and community leaders on the importance of developing digital infrastructure for effective distance education in approaches geared toward sustainable quality educati

Chapter Three

Research Methodology

The purpose of this study is to investigate the impact of digital learning infrastructures and the effectiveness of distance learning in Cameroon. This chapter provides a discussion of the methodological approach adopted for this study. The researcher adopted a mixed method. The sample is selected from a large population (Owens 2002). In this chapter, we will discuss the different elements such as the research design, sources of data, tareget population, sample size and sampling techniques, and the data collection procedures which consist of instruments and tools of data collection, the data analysis method, ethical considerations, operationalisation of variable, synoptic table and the referencing style sheet.

Research design

Kerlinger (1973), defines research design as a plan and structure of strategic investigation that is conceived by the researcher to obtain or collect data so as to answer the research questions. Research design therefore serves as a guide in collecting and analysing data by the researcher.

For the present study, the researcher opted for a cross sectional research design which seeks to establish the influence between the main variables of the study.

Area of study

The DEC is located some kilometres away from Carrefour Emia Yaoundé Cameroon along the road leading to Higher Teachers Training College Yaoundé (HTTC). It shares same building with Government bilingual technical and Industrial high school Yaoundé in Yaoundé III Mfoudi division.

The research method

A research method refers to the approach used by the researcher in a study. For Creswell (2013), the choice of research method depends on personal experiences. For the present study, the reseacher adopted for a mixed research method. This method permits the researcher to collect quantifiable data to provide answers to the research questions, realise the research objectives and confirm or reject the hypothesis of the study. For Maree & Pietersen (2013), quantitative researcher, quires three most important elements; objectivity, numerical data and

generalizability of results. The choice of this method by the researcher lies in the fact that we wanted to collect a large quantity of data from the participants on their experiences about the studied phenomenon. The quantitative method was equally chosen because we had to work with a larger population while the qualitative method gives a unique depth of understanding of the studied phenomenon which is difficult to gain from the closed question survey.

Population of the Study

A population of study refers to the total number of individuals the researcher intend to observe during his/her field work. According to Gilbert (2008), a population of study is the totality of objects in the real world in which the researcher is interested. Zibran (2007), on his part argues that a population of study does not need to be large to count as population.

For the present study, the population of study consisted of all the stakeholders involve in distance education in the social science department. Distance learning pedagogic inspectors and teachers. The choice of the distance learning pedagogic inspectors and teachers was aimed to collect data from participants experience in relation to the effectiveness of the distance learning of the ministry of secondary education.

Table 1: ***Population of the study***

Category of participants	**Gender**		**Total**
	Male	**Female**	
pedagogic inspectors for social sciences	39	20	59
Teachers	1337	891	2228
TOTAL	1376	911	**2287**

Source: Regional delegation for social sciences

Accessible population

Accessible population refers to the portion or the subset of the targeted population from which the sample population is drawn. The accessible population have the same characteristics with the general population. According to Zibran (2007) in a research, they are a good number of people to interview, a number of places to visit and a number of people to observe. As such defining the accessible population simplifies the realisation of the research work.

For the present study, a total of 360 participants were retained as the accessible population. The choice of the 360 participants as the accessible population was influenced by the fact that the researcher opted to retain only participants whom she met in the field at the time of the data collection process. The accessible population was made up of 247 males and 113 females, making the total of 360.

Table 2: Accessible population of the study

Category of the participants	**Participants**		**Total**
	Male	**Female**	
Pedagogic inspectors	39	20	59
Teachers	208	93	301
Total	**247**	**113**	**360**

Source : Fieldwork, May 2023.

Sample size and sampling techniques

The sample size is defined as the total number of participants who actually took part in the study while the sampling techniques on the other hand refers to the method used by the researcher to select participants for the study.

Sample size of the study

Cohen, Manion & Morrison (2010), defines a sample as a smaller group or a subset of the total population carefully selected**.** For Gilbert (2008), a sample size needs to be drawn and have the same characteristics as the total population. In the context of this study the researcher uses the research adviser to select the sample size from the accessible population.

Table 3: Sample size of the study

Category of participants	Population	Effective participants
Distance learning pedagogic inspectors	40	35
Teachers	120	119
Total	160	154

Source : fieldwork 2023

The table above shows the sample size of the study. A sample size of 160 participants, both male and female were selected to take part in this study. In all, a total number of 160 questionnaires was administered to the participants. As such, a total of 154 questionnaires came back completed, 4 of the questionnaires were blank while 2 came back incomplete. This distribution can be done with the following analysis of the sample size of the study.

Demographic Characteristics of participants

Demographic characteristics in this study includes; age, sex, level of education, position occupy and years of experience.

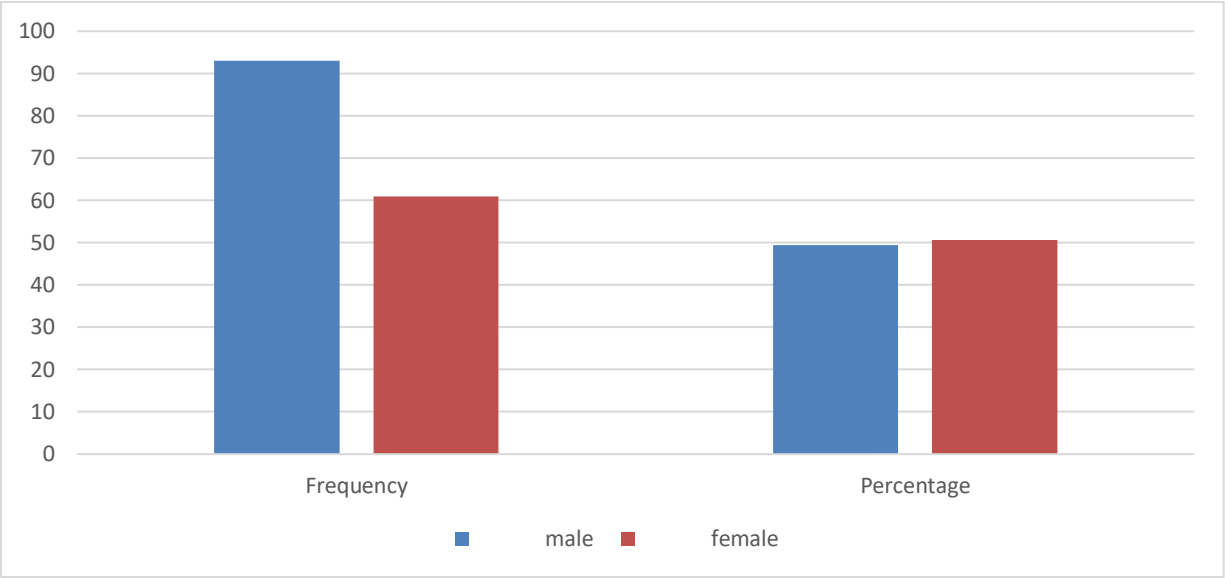
Gender of respondents

The table represents the gender distribution of respondents. In the context of this study, we use a sample population of 154 respondents. According to the table 76 of the respondents are male while 78 of the respondents are female, making a percentage of 49.4.4 and 50.6 respectively. This variation is due to the fact that there are more females than males in the sample population which was taken from those who took part in the production of lessons produced in the Distance learning center of Yaounde.

Table 4: Gender of respondents

	Frequency	Percentage
Male	93	49.4
Female	61	50.6
Total	154	100

Figure 5: Graph of gender of respondents



Age of respondents

The age distribution for this study included the age range of the teachers who participated in this study from the center of education Yaoundé. The result shows that 3.9% are between the age ranges of 20-30years, 25.3% are between 31-30years, 70% have ages between 41 to 50 years and 39% are between 51-60years.

Table; Age of respondent

Table 5: Age distribution

	Frequency	Percent
20-30years	6	3.9
31-40 years	39	25.3
41-50 years	70	45.5
51-60years	39	25.3
Total	154	100

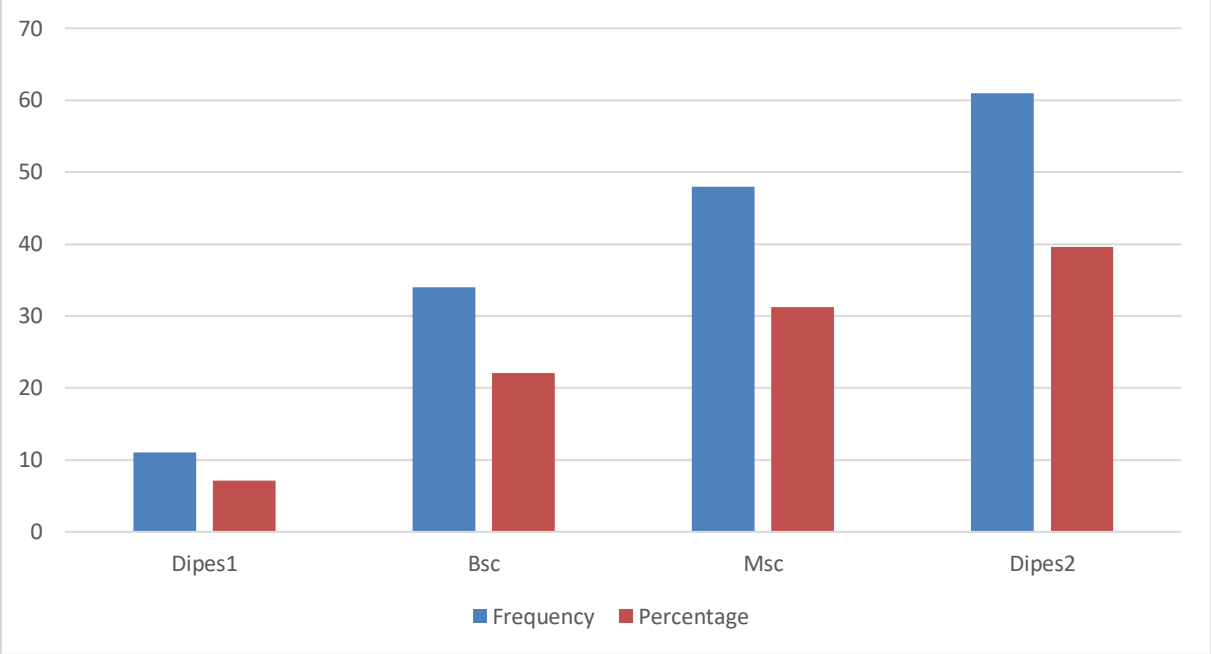
Level of Education of Respondents

The level of education of teachers who participated in this study from the center of education and inspectorate of social sciences was taken into consideration from a sample population of 154. The levels of education of the participants for this study were taken to range from Bsc, Msc, Dipes1 and Dipes2. With respect to the level of education, more than half of the respondents (39.6%) have a Dipes2, 31.2% are holders of Msc, 22.1 are holders of Bsc and 7.1% are holders Dipes 1.

Table 6: Levl of Education of Respondents

		Frequency	Percentage
	Dipes1	11	7.1
	Bsc	34	22.1
	Msc	48	31.2
	Dipes2	61	39.6
	Total	154	100

Figure 6: Level of education of respondents



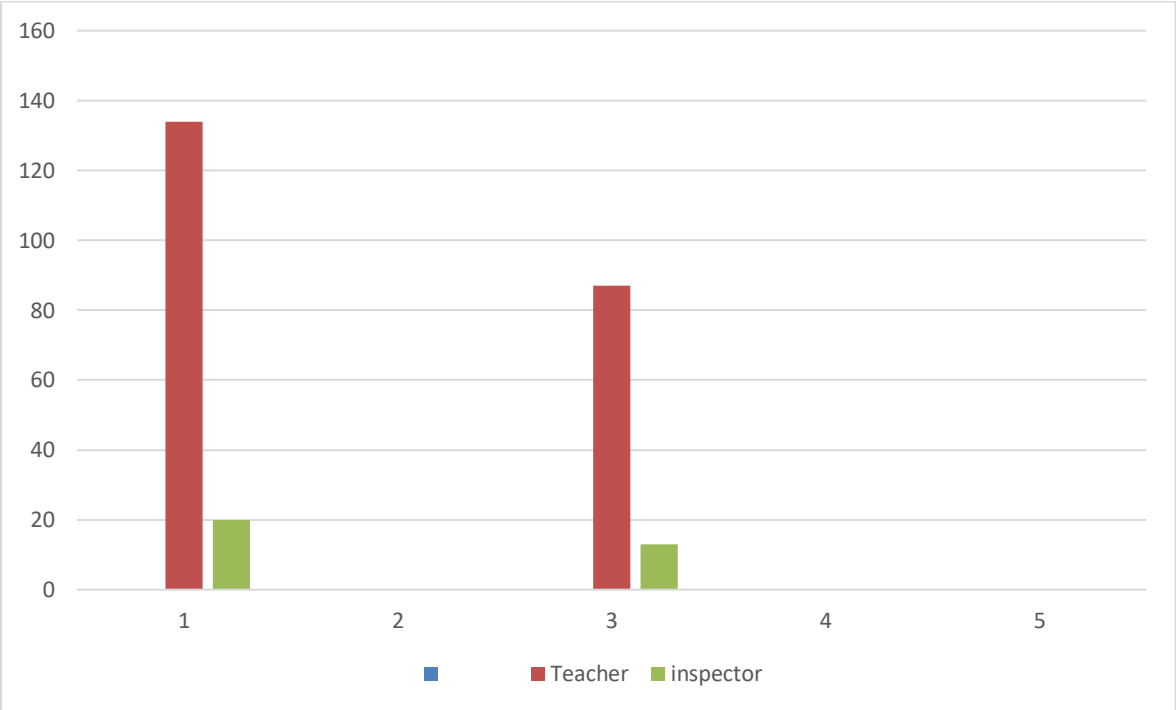
Position Occupy of the respondents

The table represents the position of the respondents in the study. In the context of this study, we use a sample population of 154 respondents. According to the table 134 of the respondents were teachers while 20 of the respondents are inspectors, making a percentage of 87% and 13% respectively. This variation is due to the fact that there are more teachers than inspectors in the sample population which was taken from those who took part in the production of lessons produced in the Distance learning center of Yaounde.

Table 7: position of respondent

	Frequency	Percentage
Teacher	134	87
inspector	20	13
Total	154	100

Figure 7: Position of respondents



Years of experience

The years of experience for this study included the number of years the teachers and inspectors have spent in the service so far. The results shows that 43.3% of the teachers have been in service for 1-5 years, 29.2% for 6-10 years while 27.3% have been in service for 11-15 years.

Table 8: Years of experience

		Frequency	Percent
Valid	1-5	67	43.5
	6-10	45	29.2
	11-15	42	27.3
	Total	154	100

Sampling techniques

Ross (2005), argues that the selection of a sample from a defined population neccessitates a careful construction of a sampling frame. This is because it helps the researcher to take hold of the target population without any need to worry about the contamination with incorrect entries or with elements associated with the excluded population (Ross 2005). The procedure for the selection of sampling technique in this study involved the probabilty sampling method more precisely the simple random and stratified sampling techniques. For the qualitative method, the purposive sampling technique was used to select participants for the study.

The choice for this sampling techniques by the researcher was base on the fact that considering the size of the sample, the researcher wanted to give equal chances to all the participants to be selected for the study. Also, this sampling technique was deemed appropriate because it permitted the researcher to randomly select the participants. The stratified sampling on the other hand helped to divide the population into different stratum in order to facilitate the data collection process.

Data collection instruments and tools

Data collection instruments and tools in this study refers to hand-outs used to collect and record data. The selection of instruments and tools used in this study were base on quantitative method of data collection. There exist several instruments of data collection as well as tools of data collection for both quantitative and qualitative study.

Data collection instrument

For the present study, a self completed questionnnaire was used as instrument of data collection and semi structured interview guide. The reason why the researcher chosed the questionnaire

was because it is recommended in quantitative study and equally because the researcher was dealing with a larger population size while the interview guide was chosen because it permitted the researcher to develop in advance a list of questions that will facilitate the interview process in advance. The choice of the questionnaire as instrument of data collection was equally to facilitate the generalization of results.

Presentation of questionnaire

A questionnaire as seen by Enshassi *et al*. (2010), is a widely used approach used for descriptive and analytical surveys in order to find out facts, opinions and views of the participants on a particular phenomenon. The questionnaires administered in this study consisted of four parts and constituted closed ended questions. Part one consisted of the introduction (the anonimity and confidentiality of the respondent's reponses and identity), the part two consisted of questions related to the modalities of the independent variable. a total of 7 questions was designed to test the learning management systems which ranges from Q1 – Q9, a total of 9 items were designed to test the digital learning devices which ranges from Q10 – Q16 and a total of 7 items were equally designed to measure the internet connections which ranges from Q17 – Q23 on the effectiveness of the distance learning centre in Yaounde. Part three which consisted of questions related to the independent variable (effectiveness of distance learning) consisted of 7 items which ranges from Q24 – Q30 and the part four which consisted of demographic information (Sex, age, position, years of experience, status) had 5 items which ranges from Q31 – Q35. In all, the consisted of 33 closed ended questions administered to the participants through the direct delivery process. The questionnaire was constructed basing on the Likert scale from strongly agree, agree, disagree and strongly disagree. The weighting of the questionnaire varies as follows;

- Strongly agree = 4;
- Agree = 3;
- Disagree = 2; and
- Strongly disagree = 1.

Data collection tool

For the present quantitative study, a questionnaire was used as a tool of data collection along side with an observation guide.

The validity and reliability of the data collection instrument

In order to taste the validity and reliability of data collection instrument, the researcher carried out a pre test to test the validity of the instrument of data collection. The validity of the instrument was equally tested through the content validity and face validity.

Face validity

Face validity consisted of meeting with the supervisor and validating the structure and the nature of iterms in the questionnaire. The researcher make sure that all together with the supervisor, corrections were carried out on the questionnaire.

Content validity

For the content validity, the researcher makes sure that all the elements of the research study was effectively discussed in the questionnaire. This consisted of making sure that all the modalities obtained through the operationaliztion of the dependent variable were fully explore in the questoionnaire.

Pre-test

The pre-test is a test of verification which consist of testing all the elements in the questionnaire so as to carryout modifications and corrections. For this study, a pre-test was conducted in the month of May. The objective of this pre-test was to ensure the appropraiteness and the correction of the questionnaire before the final survey. As such, the researcher selected a sample size of different characteristics as the original sample population of which the questionnaire was administered. The results of the pre-test permitted us to carry out adjustments, modifications and corrections on the final questionnaire.

Reliability of the Instrument

A pilot test was carried and the reliability test was carried out with the use Cronbach's Alpha and the results gave a reliability coefficient of .872. After few weeks, the same activity was repeated and the results were almost the same.

Data analysis techniques

For the data analysis techniques, the researcher opted for the statiscal data analysis techniques throught the use of the Statiscal package for service solution (SPSS) and content analysis techniques. Here, the researcher use both the descriptive and inferential statistics as statistical techniques for data analysis. This consisted of screening and cleaning the data to avoid any possible errors susceptible of affecting the results of the findings of the present study.

Source of data

This consist of handouts from which data was collected for this study. In this regard, data was drawn from two main sources which includes the primary source of data collection and the secondary source of data collection.

Primary source of data

According to Kerlinger (1973), the primary source of data consist of repository of a historical datum such as the original record kept for an important occasion, description of an event given by an eye witness, minutes of an organization minutes or a photograph. Primary source of data therefore consist of first-hand information collected for the study in the form of questionnaires. There are original data collected from the filed by the researcher. This data was principally obtained from the answers of the respondents to a self-completed questionnaires and participants observations. The data served as first-hand information for the study since some data were equally collected from other source.

Secondary source of data

This comprises of data that is collected from other sources. Kerlinger (1973), stated that secondary source of data consist of an account or record of an historical event or circumstance were one or more steps or points are removed from the original event. This source of data can therefore be known as previously collected information. This study to an extent made a good use of secondary data through the libraries, and anything that could provide relevant information on the topic. As such, available and accessible textbooks, sequential reports, performance reports, employment policies, articles, journals, newspapers, relevant information

from the Ministry website, and other documented materials and artefacts constituted the secondary sources of data for this study. These secondary sources of data were extremely important to this work during the literature review.

Ethical consideration

Research cannot be simply conducted by everyone and every where. This is because, research rather follows some ethical standards. Fouka and Mantzorou (2011), argues that ethics in research are all actions taken by the researcher to ensure the protection of the dignity of participants and the publication of information of the research. When a researcher is working with persons, it is necessary to understand and pay attention to ethical principles such as privacy, confidentiality, anonimity, protection from harm, informed consent, voluntary participation, free consent and skills of the research (Fouka and Mantzorou 2011). For the present study, the participants were informed in the fact that they had the right to withold any information that they did not want to disclose. The participants were also informed about their rights to withdraw from the study if ever they did not feel confortable in participating in the study. For anonimity and confidentiality, codes rather than actual names of participants were used. The researcher stored the data in a separate folder which is accessible to him alone. For the informed consent, the researcher obtained an authorization of research from the faculty of Education as well as an authorization from the director of the digital learning center in Yaounde. The researcher equally made sure that all the participants were protected from any harm. Free consent and voluntary participation were equally ensured to all the participants.

Level of evaluation

In project evaluation, there are principally three types of evaluation which are:

Ex-ante correcponds to the first level of evaluation. This form of evaluation generally comes before the Implantation of the project. It is a kind of feasibility analysis which helps to determine how feasible a project is as well as identify possible obstacles.

Mid term evaluation is a vital assessment carried out during the execution phase of every project. It is considered as very important since it helps in assessing progress in project, identifying possible challenges and risks and ensuring compliance of the project

Post ante is the last level of evaluation wich is carried out at the end of a project or when a policy has been completed. This involves assessing the projects outcomes, impacts and

effectiveness, evaluating the achievements of project objectives and goals and identifying lessons learnt, best practices and areas for Improvement.
For the purpose of this study, the level of evaluation adopted was, post-ante evaluation.

Operationalisation of the veriables

Measurable characteristics that assumes different values among subjects is known as a variable (Mugenda 2003). A variable can also be defined as anything that can be differing or having varying value (Amin 2005).

Independent variable

According to Kumar (2011), in a scientific study, an independent variable is always known as the predictor variable. This means that it is the variable which confirms and determines the relationship of the research iterms.
Digital learning infrastructure is the independent variable in this study.

Dependent variable

For Kumar (2011), a dependent variable is a variable which receives the effect of the course. On the other hand, Kan (2008), sees the dependent variable as the criterion variable. This variable constitute the primary interest of the researcher.
Effectiveness of distance learning is the dependent variable of this study.

Table 9: Dependent variable

Digital infrastructural disposition	Distance learning
Learning management systems	
Connectivity	
Digital devices	

Source: Researcher

Table 10: A synoptic table

General hypothesis	Specific hypothesis	Independent variable	Modalities	Indicators	Items	Dependent variable	Modalities	Items	Instrument of data collection	Techniques of data analysis
Digital learning infrastructures has a significant effect on the effectiveness of distance learning center in Yaounde.	Learning management systems has a significant effect on the effectiveness of the distance learning center in Yaounde,	IV1	Learning management systems	Active interaction, collaboration, reporting, instructional management, uploading notes, assessment, knowledge sharing,	Q1 – Q9	Effectiveness of distance learning center	Strongly agree, agree, disagree, strongly disagree	Q25 – Q32	Close ended questionnaire And A semi-structured interview guide	Statistical data analysis techniques (Simple linear regression) And Qualitative data analysis technique (Content analysis)
	Internet connectivity has a significant effect on the effectiveness of the distance learning center in Yaounde.	IV2	Internet connectivity	Up to date modems, quality internet, free access, network coverage, funds, quality human resource, equity in connectivity,	Q10 – Q16		Strongly agree, agree, disagree, strongly disagree			
	Digital learning devices has a significant effect on the effectiveness of the distance learning center in Yaounde.	IV3	Digital learning devices	Quality digital cameras, white boards, multifunctional printers, quality projectors, computer devices, artificial intelligence	Q17– Q24		Strongly agree, agree, disagree, strongly disagree			

Stylesheet APA 7th edition: In this study we adopted APA 7th edition for the in text citations and reference. This abbreviation stands for American psychological association. This organisation prescribes the norms which are to be respected in scientific writing in the social and educational sciences.

This chapter presented explicitly explains the various elements of the research methodology. These elements included: The research approach**,** the research design, the area of the study**,** population, sample size, Instruments, validity and reliability, model, ethical considerations, operationalization of variables, and the synoptic table. These elements constituted the overall scientific approach of the research process in the educational science. It equally gave a specific orientation to the present study as an original topic that contribute to knowledge and advance educational management practices in secondary schools in Cameroon. The following chapter will present and analyse field data collected through a questionnaire.

Chapter Four

Presentation and Interpretation of Findings

This chapter presents the quantitiative and qualitiative field data collected from 157 participants in the distance learning center. The research findings were presented according to the research objectives. Data was analyzed using; frequencies, percentages, weighted mean and standard deviation. The study sought to provide answers to three specific objectives: (i) to analyze the impact of the use of learning management system on the effectiveness of distance learning center in Yaounde. (ii) To examine the importance of the use of digital devices on the effectiveness of distance learning center in Yaounde. (iii) To assess the impact of internet connectivity on the effectiveness of distance learning center in Yaounde.

Research objective one: To analyse the impact of the use of learning management system on the effectiveness of distance learning center in Yaounde. The participants responses were scaled according to the level of agreement or disagreement presented in a Likert scale 4-1 (strongly agree, agree, strongly disagree and disagree).

Table 11: Impact of LMS on the effectiveness of distance learning.

No	Item	SA		A		D		SD		Mean	Std d
		f	%	f	%	f	%	f	%		
1	Learning management system promote active interaction between teachers and students	84	54.5	49	31.8	14	9.1	7	4.5	3.36	.831
2	Learning management system enhances collaboration between instructors	70	45.5	63	40.9	14	9.1	7	4.5	3.27	.811
3	Learning management platforms helps in reporting students' progress	77	50	56	36.4	21	13.6	00	00	3.36	.712
4	Learning management system ensure effective instructional management processes	35	22.7	84	54.5	28	18.2	7	4.5	2.95	.770
5	Learning management system helps in uploading notes to enhance students effectiveness	56	36.4	63	40.9	21	13.6	14	9.1	3.04	.931
6	Learning management system improves on students assessment level	56	36.4	56	36.4	14	9.1	28	18.2	2.9	1.085
7	Teachers and students confident is built through the integration of LMS	56	36.4	63	40.9	28	18.2	7	4.5	3.09	.851
8	Learning management system enhance course content management	35	22.7	84	54.5	21	13.6	14	9.1	2.9	.851

9	LMS facilitate knowledge sharing and acquisition among learners	28	18.2	56	36.4	49	31.8	21	13.6	2.59	.940
	TOTAL									**3.10**	**0.650**

(Source: Researcher from field work, 2023)

As shown on the table above, the respondent's views were graded using the four likert scale. Nine items were designed in the questionnaire to respond to the objective of learning management systems as follows; Learning management system promotes active interactions between teachers and students 84(54.5%) respondents strongly agree, secondly , learning management system enhances collaboration between instructors with a frequency of 70 and 45.5% of respondents corresponding to strongly agree, thirdly LMS platforms helps in reporting students' progress in learning 77(50%) strongly agree, fourth, LMS ensures effective instructional management processes 84(54.5%) agree, fifth, LMS helps in uploading notes to enhance students effectiveness; 56(36.4%) strongly agree, sixth; LMS improves on students assessment level 56(36.4%),seven; teachers and students confident is built through the integration of LMS 63(40.9%) agree, eight ;LMS enhance course content management 84(54.5%) agree and nine, LMS facilitates knowledge sharing and acquisition among learners 56(36.4) agree.

From the findings of the research objective one, the majority of the respondents strongly agreed that LMS has a strong effect on the effectiveness of distance learning with a cut off mean 3.10, standard deviation 0.651 which is above a normal cut off mean of 2.5. Among the 9 items which were designed to measure the influence the learning management system, all the items were more than 2.5 which is the cut off mean.

Research objective two: To examine the importance of the use of digital learning devices on the effectiveness of distance learning center in Yaounde. The research finding according to research objective II was analyze using frequencies, percentages, weighted mean, and standard deviation as show below. The responses were also scale using Likert scale.

Table12: Importance of the use of digital devices on the effectiveness of distance learning.

No	Item	SA		A		D		SD		Mean	Std d
		f	%	f	%	f	%	f	%		
10	There exist up to date modems in the distance learning center	35	22.7	70	45.5	28	18.2	21	13.6	2.77	.953
11	The distance learning center has free access to internet connection	28	18.2	42	27.3	49	31.8	35	22.7	2.41	1.033
12	Distance learning center has free access to internet connection	14	9.1	49	31.8	77	50	14	9.1	2.41	.781
13	Service providers ensures sufficient network coverage	14	9.1	63	40.9	49	31.8	28	18.2	2.41	.890
14	there is availability of funds for internet connections	14	9.1	63	40.9	63	40.9	14	9.1	2.50	.786
15	There exist quality human resources in managing connectivity	21	13.6	91	59.1	28	18.2	14	9.1	2.77	.798
16	Center management guarantees equity in connectivity.	21	13.6	98	63.6	28	18.2	7	4.5	2.86	.696
	Total									**2.59**	**.615**

(Source: Researcher from field work, 2023)

The following modalities were analyzed for this objective: firstly; the learning center has up to date modems for internet connectivity 70(45.5%) agree, secondly; the learning center provide quality internet connection 49(31.8%) disagree, thirdly; the center has free access to internet connection 77(50%%) disagree, fourth; service providers ensures sufficient network coverage 49(31.8%) disagree, fifth, availability of funds for internet connectivity 63(40.9%) disagree, sixth, existence of quality human resources in managing connectivity 91(59.1%) and lastly center management guarantees equity in management 98(63.6%) agree.

The cut off mean here is 2.5 for this objective. Therefore it can be concluded with a mean of 2.59 which means that a majority of the respondents strongly agree that internet connectivity is important for the effectiveness of distance learning. This means that there is a weak relationship between the internet connectivity and the effectiveness of distance learning centre in Yaounde.

Research objective three: To assess the impact of internet connectivity on the effectiveness of distance learning center in Yaounde. The research findings according to research objective on

digital devices was analyzed using frequencies, percentages, weighted mean, and standard deviation as show in Table 3. The responses were also scale using Likert scale

Table 13. Impact of internet connectivity on the effectiveness of distance learning center in Yaounde.

No	Item	SA		A		D		SD		Mean	Std d
		f	%	f	%	f	%	f	%		
17	The distance learning Centre has high quality digital cameras for quality learning recordings	63	40.9	84	54.5	7	4.5	0	0	3.36	.570
18	There is the availability of white boards in the distance learning Centre	77	50	63	40.9	14	9.1	0	0	3.41	.563
19	There are multifunctional printers in the distance learning Centre	56	36.4	77	50	21	13.6	0	0	3.23	.672
20	High quality projectors are used to present lessons	35	22.7	70	45.5	35	22.7	14	9.1	2.82	.889
21	Lessons recorded are of good sound quality	21	13.6	91	59.1	35	22.7	7	4.5	2.82	.718
22	The distance learning centre has up-to-date computer device	14	9.1	91	59.1	35	22.7	14	9.1	2.68	.764
23	The centre intent to adopts artificial intelligences devices for students learning	14	9.1	84	54.5	56	36.4	0	0	2.73	.619
	Total									**3.01**	**.501**

Source: Researcher from field work, 2023

Seven items were designed to explain the third objective on digital devices as follows; 84(54.5%) respondents agree that the distance learning center has high quality digital cameras for quality learning and recording. secondly; 77(50%) of respondents strongly agree that there is the availability of white boards in the distance learning center, thirdly ; 77(50%) agree that there are multifunctional printers at the distance learning center; fourthly, 70(45.5%) respondents agree that high quality projectors are used to present lessons, fifth; 91(59.1%) respondents agree that lessons recorded are of good quality, sixth, 91(59.1%) of respondents

also agrees that the learning center has up to date computer services and lastly; 84(54.5%) agree that the center intents to adopt artificial intelligence devices for student learning.

The cut off mean for this objective is 2.5. Therefore, it can be concluded with a mean of 3.0065 that a majority of the respondents agree that digital devices has an impact on the effectiveness of distance learning. This implies that there is a strong relationship between digital learning devices and the effectiveness of the distance learning Centre in Yaounde.

Dependent Variable: Effectiveness of distance learning

The research findings in line with the dependent variable; effectiveness of distance learning was analyzed using; frequencies, percentages, weighted mean, and standard deviation too as shown in the table below. The responses were also scaled using Likert scale (Strongly Agree, Agree, Disagree and Strongly Disagree).

Table 14: Effectiveness of distance learning.

No	Item 4: Effectiveness of distance learning	SA		A		D		SD		Mean	Std d
		f	%	f	%	f	%	f	%		
24	The distance learning center is well structured	49	3.8	42	27.3	63	40.9	0	0	2.09	.851
25	There are competent human resources in the center	56	36.4	56	36.4	42	27.3	0	0	3.09	.795
26	There is regular maintenance of the structure	42	27.3	56	36.4	42	27.3	14	9.1	2.82	.939
27	There is easy access to the structure for all stakeholders	42	27.3	49	31.8	63	40.9	0	0	2.86	.817
28	The center ensures an effective managerial operation	49	31.8	77	50	28	18.2	0	0	3.14	.696
29	The center practices both online and traditional methods of learning	42	27.3	77	50	28	18.2	7	4.5	3.00	.800
30	There are secured databases content management in the center	35	22.7	84	54.5	14	9.5	14	9.5	2.95	.827
	Total									**2.97**	**.523**

Source: Researcher from field work; 2023

The dependent variable was analyzed using 7 modalities ; from the table it can be seen that 63(40.9%) respondents disagree that the distance learning center is well structured, secondly 56(36.4%) respondents strongly agree that there are competent human resources in the center, thirdly, 50(36.4%) agree there is regular maintenance of the structure, also 63(40.9%) agrees that there is easy access to the center for all the stakeholders, fifth, 77(50%) agrees that the center ensures an effective managerial operations, sixth, 77(50%) also agrees that the center practice both online and traditional methods of learning and lastly, 84(54.5%) also agrees that there are secured databases content management in the center.

Therefore, following the cut off mean of 2.5 and the calculated mean of the dependent variable which is 2.97, shows that a majority of the respondents strongly agree that effectiveness of distance learning was greatly influenced by; learning management system, internet connectivity and digital devices.

Inferential Statistics (Regression analysis)

Hypothesis testing

In this part of the study, we are going to focus on determining whether the independent variable exerts an effect on the dependent variable. As such, we will proceed by the hypothesis testing. To test the effect of the digital learning infrastructures on the effectiveness of the distance learning Centre, it is primordial to formulate the null and the alternative hypothesis.

Ho1: The use of learning management system has no impact on the effectiveness of distance learning in Yaounde.

Ha1: The use of learning management system has an impact on the effectiveness of distance learning in Yaounde.

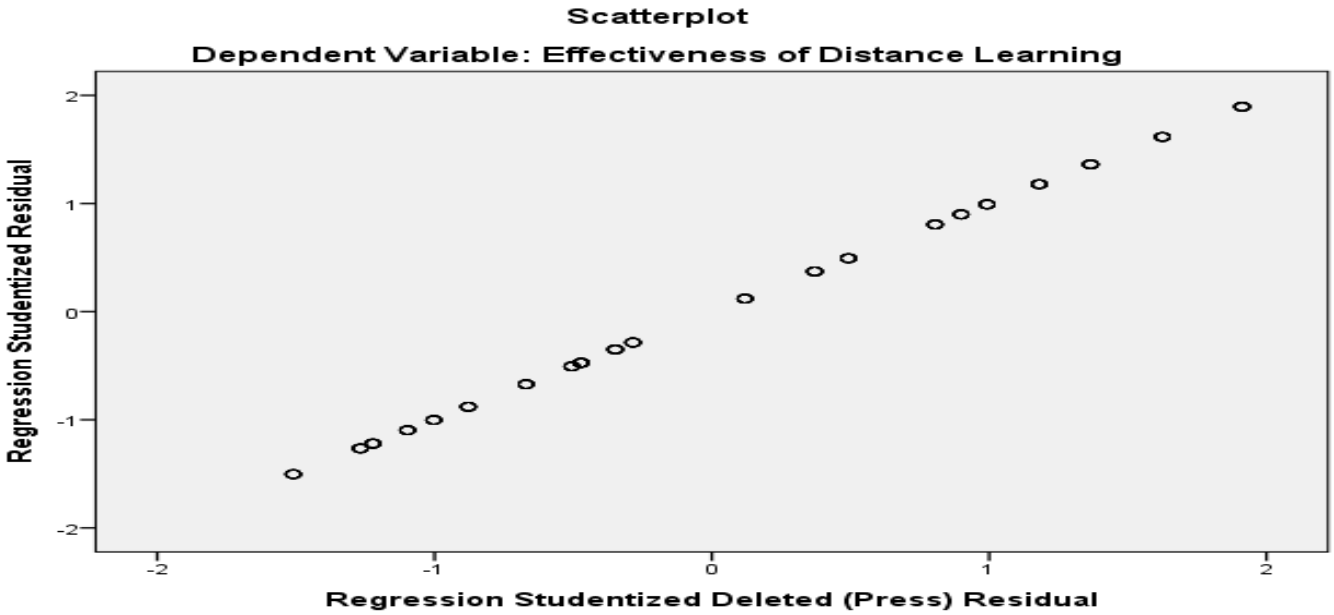
Regression was carried out to ascertain the extent to which learning management systems has an impact on the effectiveness of distance learning in Yaounde.

All the tables below present the linear regression test that was carried out to determine the effect of learning management system on the effectiveness of the distance learning Centre.

Table 16: Model summary of the effectiveness of learning management system on the effectiveness of distance learning.

Model Summary[b]

Model	R	R-square	Adjusted R-square	Std. Error of the Estimate
1	.481[a]	.231	.226	.46002



The scatterplot showed that there was a positive linear relationship between learning management system and the effectiveness of distance learning, which was confirmed with a Pearson's Correlation Coefficient of r=0.48. The regression model predicted 22.6% of the variance in the effectiveness of distance learning. The model was a good fit for the data at F (1, 153=45.772, P<0.05).

Figure 3: Scatterplot of the effectiveness of learning management system on the effectiveness of distance learning

The scattered plot above shows the relationship between Learning Management Systems (DV1) and the effectiveness of distance learning (DV).

Table 17: ANOVA of the effects of learning management systems on the effectiveness of distance learning

ANOVA[a]

Model		Sum of squares	Df	Mean	F	Sig.
1	Regression	9.686	1	9.686	45.772	.000[b]
	Residual	32.165	152	.212		
	Total	41.852	153			

a. Dependent Variable: Effectiveness of distance Learning

b. Predictors: (Constant), Learning Management Systems

This table is on the F test. The linear regression F test states that the null hypothesis that learning management systems does not have a statistically significant impact on the effectiveness of distance learning at p=0.05. In other words, R^2= 0, with F (1,152) = 45.772, p= .000, the test is significant. Thus we can conclude that there is a statistically significant impact of learning management systems on the effectiveness of distance learning.

Table 18: Coefficient of the effects of learning management system on the effectiveness of distance learning

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.785	.179		9.998	.000
	Learning management systems	.387	.057	.481	6.766	.000

a. Dependent Variable: Effectiveness of Distance Learning

The regression results shows that there is no statistically significant influence of learning management systems and the effectiveness of distance learning. (1.785 greater than 0.05). The slope coefficient for effectiveness of distance learning is 1.785, therefore, learning management systems increases by a gradient of 1.785.

Ho2: Internet connectivity is not statistically significant with the effectiveness of distance learning in Yaounde.

Ha2: Internet connectivity is statistically significant with the effectiveness of distance learning in Yaounde.

In order to ascertain the extent to which internet connectivity leads to effectiveness of distance learning, a simple linear regression analysis was used.

Table 19: Model summary of the effects of internet connectivity on the effects of distance learning

Model Summary[b]

Model	R	R-square	Adjusted R-square	Std. Error of the Estimate
1	.253[a]	.064	.058	.50759

The scattered plot showed that there was a strong positive linear relationship between internet connectivity and the effectiveness of distance learning with a Pearson's correlation coefficient of r=.253. The regression model predicted 6.4% of distance learning variance. Therefore, the goodness of fit for the data (F (1, 154) =064.

Figure 9: Scattered plot of the effect of internet connectivity on the effectiveness of distance learning.

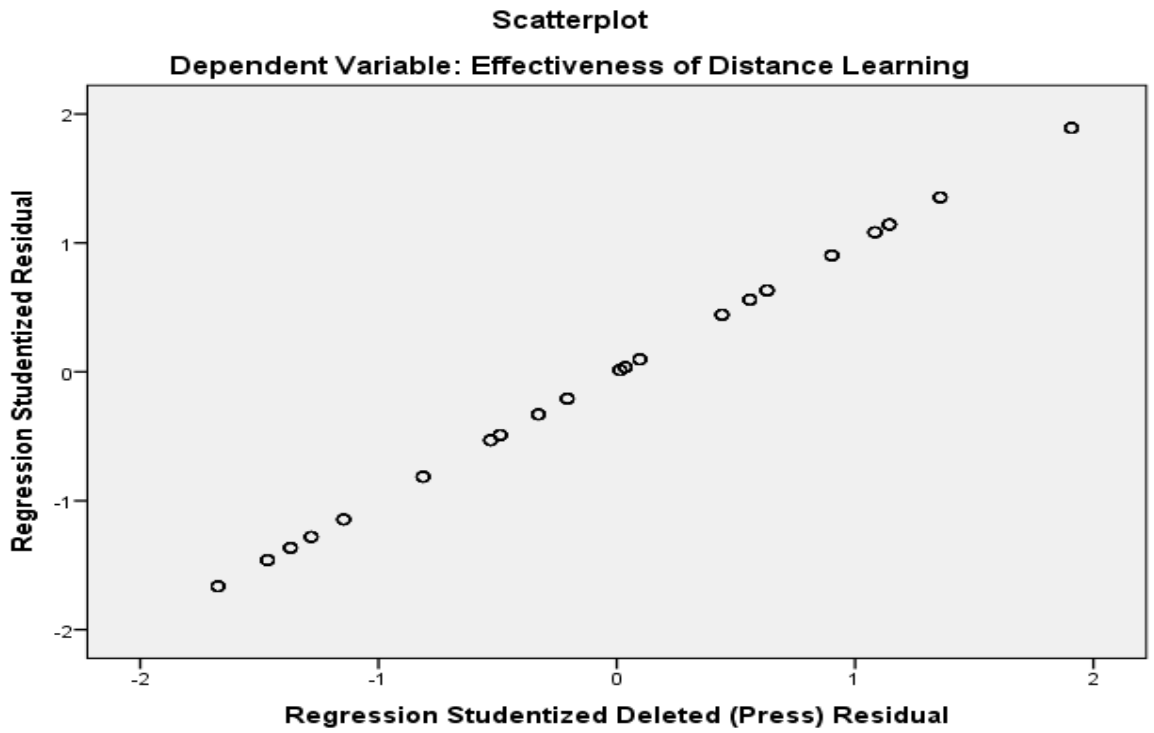


Table 20: ANOVA of the effect of internet connectivity on the effectiveness of distance learning

ANOVA[a]

Model		Sum of squares	Ff	Mean square	F	Sig.
1	Regression	2.689	1	2.689	10.438	.002[b]
	Residual	39.162	152	.258		
	Total	41.852	153			

a. dependent variable : effectiveness of distance learning

b. Predictors : (Constant), internet connectivity

The above table shows the results of the F test. Internet connectivity has a statistically, significant on the effectiveness of distance learning with F (1, 152) = 10.438, p <.002, the test is highly significant. Thus we can assume that there is a statistically significant effect of internet connectivity and the effectiveness of distance learning.

Table 21: Coefficient of the effect of internet connectivity on the effectiveness of distance learning

Coefficients[a]

		Unstandardized coefficient		Standardized coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.408	.178		13.545	.000
	Internet connectivity	.216	.067	.253	3.231	.002

a. dependent variable : Effectiveness of Distance Learning

The regression results showed a significant relationship between internet connectivity and the effectiveness of distance learning with a positive beta (B) coefficient (2.408). The results also reveal that any unit increase in the internet connectivity will lead to a 0.216 increase in the effectiveness of distance learning centre. At 5% level of significance and 95% level of confidence competence had a 0.000 level of significance, meaning that internet connectivity has a significant effect on the effectiveness of distance learning centre.

Ho3: The use of digital devices has no influence on the effectiveness of distance learning in Yaounde.

Ha3: The use of digital devices has an influence on the effectiveness of distance learning in Yaounde.

For this hypothesis to be verified, a regression analysis was carried out to ascertain the extent to which digital devices can predict the effectiveness of distance learning.

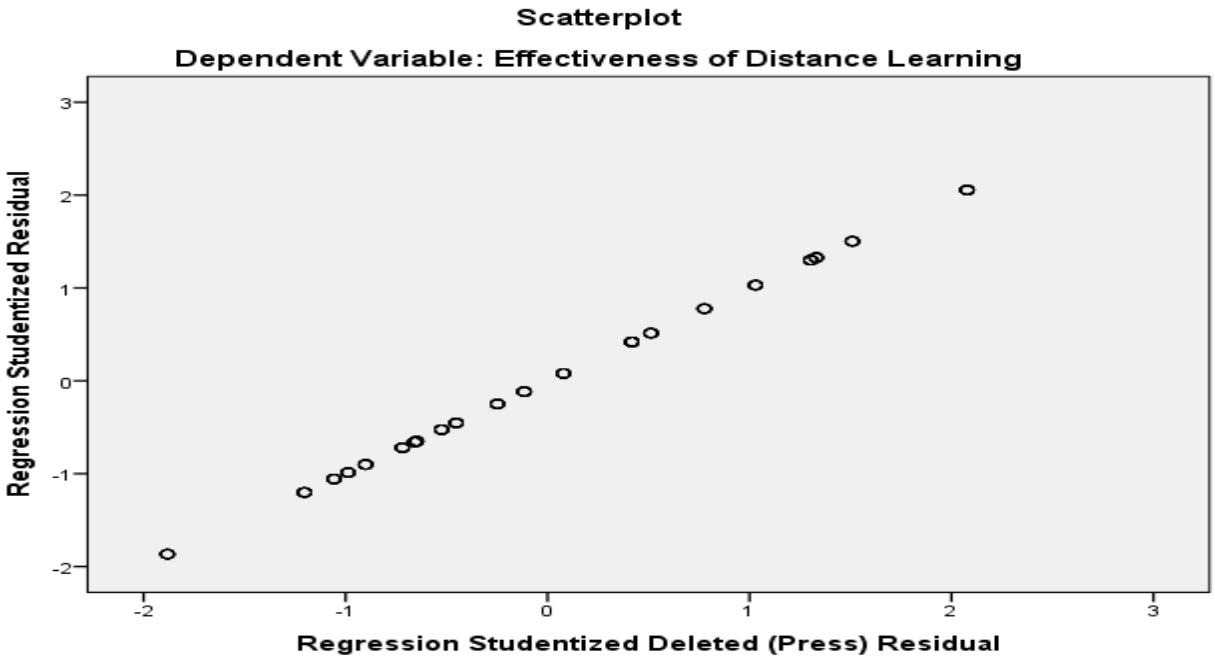
Table 22: Model summary of the effects of digital devices on the effectiveness of distamce learning

Model Summary[b]

Model	R	R-Square	Adjusted R Square	Std. Error of the estimate
1	.587[a]	.344	.340	.42492

a. Predictors : (Constant), digital devices
b. Dependent Variable : Effectiveness of distance Learning

Figure 10: Scatterplot of the impact of digital devices on the effectiveness of distance learning.



The scatterplot showed a strong positive linear relationship between digital learning devices and the effectiveness of distance learning which was confirmed with a Pearson's correlation coefficient of r=, 587. The regression model predicted 34.4% of the variance in the effectiveness of distance learning. The model was of good fit for the data set (F (1,153) =79.792, $p < .000$)

Table 23: ANOVA of the effects of digital deviecs on the effectiveness of distance learning

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14.407	1	14.407	79.792	.000[b]
	Residual	27.445	152	.181		
	Total	41.852	153			

a. Dependent Variable effectiveness of distance learning

ANOVA results show that the linear regression F test has the null hypothesis that the use of digital devices has no use on the effectiveness of distance learning. Given that, $R^2 = 0$, with F (1, 152) = 79.792, p<.000, the test is highly significant. Therefore, we can conclude that the use of digital devices have a statistically significant impact on the effectiveness of distance learning at p=.01 in our model.

Table 24: Coefficient of the effects of digital learning devices on the effectiveness of distance learning

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.146	.207		5.543	.000
	Digital devices	.606	.068	.587	8.933	.000

a. dependent Variable : Effectiveness of distance learning

The regression equation showed a statically significant relationship between the use of digital devices and the effectiveness of distance learning at (1.146, $p < 0.000$). The gradient coefficient for digital devices was 0.587, so the effectiveness of distance learning increased by a factor of 0.587.

Table 25: Summary of quantitative study

Research Objectives	Research questions	Percentage & mean		Research hypothesis	PV<0.005or 95%	
To analyze the impact of the use of learning managemen t systems on the effectivenes s of distance learning.	What is the impact of the use of learning management systems affects distance learning?	Standard deviation Mean	0.650 3.10	H_{a1}: Learning management system has no a statistically significant influence on the effectiveness of distance learning.	0.00 0	Rejected
				H_{a1}: Learning management system have a statistically significant influence on the effectiveness of distance learning.		Retained
. To assess the impact of internet connectivit y on the effectivenes s of distance learning.	To what extent does the availability and use of digital devices influences the effectiveness of distance learning?	Standard deviation Mean	0.65 3.15	H_{a2}: internet connectivity has no statistically significant effect on the effectiveness of distance learning	0.00 2	Rejected
				H_{a2}: internet connectivity has a statistically significant effect on the effectiveness of distance learning		Retained
To examine the importance of the use of digital devices on the effectivenes s of distance learning.	To what extent does internet connectivity affect the effectiveness distance learning?	Standard deviation Mean	0.501 3.45	H_{a3}: The use of digital devices has a statistically significant impact on the effectiveness of distance learning.	0.00 0	Rejected
				H_{a3}: The use of digital devices has a statistically significant impact on the effectiveness of distance learning.		Retained

Qualitative data analysis and presentation

This section presents the results of the findings extracted from the respondent's interviews. The process consisted of data familiarization, data coding, identification of themes and sub themes and the evaluation of the themes and the sub themes. A total of four themes were extracted from the respondent's interviews which helps us to come out with a number of sub themes. The table below presents the themes, the sub themes and the participants for the qualitative part of the study.

Table 26: Identification of the themes and sub themes

Themes (T)	Sub themes (ST)	Participant 1 (P1)	Participants 2 (P2)	Participant 3 (p3)
	Managerial dispositions	x	x	X
	Structure of center	x	x	X
Distance	Challenges	x	-	X
learning	Recommendations	x	x	X
	Types of LMS	x	x	-
Learning	Training methods	x	-	X
management	Contextualizing LMS	-	x	X
system	Challenges of LMS	x	x	X
Internet	Quality of internet	x	x	-
connectivity	Accessibility to users	x	x	X
	Types connections	x	x	X
	Management/challenges	x	x	X
Digital learning	Types of devices	x	x	X
devices	Quality of devices	x	x	X
	Availability of devices	x	x	X
	Maintenance of devices	x	x	X

Source: The research, 2023

Where T = Themes, ST = Sub themes, P1 = Participant 1, P2 = Participant 2, and P3 = participant 3, X = an answer and - = no answer.

Interpretation of qualitative results

This section focusses on the interpretation of the qualitative results. The interpretation is based on the main themes and sub themes of the study. In all, a total of four main themes was extracted from the respondent`s interviews, with each theme breaking down to give four sub themes each.

Theme one: Distance learning center

Distance learning is a method of studying which has gradually gain ground in the 21st century. It is a way of teaching and learning which does not necessarily requires the physical presence of a teacher or students. This form of transmitting took another dimension in the developed and

less developed countries especially following the outbreak of the COVID-19 in 2019. This disease gradually became a serious threat to the health conditions of the population worldwide. Faced with this challenges, nations, governments, policy makers, and educational stakeholders seeks for alternative means through which education could continue despite the menace of the COVID-19. It was for this reason that distance education became the ideal solution to this worldwide problem. this can be corroborated by one of the participant`s verbatim which states that;

Learning Management Systems as digital infrastructural disposition for effective distance education in Cameroon

Participant 1: "*All what supports the promotion or the working or the appropriate functioning of digital devices which can include hardware or connectivity."*

in this view learning management systems iss combination of hardware and software system that facilitate the ***"appropriate functioning"*** of the dis the distance learning center. Effective function of this center therefores depends on the learning management systems that are provided as infrastructural dispositions. *"**Connectivity"*** is an important component of the learning management system. Therefore, using the connectivism approach in development distance learing at the community level will enhance the holistic integration of information and communication technologies in the secondary eduction sector.

> *I think that when we talk about distance learning one of the best ways of measuring and monitor progress is with the help of LMS and also to automate certain processes as far as learning is concern. So LMS are very powerful software that can help monitor learner's process, evaluate automatically and do a lot of things*" (P1).

This inspector perceives learning management systems as and infrastructure that ***"automate certain processes".*** This implies that learning managmen systems in distance learning education are capable of generating learning and evaluation processes autonomically. learning management system are also describing as powerful software", which are to ***"monitor learner's process"*** and *"**evaluate automatically"*** in this light, the deployment of learning management systems as infrastructural disposition has significant implication of effective distance education in Cameroon secondary education.

Participant 2: *To the best of my knowledge without being an expert in distance education, as a normal inspector, LMS form the word LMS constitutes a good number of instruments that can permit and facilitate the teaching learning process. It involves the process through which information is processed and stored and can be retrieved at any time by the user. It constitutes*

of many things that's why I said it's a process. I use instrument as a blanket term because it constitutes of many things."

learning management system is seeming here as *"**good number of instruments"** term* instruments is used as "blanket term, this signifies that learning management is collection or combination of services divices and application to better *"**permit and facilitate the teaching learning process, process through which information is processed and stored and can be retrieved"*** learning management systems are infrastructural dispositions which as repositories and platforms of information, skills and knowledge diffusion and storge . These are innovative approaches in improving education at the secondary level in Cameroon. Notion of Learning Management Systems from the field data showed that there is ambiguity in the definition of LMS, actors in the fields do not master the definition of Learning Management System. Speaker almost got the definition of Learning Management Systems but added…These categories of persons' view interview in separate ways. this shows that the definition of LMS is evolving or its dynamique. The respondents at the distance learning center could not bring out clearly the types of Learning Management System.

Participant 2 (P2) argued that;

> *When we talk about distance education or E-learning, we are making reference to education in the absence of the teacher or the students. In this form of knowledge transmission, the students do not necessarily need the presence of the teacher to learn nor the teacher need the presence of the students to teach. Both of them can be on different geographical spheres and still learning without any problem. I think in the 21st century, distance learning should be generally accepted by everyone as it is less time consuming and efficient whenever it is well design and implemented (P2).*

Participant three on his part argued that;

> *Distance education refers to the transmission of knowledge from teachers to students in the absence of any physical contact. This method of acquiring knowledge has considerably gain especially with the outbreak of COVID-19 which forced the closure of all the school campuses. Students were forced to stay home for practically a year or more than in some countries. But in order to avoid a blank school year by the government of Cameroon, distance education was adopted in which knowledge was transmitted through the radio, television, digital learning platforms. This help to avoid a blank school (P3).*

This means that distance education is an absolute necessity in both the developed and less developed countries. This is also because due to a number of occupations, and the United Nations initiative of ensuring lifelong training opportunities for all, distance education is thus seen as a "panaxia" to this problem.

Sub theme one: Managerial dispositions

The distance learning center of Yaounde translate the clear desire of the government of the Republic to ensure quality and access to education to all the citizens irrespective of sex, race, religious beliefs and ethnic belongings. The center was set up in 2019 as a respond to the COVID-19. The center went operational in July 2020. The center is a full fledge distance education center which operates practically every day. According to one of the participants, in terms of managerial dispositions;

> *As of now it is average in terms of management as of now because things are not yet well structured because at one moment the minister has not yet appointed the coordinator. There is no decision appointing that this or that man is not the coordinator of the center makes people to begin to think that some other person can be there because for now the people who are working at the center as in terms of management are inspector coordinating inspectors and one of them (there are nine of them) is the one coordinating the center who is possibly not an expert in distance education. Even if he is an expert in distance education. He should be given the real command just like the appointment of director of technical education, director of secondary education, so the director of distance education should also be appointed for the center to go smoothly so in terms of management it is just average (P1).*

For participant 3;

> *Actually, the process starts at the level of each inspectorate. Each inspectorate knows how they start until they enter the studio and present their lessons. They know that they get the teachers, prepare lessons, bring to the center, there being checked by the technical and pedagogic team, if just two persons say its ok, you enter the studio and record your lessons. And when you record your lessons, at the end, there is a whole set of mini data base, which information is being recorded which inspectors represent. You have the right to come back and check if the lessons are accepted or rejected. Sometimes technical fault might take place and the team will call back the people involve for repetition (P3).*

Sub theme two: Structure of the center

In terms of the structure of the digital learning center, it is organized in a hierarchical order whereby we have a general director at top of the center. This director is in charge of running the distance learning center. He takes decision in relation to the organization and structuring of lessons. He see into it that the prescription of the Ministry of secondary education are well implemented in the distance learning center. In all, the center is under the ministry of secondary education run by a director. This can be justified by one of the respondents verbatim who stated that;

> *The center is socially organized and controlled by the minister of secondary education who delegates power to the inspector general of education (IGE) who oversees the activities of the Center. The main building comprises of five recording studios with one recording over 10-15 lessons a day. All the educational sub*

systems both Anglophone, francophone and technical systems are represented in the Center. It also includes the director and his own technical team but the teachers are just users of the center.

Sub theme three: Challenges

In terms of challenges, the center is undergoing a certain number of challenges at the level of operation and in the management of the center. The challenges ranges from the level of infrastructure, managerial functions and teachers competences. This goes in line with some of the challenges mentioned by the participants.

Use and management of human resources (teachers) is still a challenge. To take control of teachers is still a challenge given that fact that a teacher is supposed to be in class at a particular time and still be at the center at this same time. And since the center is a body on its own, the teacher will chose where he/she is more comfortable. So the center needs to be given a legal status. With this cacophony of management, the lessons will never be produced on time (P1).

Accessibility: Since the project is meant to solve this problem, there are places with no network and those in such areas still have no knowledge of distance learning. So the concept of distance learning still remains a dream to them. So the question that arise is how such areas will gain access to this digital instruments and distance education. So the question now is for the powers that be to send network coverage to all the remote areas in Cameroon so as to benefit everybody. If not we will only be working for children of the urban center and children of the rural areas will continue to be left in the dark (P2).

The powers that be will know how to make the project a long lasting one. But talking of some of the ethical issues I'll say the following: Dressing code; the teacher needs to appear in front of the camera clean because the teachers is appearing in front of the world and that can tannish and even stop the broadcast of distance education if the dressing code is not well stipulated and the distance education thou I said it is average, they thought of that and gave prescriptions on how teachers should dress. Security because they have security cameras all over. Conducive environment because the center needs to be located in a very calm environment (P3).

Sub theme four: Recommendations

Basing on the challenges identified above, a number of participants advanced some recommendations and suggestions which if there are well implemented, will enhance the effectiveness and efficiency of the distance learning center. For the participant 1, overcoming challenges require the center to;

The legal status of the distance learning center. People often doubt the authenticity of the communicate written by the coordinating inspector general with no stamp. Personnel appointed. Continuous capacity building of the stakeholders (training) that is the inspectors, teachers and students. Motivation of the different actors involve in distance learning. People are just working and going and there don't know how much,

when they are going to be paid. For example teachers who leave far away are oblige to pay transport fare and at times they are reluctant and easily discourage of continuing. This frustrates the inspectors in charge and also the distance learning center as a whole (P2).

Because you know we responded to a situation. And I think for a responsive situation we have done a great job. But I also want to think that we need to move to a more mature level where we now manage things slowly. I mean that we may want to make a kind of 10 year plan, 15 year plan or 20year plan or kind of an action plan. That each year to this year this is what we can achieve. And we now work with experts in change management who will help us to navigate the publicity of this social Change. I think that since it has come to stay, lets define a 20 or ,50 year strategy and build a kind of model that doesn't cancel what we already started doing but reinforce what we are doing and making teachers more comfortable. To conclude, since energy is key in all of what we do, no matter what we do interns of digital infrastructure if we don't solve the problem of power, for example the area of Ekondo Titi that has spent about 3years without power then nothing will push forward. To solve this problem, I think we have to work in collaboration with other ministries such as the ministry of post and telecommunication and the ministry of energy (P3).

Theme two: Learning management systems

Learning management is an indispensable part of the distance education. Learning management system provide a framework for the management of courses online. The learning management system is platform which provide virtual interaction between the students and the teachers from a faraway distance. All the participants made mention of the learning management system. For participant one,

As far as the center concern, we can really say there is no define LMS. The lessons produced are placed on a platform or WebApps. There is really no specific name but it's a WebApps where it records and stores information. If you go to the MINISEC distance learning site (www.minisec.cm) you will fall on a WebApp or platform that will give you access to the material but there is work in the pipe line to came out with a well-defined LMS.

For participant two;

To the best of my knowledge without being an expert in distance education, as a normal inspector, LMS form the word LMS constitutes a good number of instruments that can permit and facilitate the teaching learning process. It involves the process through which information is processed and stored and can be retrieved at any time by the user. It constitutes of many things that's why I said it's a process. I use instrument as a blanket term because it constitutes of many things.

This proves that the participants although without any group mastering in distance education have an understanding of the learning management system. All the participants expressed their views as far as learning management system is concern.

Sub theme one: Training methods used

Learning management system remains a vital tool for the effectiveness of the distance learning education. The system helps in the transmission of lessons. It also helps to train teachers on how to use the distance learning effectively. In the digital center, the participants were of the view that the learning management system is of different kind. This can be corroborated by one of the participants verbatim who states that;

> *There is one I use called "subtle repetition". It means that repetition that is not felt when it is being repeated. I use this because repetition is a means of learning and we know repetition is boring but we have to explain it in a way that the learner will not feel it as boring. One is the way I use is that concept can be explained by using an image that represents that idea or an animation that illustrates that idea and you see the concept is being explain in several ways (P1).*

For participant 2;

> *Another concept i use is the concept of factorization. This one is generally used to still support subtle repetition. Because the thesis behind the learning is that there is substitution so subtle repetition can be achieved again through factorization. So it means that on trying to teach kinds of something, maybe there four, thins you want to explain they are maybe four. What do you do? You look for common matrix, what they have in common. You factories those elements and structure them in such a way that those elements in those four things you want to present are there in the same order. That now supports the technique of advance organizing. So one of the base I insist with teachers is that I tell them in advance. Let's assume if you want to present a lesson on the type of interview, let's assume there are three types of interview, the first thing I want to see is what are the things you say about the types of interview not in the same interns of things that I'll see but in terms of matrix. One can be maybe in terms of form maybe it's done online, offline or face to face just like that and we do for all. And then most of the times we speak to the learners that this is how we are going to do it. It's called advance organizing and it will reduce the extraneous efforts the learner will make.*

This means that in the distance learning center, learning management system provide a framework for teachers and students to interact. The learning management system permit the inspectors to train the teachers. In this line two principal methods are used, that is; the concept of factorization and the subtle repetition.

Sub theme two: Contents of the learning management system

In terms of the contents of the learning management system, one of the participants stated;

> *The content is organize into classes but first of all the subsystems and consist of the two main section of education that is general and technical. Now the classes or cycles are section in to form 1to 3 and 4-5 and 6-7. If u go to the platform of form 1 you will see everything about form one and so on.*

For the third participant, the content of the learning management system consists of;

The content are video lessons that learners can access at any time on YouTube. But in the case of a live lesson, the use application zoom with other tools on an environment where learners can follow the lessons live and discuss with the teachers.

The second participant elaborated on the contents of the learning management system by insisting that;

Yes, but as of now lessons are rarely placed on the platform because the live lesson is generally done before revision so there are choosing a set of topics but the lessons that are online are lessons of the syllabus that are done one by one, chapter by chapter in a chronological order and placed on the platform for learners to access in an asynchronous way. So any time the learner want to access the lessons but when it is a live lesson the teacher is there and it happens in a synchronous way. There are working together and at the end the meeting is over. Sometimes it's recorded and kept, sometimes it's not.

Sub theme three: Contextualizing the LMS

The success of the distance learning center largely depends on the conception and designing of the center. This requires the policy makers to look into it that the center reflects the realities of the Cameroon context. In this light, there is the need to contextualize the learning management system to make sure that it takes into account the particularities of the Cameroonian context. In this sense, the participants stated that;

I think the platform itself is already contextual with a lot of Cameroonian type of colors you know every ministry tries it's best to include the colors of the country in their websites an in all the things they do. Now talking about context, the context must have to be "cameroonized". In terms of the content, there is a lot of seminars trying to push lesson producers and inspectors to make sure the content of the lessons are kind of reflecting our culture a bit and of course that demands a lot of work and allot of change in perspectives because it's easier when you go online you see a lot of things if the western world trying to contextual pictures and other things for example if I want to use an image in my lesson, it will be ideal for me which is the image of a black person that will be pushing the idea that we are trying to bring out the fact that we are in Africa. And I can use names of Cameroon symbols (P2).

I'm going to answer that question as a technology expert by saying this, by saying that if there is one thing about technology is that we don't want to invent a new, we use what others already has. So, entering into the process that I'm going to build my platform might take a lot of time which we don't have. Maybe the question should have been what are the consequences or the issues that may arise in depending on outside technology. We need a kind of long term plan maybe between 10 to 20 years (P1).

This question is a very challenging question not only to the person responding but to the system itself because when this was introduced, people were very skeptical whether Cameroon can even adapt to the necessary instruments and the system available because the question of personnels came into play, the question of knowledge came into play, the question of accessibility and a good number of persons have not been trained to use these resources. so now that it was a systematic process and a step by step and a few were trained and now that de has come to stay, I think that in the long run if these persons who have already been trained, to manage these foreign instruments because they have already been trained, if they reinforce their skills and then train them following the Cameroonian context because they are implementing the

foreign context so if these same people are retrained, if their capacities are reinforced following Cameroonian realities I think in the long run they will be the ones to spearhead the production of systems that can be adapted to the Cameroonian context because there are children who have not even gone to school but they are capable of producing so why not of these people who have acquire a lot of skills? so I think it's very possible for Cameroon educationist to produce their own systems adapted to the Cameroonian problems and challenges but the political way must also be there (P2).

Sub theme four: Challenges of the LMS

Challenges are simply inseparable from any project. The learning management system is still a challenging issue in the context of Cameroon. This is because Cameroon being part of the less developed countries still faces difficulties in terms of effectiveness of learning management system. This can be corroborated by one of the participant verbatim who stated that;

So first thing about production is, you know this is a chain process. First things is that getting the lessons is being a very daunting task because of the fact that it's about changing the way people do things. The way teachers are expected to produce their lessons has changed and it's demanding more efforts but that's not all, it's demanding a different kind of theory of learning which needs to be. So I agree with you that there is that training gap that exist that is making some teachers not having the skills necessary to produce the lessons. But I also have to say, since it's a change process people are resisting. It is easier to them, to do "wasawasa" there used to do because wasawasa hear means let me produce my lessons intellectual get to the classroom after 45minutes I leave but this one is a lesson where we prepare the lessons, present to an inspector, he evaluates your lessons and tell you if you have apply the methodology or not. You see it means another screening or evaluate the multimedia pedagogy in your lessons before you can now take it to the studio being recorded and being corrected. So it's a kind of very solid process that demands that the teacher should be very patient and not bring wasawasa. So if he brings his wasawasa again, most of the time they are being corrected and ask to change and has to do more efforts and since efforts is one of the problem with people in work we end up seeing teachers resigning, running away.

In order to overcome the challenges, the participants advanced a number of ways such as;

I think that one of the first things the government is trying to do is wiring this place with internet. I think that where the problem lies now is the fact that they have not try to touch another type of motivation to ensure that teachers have certain things that they can really just work. But I think that they expect teachers to join the trend by investing because first of all if you are a government teacher you have what we called "prime de recherché". So we cannot also claim that we should get additional money for that even thou I think we should. But I think that most of the time we use something before saying that ok I have done this and I need this. But in terms of resources the govern ment is doing their planning. But for lessons, they actually pay thou the payment be a kind of variable lessons. It may not came immediately because we know how the government machinery works which may take one or two years before being given out. Each live lesson is paid. This also one of the reasons why most of the teachers get to slip away from doing the job because they must have

waited up to 6months and their patient gets to run out and they seek for other alternatives. I think that most government processes function like that but I think that they should change that process.

Theme three: Internet Connectivity

Internet connectivity refers to the quality of internet or network available to the users. The quality of the connections is instrumental for distance education. This is because everything concerning distance education cannot be possible in the absence of internet connection or even poor connection. All the participants were of the views that internet connectivity plays a vital role in the effectiveness of the distance learning center.

For participant one;

I think it's excellent and I think it's the core of the distance learning center. Because I think the distance learning center does more of electronic learning than the distance learning it's supposed to do. Because it's not called distance learning for nothing. It's called distance learning and not e-learning. Because the plan on having a mini printing press where lessons will be printed and sent to areas of low energy for now. But since this mini printing press has not been set up, the core of distance learning is found around electronic learning. Internet is core mostly for live lessons. But there is another part that has nothing to do with internet connectivity which is the recording of lessons but live lessons need internet and live meeting needs internet.

Sub theme one: Quality of the internet connection

The quality of the internet connection determines the effectiveness of the distance learning center of Yaounde. This is because it is very impossible for the distance education to operate without internet. The most important thing is not having the connection but having connection of good quality to facilitate the transmission of the lessons. This can be corroborated by the respondents verbatim.

For participant three;

There is a whole technical team at this center which about 8. That sets up the whole environment and also controls how people are going in and out of the meeting. Either by muting the mic of unstable members online etc. There mostly coordinate than administrative coordination. So long as you are around you can access the internet. And we have at least three internet connectivity i.e. Wi-Fi connections which are SCIreal estate, minisec1, minisec.

For the second participant,

Not very strong, why do I say so? Because the main service provider is CAMTEL because the first lessons where produced at MINIPOSTEL because the center was not existing because they had already the resources available there which is another ministry from MINESEC. But we know that CAMTEL even with its strong network cannot be available all the time and with the competitiveness of the world, other service providers have been supporting the educational systems and they have even

had the possibility of lunching some of these LMS to the Cameroonian government such as orange and mtn.

Sub theme two: Accessibility of internet to users

In terms of the accessibility of the internet connection to the users, one of the participants stated that;

While at the Center its free. At the center you just need to copy the code and the connection depends on the studios (5 studios) because you know that at one moment when one line is over saturated, they have to connect to the next line. And the next line might not necessarely be MTN.

For the second participant in case of internet failure;

The technicians switch immediately because the lesson is a whole process. so in case of failure the recording stops especially direct lessons where learners are following on directly, then the error is being corrected and the lesson continues because there still rework the lessons before it's been uploaded online.

A third participant pointed out that in terms of access rate of the users;

It could be between 45% and 60%. This is reflectable because you can only go for what you are interested in because the essence if first of all for everybody to be aware that the lessons are available because the lessons are open first of all to the world not only to the students and teachers but for the world to know that there are lessons there.

Sub theme three: Types of connections

Regarding the types of connections, one of the participants stated that;

I think it's excellent and I think it's the core of the distance learning center. Because I think the distance learning center does more of electronic learning than the distance learning it's supposed to do. Because it's not called distance learning for nothing. It's called distance learning and not e-learning. Because the plan on having a mini printing press where lessons will be printed and sent to areas of low energy for now. But since this mini printing press has not been set up, the core of distance learning is found around electronic learning. Internet is core mostly for live lessons. But there is another part that has nothing to do with internet connectivity which is the recording of lessons but live lessons need internet and live meeting needs internet.

Another participant pointed out that there are several types of internet connections used at the center.

Because the main service provider is CAMTEL because the first lessons where produced at MINIPOSTEL because the center was not existing because they had already the resources available there which is another ministry from MINESEC. But we know that CAMTEL even with its strong network cannot be available all the time and with the competitiveness of the world, other service providers have been supporting the educational systems and they have even had the possibility of lunching some of these LMS to the Cameroonian government such as orange and mtn.

Theme four: Digital learning devices

The digital learning devices are the materials used in the transmission of knowledge in distance education. It provides the framework for interaction between the teachers and the students. In the digital learning center of Yaounde, the devices which are commonly used are mobile phones, computers, and interactive boards and so on. This permits the teachers to be able to put the notes at the disposal of the students.

Sub theme one: Types of devices

In the Cameroonian context, the digital learning devices which are commonly used include; mobile phones, computers, interactive boards etc. This can be corroborated by one of the participants`s verbatim who stated clearly that;

These devices are there such as cell phones, digital cameras, white boards, laptops, microphones, projectors etc. each studio has all these devices and there are even backups available. I remember UNESCO recently donated a number of white boards to facilitate this teaching and learning process. All these devices carry the mark of UNESCO written behind. Thou there are not all that sufficient because at times even the backups develop fault. That is the more reason I was talking of training and retraining.

For another participant;

I think is if I want to start, I most start with one of the most interesting devices they need to record lessons which is a powerful digital camera, powerful multimedia interactive whiteboards, very powerful computers with marks such as Lenovo and ten generation machines, and some are even gaming machines which have powerful graphic cards so that we when lessons are done recording it helps in oriented and ranging of the videos which takes a lot of powers. Other devices microphones, video cameras, tables and so on. For great lessons we need very powerful digital devices.

All these devices are indispensable in the effectiveness of the distance learning center of Yaounde.

Sub theme two: Quality of devices

The quality of the devices is also indispensable for the success of the distance learning center in Yaounde. One of the participants stated that;

> *There are very strong and very adaptable to the environment for now. Even the boards as I was saying a short person can access the board just like a tall person can because there is a place like a bar corny for the short person to*

climb and have the same height like tall person who is standing on the floor to access these boards.

Another participant stated that;

In terms of performance there are very strong and as of now I can only think of Lenovo. All the devices have marks but I have not had the opportunity to master these marks. But only the technicians can really give more insights.

Sub theme three: Maintenance of the devices

Digital devices are very essential elements when it comes to effectiveness of distance learning. The devices need to be in good shape for the proper functioning of distance education. The is why a participant stated that;

Digital devices when used appropriately are very powerful educational tools that facilitates the distance learning process. That is why for any effective distance learning, these devices must be made available before any other thing can be considered. For the maintenance of these devices, there is a whole technical team incharge of the maintainance and there make sure that the devices are always in good shape and up-to-date at all times.

Sub theme four: Availability of the devices

For every effective distance learning, digital devices must be available. That is why a participant stated that;

The devices are available in each studio. We have 5 studios and each studio is equipped with devices that enhance the effectiveness in the production of lessons. These devices are mostly donated by UNESCO. I remember UNESCO recently donated a number of white boards to facilitate this teaching and learning process. All these devices carry the mark of UNESCO. Atleast I can say that the devices available are able to meet up with the production of lessons for now but in the long-run, since distance learning has come to stay, these devices need to be multiplied to meet up with the standards of distance learning because to talk of an effective distance learning, we must first of all talk of not just the devices but the quality and number of devices made available to carron with the said distance learning project.

Table 27: Summary of qualitative study

Major Themes	*Sub Themes*	*Emperging Themes and Concepts*	*Managerial Implications*
Distance learning	*Structure of the centre*	*Hierarchical structure* *Manageing directors* *Director in charge of distance learning*	*The distance learning still needs a lot of conception in terms of organisational structuring*
	Distance learning challenges *Material and human resopurces challenges*	*Operations* *Managerial functions* *Teachers' competences*	*Deployment of resources is indispensable in order to attain sustainable outcomes and make it pertince*
	Recommendations	*Enhance effectiveness* *Efficiency* *Legal framework* *Authenticity* *Continuous capacity builty* *Teacher motivation*	
	Types of LMS	*webApp* *platforms*	
Learning managemen systems	*Training methods*	*Subtle repitation* *Factorisation common metrix* *Synchronous learning* *asychronomous*	*There are ongoing pedagogic nnovation and practices more distance education approaches have to be development with context-based knowledge. This implies endongenisation of learning management on cameroon*
	Content	*Subsystems* *Classes* *Recorded videos lessons* *Live lesion*	
	Contextualisation of LMS	*National colors* *Cameroonised symbols* *Content contectualistion* *Cameroonian realities* *Cameroonian education* *Cameroonian problem*	
	Challenges of LMS	*Production* *Theoretiucal approach* *Methodology* *Infrastructure* *Resources*	
Internet connectivity	*Quality of internent*	*Excellent*	

			Technical team control coordination connection	*There are indiations that staholders are investing into distance education but the digital resources are still limited to catch up with the demands of the fourth industrial estate,*
		Accessibility	*Codes 5 studios Switching Uploading*	
		Types of connectivity	*SCIreal CAMTEL MINEPOSTEL MINESEC*	
		Management challenges	/	
Digital devices	*learning*	*Types of devices*	*Mobile phone Computers Whiteboards Laptops/leveno ten generation Graph cards Video cameras*	*There is provide of integration and the tendency towards appropriation.*
		Quality of devices	*Very strong Adaptable*	*Much is still needed in terms of availability of device*
		Availability		
		Maintenance of devices	*Technical teams*	

To conclude, this chapter handled data analyses which is divided into section A and B. Section A concerns descriptive statistics which frequencies and percentages were interpreted. the items of each independent variable were also interpreted according to scales of strongly disagree, disagree, agree and strongly agree. This was immediately followed by the inferential statistics in where the. Therefore, infrastructural dispositions have significant contribution in the effectiveness of distance learning in Cameroon secondary school. For section B we present verbatim the semi structured interview of 3 particpant from the distance learning in the various schools. The interview focusses learning management systems, internet connectivity, digital devices and their relationship with effectiveness distance learning in Cameroon secondary

Chapter Five

Discussion, Recoomendations, Perspectives and Conclusion

The above chapter analyses and presents the results of the findings of the study. The present chapter focusses on the discussion, the recommendations, the perspectives for further studies, the constraints or difficulties faced and the overall conclusion of the study. The discussion is performed in line with the various hypotheses of the study. Here, internet connectivity, learning management systems and digital learning devices are used to discuss clearly the results of the findings. This consists of reporting the results of the findings in the first place and secondly looking at the convergence or the divergence of the present results to that of our predecessors. The recommendations are done basing on the results of the findings.

Discussion of the results of the findings of the study

The discussion of the findings consists of reporting the results as well as looking at the convergence or divergence of the present results to that of our predecessors. Here, the discussion is done basing on the hypotheses of the study such as the learning management system, the internet connectivity, and the digital learning devices.

The Innovation in Learning Management Systems as Knowledge Management Systems Has a Corresponding Significant Impact on The Effectiveness of Distance Learning in Cameroon Secondary Education.

The results of the findings of the model summary revealed that the independent variable (learning management system) discussed, influences the dependent variable (effectiveness of distance learning). This means that learning management system has an effect on the effectiveness of the distance learning center of the Ministry of Secondary Education. The findings further revealed that the analysis of Variance (ANOVA) was used to test the significant level of relationship between the learning management system and the effectiveness of the digital learning center. As such, a significant regression equation was obtained. The p-value obtained, indicated that there was a statistically significant influence of the learning management system on the effectiveness of the distance learning center of the Ministry of secondary education of Yaounde. This therefore implies that learning management system is a strong predictor of the effectiveness of distance learning center since they are linearly related. Again, the results of the findings of the study obtained through the simple linear regression analysis, the simple linear regression model indicates that the independent variable (learning management system) had a positive β coefficient. According to the regression equation

established, learning management system at a constant zero (0), effectiveness of distance learning center will be positive. This therefore means that every unit increase in learning management system will deliberately lead to an increase in the effectiveness of the distance learning center of Yaounde. This implies that learning management system has a significant influence on the effectiveness of the distance learning center of the Ministry of secondary education. This finding is corroborated by the findings of the qualitative study. Some of the participants argued that learning management system is a determinant of the effectiveness of the distance learning center as it enhances interaction between the teacher and the students. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted which stipulates that learning management system has a significant effect on the effectiveness of the distance learning center of the ministry of secondary education. This result rejoint the work of other scholars on the topic.

Haji (2020), perceived learning management system as a software application that plays a vital role in the educational system. Apart from supporting the individual learning process and connecting educational resources at the disposal of learners, the LMS also serves as a platform that provides learning materials and facilities for interractive discussions, promoting interrative peer learning and enables both face-to-face learning and interractive online learning between instrcutors and learners (Haji 2020). This system has been embraced by software vendors, open-source developers and educational institutions in order to facilitate the management of courses and engagement with students remotely. LMS is one of the technologies that help to facilitate the provision of courses over long distances. LMS can be defined as web-based software platforms that provide an interactive online learning environment and automate the administration, organization, delivery and repo rting the educational content and learner's outcome.

In line with this, terms such as content management systems (CMS), Learning Content Management systems are often used in confusion with LMS. The term CMS is often associated with two distinctive software applications content management system and course management system. Meanwhile, the content management system is often associated with software applications designed for the creation and management of digital content in a collaborative environment. Course management on the other hand according to Watson (2007), are software applications used for blended learning, supporting the placement of course materials online, associating students with course, tracking student performance, storing student submissions and

mediating communication between the students as well as the instructor. Some academic users prefer to use the word learning content management system (LCMS) in place of learning management system. The difference between these two terms is that, learning content management system is broader in scope and has the ability to track the progress of its learners through online courses.

Turnbull *et al* (2020), revealed that the creation of Sidney Pressey's learning machine, a device that could administer questions through a window prompting the user to select response out of four choices that led to the development of the first ever learning management systems that existed. According to these same authors, the LMS is categorized into two broad categories; the proprietary system and the open-source system. Many school organizations are faced with the challenge of choosing between proprietary and open learning management systems. The choice often depends on the available resources and the knowledge or level of expertise of the LMS users within the school environment. Kimmons *et al* (2019), argued that a proprietary system uses an exclusive code where school's organization purchase a subscription or license to access and use the LMS features. Examples of proprietary systems include; blackboard, PowerSchool, school wires, Edline, eSchool view and school pointe. One of the earliest proprietary system was WebCT, developed at the University of British Columbia in 1995.

Yawisah *et al* (2022), found out that the use of the LMS requires strong network support throughout the region. They also found out that the LMS application is required to update its capacity to send lecture assignments in the form of videos and photos so that learning is maximized. It was also discussed that interactive learning between lecturers and students is needed to support learning. This is seen by the role of the LMS in helping lecturers plan and create a syllabus, manage learning materials, manage distance lectures activities and recapitulate student's grades and attendance. These scholars went further to recommend that the government of Indonesia needs to consider supporting policies related to cooperation with the private sector to build Internet access throughout the territory. Furthermore, the stakeholders must focus on the availability of LMS support facilities, providing alternative offline classroom software program based on technology in order to reach better higher education.

Conde *et al* (2014), laid down six LMS features to support the online learning process: A user interface that is easy to use and attractive; Online registration with various payment methods according to the ability of the user; virtual classes in which distance learning processes are presented without having to make physical contact and provide video conferencing features;

Online quizzes and exams in which the need to create questions and distribute them to students online is supported; A discussion room regarding the subject matter that has been studied by students independently And a report feature with which it is easier for teachers to track the progress of their students.

Akay and Gumusoglu (2020), found out that although LMS has an effect on both midterm exams and proficiency exams, the impact on midterm exams is much greater than that of proficiency exams. The results conducted during interview shows that participants have positive attitudes towards the use of LMS as they thought it contributed to their language learning processes. The results of this study went further to show that the more hours spent on learning management system, the better the results compared to those who spent less hours on LMS. The study conducted by Karim (2022), explains that various platforms have different advantages and disadvantages, educators and students are generally satisfied with online interactions considering their learning needs.

The technology acceptance model of Davis is a good fit to better understand the effect of the learning management system on the effectiveness of the distance learning center in particular and distance education in general. Davis (1986, 1989) introduced four principles or constructs in relation to Technology Acceptance Model. These constructs are as follows; perceived usefulness (PU), perceived ease of use (PEOU), attitude and behavioral intention to use. He went further to explain that these constructs are interrelated and one can be used to predict the other. The constructs PU and PEOU form an end-user's beliefs on technology which turns to predict the attitude of an individual towards technology and attitude turns to predict the acceptance. This therefore means that the usefulness of the learning management system in distance learning largely depends on the capacity and ability of the users to accept technology.

Internet Connectivity is an Indispensable Resources in The Effectiveness of Distance Learning in Cameroon Secondary Education

The results of the findings of the model summary revealed that the independent variable (internet connectivity) discussed, influences the dependent variable (effectiveness of distance learning) reflected by a significant level of percentage. This means that internet connectivity has an effect on the effectiveness of the digital learning center of the Ministry of Secondary Education. The findings further revealed that the analysis of Variance (ANOVA) was used to test the significant level of relationship between the internet connectivity and the effectiveness

of the digital learning center. As such, a significant regression equation was obtained with a value less than the value of the alpha. The p-value obtained, indicated that there was a statistically significant influence of the internet connectivity on the effectiveness of the distance learning center of the Ministry of secondary education of Yaounde. This therefore implies that internet connectivity is a strong predictor of the effectiveness of distance learning center since they are lineary related. Again, the results of the findings of the study obtained through the simple linear regression analysis, the simple linear regression model indicates that the independent variable (internet connectivity) had a positive β coefficient. According to the regression equation established, internet connectivity at a constant zero (0), effectiveness of distance learning center will be positve. This therefore means that every unit increase in internet conncetivity will deliberately lead to an increase in the effectiveness of the distance learning. This implies that internet connectivity has a significant influence on the effectiveness of the distance learning center of the Ministry of secondary education. This finding is corroborated by the findings of the qualitative study.

All of the participants retained for the qualitative part of the study argued that internet connectivity is a determinant of the effectiveness of the distance learning center as it enhances interaction between the teacher and the students. This is because without quality internet connectin and easy access to internet connection, distance learning will remain a mere theory of knowledge. Internet connection thus enhances the effectiveness of distance learning since it provides the opportunity for all to easily access the various learning platforms. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted which states that internet connectivity has a significant effect on the effectiveness of the distance learning center of the ministry of secondary education. This result rejoint the work of other scholars on the topic.

According Amponsah (2022), “the internet is a worldwide network system that connects a diverse set of commercial, public, business, academic, and government networks to enable global communication and access to data resources”. Yebowaah (2018), argues that there has been a global shift in the quality of information thanks to the internet which is seen as one of the most essential information and communication technology. This is supported by the work of *Siraj et al* (2015), who conducted a similar study and reveals that the internet is one of the main primary information and communication technology that has also led to a quality shift in the situation of information globally. The use of internet permits its users’ to view the vastness

of the world surrounding them. They are able to carry out activities, communicate and pass on information more easily to their counterparts when connected to the internet without the necessary need of displacing themeslves.

Amponsah (2022), reveals that, school ICT labs, mobile phones, internet facilities for families and public internet cafes are the internet outlets available for SHS students. The results further show that the academic standards among students is influenced by the accessibility of internet facilities as the academic performance of those who have access to internet is higher than those without internet. In a similar manner, the results of this study also shows that different internet use has no impact on academic performance and the presence of several sources of internet connectivity does not guarantee immediate access to them all. It further recommended by this study that the heads of institutions should work in collaboration with stakeholders to provide proper internet facilities with support management. This study also recommends that in order to supports student's research, the ICT laboratories of various schools should be well equipped with internet facilities and experts should be recruited to train students on how to use search engines to search academic materials online.

The theory of diffusion of technology of Rogers (1962) provides more grounds for a better understanding of the implications of internet connectivity on the effectiveness of the distance education in general and distance learning center in particular. This theory uses communication as the principal element that determines how and over time an idea diffuses through a specific population or social system. The main aim of this theory of diffusion is that people should be able to adopt a new idea or behavior as a social system. It is only when an individual perceived the idea or behavior as new that diffusion becomes possible. Rogers defined diffusion as « the process in which an innovation is communicated through certain channels over time among the members of a social system ». From the above definition, it is observed that the theory of diffusion of innovation is based on four main principles which are; innovation, communication channels, time and social system. Innovation: Rogers (2003), defines innovation as « an idea, practice, or project that is perceived as new by an individual or other unit of adoption ». An innovation might have been into existence over many years but might still be an innovation for the individual depending on how they perceived it as new. Communication channel: Rogers went further to define communication channel as "a process in which participants create and share information with one another in order to reach a mutual understanding. Time: the aspect of time in the theory of diffusion of innovation refers to the period of diffusion of a technology

to the users. Social system: this constitutes the last element in the diffusion process. Rogers (2003), defines it as “a set of interrelated units engaged in joint problem solving to accomplish a common goal.

Rogers developed five categories of adopters that constitute the target population when promoting innovation; the innovators, the early adopters, the early majority, the late majority and the laggards. This proofs that the quality of the internet largely determines the effectiveness of the distance learning center of the ministry of secondary education.

The Provision of Modern Digital Devices Has a Significant Influence on the Effectiveness of Distance Learning in Cameroon Secondary Education

The results of the findings of the model summary revealed that the independent variable (digital learning devices) discussed, influences the dependent variable (effectiveness of distance learning) by a significant percentage which therefore means that digital learning devices has an effect on the effectiveness of the digital learning center of the Ministry of Secondary Education. The findings further revealed that the analysis of Variance (ANOVA) was used to test the significant level of relationship between the digital learning devices and the effectiveness of the digital learning center and a significant regression equation was obtained which is less than the alpha value. The p-value obtained, indicated that there was a statistically significant influence of the digital learning devices on the effectiveness of the distance learning center of the Ministry of secondary education of Yaounde. This therefore implies that digital learning devices is a strong predictor of the effectiveness of distance learning center since they are lineary related. Again, the results of the findings of the study obtained through the simple linear regression analysis, the simple linear regression model indicates that the independent variable (digital learning devices) had a positive β coefficient. According to the regression equation established, digital learning devices at a constant zero (0), effectiveness of distance learning center will be above one. This therefore means that every unit increase in digital learning devices will deliberately lead to a positive increase in the effectiveness of the distance learning center of Yaounde. This implies thatd digital learning devices has a significant influence on the effectiveness of the distance learning center of the Ministry of secondary education. This finding is corroborated by the findings of the qualitative study. All of the participants retained for the qualitative part of the study argued that digital learning devices is a determinant of the effectiveness of the distance learning center as it enhances interaction between the teacher and

the students. This is because in the absence of quality learning devices such as smart phones, laptops, interactive boards, video-projctor etc., distance learning will remain a mere theory of knowledge. Digital learning devices thus enhances the effectiveness of distance learning since it provides the opportunity for all to easily access the various learning platforms. Based on this, the null hypothesis was rejected and the alternative hypothesis accepted which states that digital learning devices has a significant effect on the effectiveness of the distance learning center of the ministry of secondary education. This result rejoint the work of other scholars on the topic.

Al-Ansi *et al*. (2019), asserted that electronic devices and applications are known as hard ware and software. Personal notebooks and cellphones are the most useable device in distance learning in addition to PCs and tablets. He went further to say that technological devices used in distance learning are of great significant since it contributes to high complexity of study and student's competence. Through the use of electronic devices, knowledge of distance learning is transformed in to video, audio, text, images and data. Distance learning permits educational content to be delivered to learners through gadgets such as computers, laptops, tablets or smartphones. It does not only save time but open many doors for interactive learning. According to Florida *et al. (*2012), gadgets are small electronic devices that have special functions in each type to make work and human needs more practical and efficient. Such are seen as educational or learning media that permits learners in remote areas to have access to learning materials at any given point in time.

Baker *et al* (2012), investigated the perceptions of faculty and students regarding the use of cell phones and other electronic devices in the classroom and found out that students differ markedly from faculty, with students exhibiting much greater acceptance of in-class use of technology. The study also shows that gender affects perceptions and that male students specifically accept the in-class use of technology than the female students. Skolnik and Puzo (2008), also study the perceptions of students and faculty and argued that the use of laptop computers enhances instruction through spreadsheet skills and also gives the opportunity to record notes electrically. They also find out that academic dishonesty in classrooms increases because of the use of laptops in class. This is because an average of 15% of students are often carried away by other computer applications and lose focus on the class topic.

While the use of new technologies such as laptops, game console, music players and cell phones keeps us connected, we are also constantly distracted by these same devices (Bugeja, 2008).

The findings of Wagner (2005), reveals that the most important hardware issue trending on most campuses these days are laptops, cell phones and note book computers and brings out the characteristics of these devices to interfere with deeper learning, inhibit critical thinking and effective communication.

Bozkus (2021), argued that the infrastructure of digital devices within the school affected PISA 2018 reading, math and science scores more than teachers' capacity using digital devices. The results also revealed that there was a strong relationship between the infrastructures of digital devices within the school and teachers' capacity using digital devices, and developing the infrastructure of digital technologies could provide practical benefits for students.

Florida *et al. (*2012), found out that gadgets are small electronic devices that have specific functions depending on the type and make human works and needs more practical and efficient. Such gadgets are seen as educational or learning media that permits learners in remote areas to have access to learning materials at any given point in time**.** Li and Chiang (2021), conducted a longitudinal and found out that students using tablets in class performed better than students using computer and students' utility value and cognitive cost towards the eschoolbag will change over time. Li and Chiang (2021), defined eschoolbag or electronic school bag as an enhanced one-on-one computing environment compatible with various digital devices. This eschoolbag provides instructors with an intelligent teaching management system and offers student's highly interactive environment. This study is in line with the study of Xie (2015), who viewed eschoolbag as «an intelligent and learning system integrated with electronic textbooks, subject related cognitive tools, administrative function and digital resources. All of this helps to justify the findings of this study.

Recommendations and suggestions

The results of the findings of the present study proves that digital learning infrastructures plays an indispensable role in the enhancement of the the effectiveness of the distance learning center of the ministry of secondary education of Yaounde. Basing on this, we therefore recommend to the government, educational stakeholders and all those involve in the running of the distance learning center the following;

- The result of the findings reveals that learning management system is a determinant of the effectiveness of the distance learning center of Yaounde. Bearing in mind that learning

management system is central in distance education as it ensures interactions between the teacher and the students, it is thus, advisable that the government through its policy of digitalising the entire educational system should proceed in the creation of a national platform and sub-national platforms for every region. The usefulness of the national platform will be in the sense that this platform will coordinates the activities of the various regional platforms. Through this initiative, the inspection mechanism put in place will be in charge of coordinating the various activities in the platforms. It is equally recommended that the government should improve the quality of e-inspection and e-supervision. This consist of developing an online mechanism which aim will be to reinforce the use of the learning management system. By so doing, it will be possible for the government to easily identify teachers, areas or localities where e-interaction is not effective and thus develop measures to ameliorate it. This will go a long way to enhance the effectiveness of the distance learning center of Yaounde in particular and the overall distance learning education in general.

- The result of the findings of this study also reveals that internet connectivity is a strong and positive predictor of the effectiveness of the distance education in Cameroon. This result is in line with those of our predecessors in both developed and developing countries who concluded that the effectiveness of distance education is in larger part attributed to the quality of internet connectivity. Basing on this, we therefore recommend to the government and the educational community that emphasis should be laid on the quality and access of internet connection through out the national territory. In order to ensure the effectiveness of the distance learning center of Yaounde, the government through its digitalisation policy is hereby advice to provide internet connection to all the localities. This is because the success of the e-learning does not rely on the number of people who are connected in the metropolitan cities but instead those who are in the country side. It is thus, very vital for the government and other educational stakeholders to make sure that the quality of internet connection is guaranteed and also the access is made possible to all the communities and localities. By doing this, the government will directly ensure the effectiveness of the distance learning center in Yaounde and most importantly the effectiveness of the distance education across the national territory.
- The findings once again reveal that the effectiveness of the distance learning center largely depends on the effective use of digital learning devices in learning centers such as the eschoolbag, the interactive boards, the smart phones, the laptops, video-projectors etc. Basing on this, we therefore recommend that the government, educational pedagaogic inspectors and educational partners should ensure the use of digital learning devices in school. A number of

findings reveal that students who master the use of digital learning devices tend to perform better than those who do not. As such, it is very imperative for the government to train teachers and students on the use of these devices. We equally recommend that most of the times, students who have the priviledge of affording a digital learning device ends up using it for other purposes far away from the educational purposes. It is thus, very important for the government and all those involve to regulate the use of digital learning devices for students and restrict it only for educational purposes. This will equally ensure the effectiveness of the distance education across the national territory.

Perspectives for further studies

Considering the important place that technology occupies in the society nowadays, intensifying research on it integration in the domain of education appears to be a loudable initiative. This is because ICT and Technolgy over the past years has become the subject of both national and international discussions. As such, the present research project addresses the problem of the effectiveness of the digital learning center in Yaounde. A number of studies can also be conducted in this domain such as

- Another study can be conducted to evaluate the impact of the perception of ICT by students and the effectiveness of distance education in Cameroon.
- Another study can equally be carried out to measure the impact of the introduction of distance education on the academic performance of students in secondary schools and colleges in Cameroon.
- A study can also be envisaged on a comparative study of the distance learning and the classical learning methods on the academic performance of students in secondary schools in Cameroon.

Constraints /difficulties encountered

Constraints and difficulties are known to be part and parcel of research. This is so because carrying out a research project has been proven to be a challenging initiative especially to novice researchers and thus, requires a lot of perserverance, determination, endurance, auto-regulation and patience on the part of the researcher. In the present study, the researcher was faced with a number of challenges of varriying natures such as accessibility of the participants, administrative bottlenecks, language, time and financial constraints.

- **Administrative bottlenecks:** Administrative procedures proves to be very challenging to the researcher. In order to have access to the distance learning center of Yaounde, the researcher had to obtain an authorisation signed by the sub-divisional inspector for secondary.

This stage proves to be very challenging as the researcher had to wait for weeks for the attestation to be delivered. The researcher equally went through the same process at the center are the director of the center was required to grant permission before any direct contact with the participants.

- **Accessibility of the participants:** The accessibility of the participants equally proved to be challenging as not all the participants were willing to participate in the study. Many saw the study as an inquiry and as such were very resistant to participate in the study. This was challenging as the researcher had to stay in the field for data collection more than expected.
- **Language constraint:** Language was another challenging factor to both the researcher and the participants. This came as a result of the fact that most of the participants has French as their first language and as such did not understand clearly the questionnaire. So the researcher had in some case to read and translate the sentences for the participants to tick the correct answer. This proves to be time consuming.
- **Financial Constraints:** Naturally, we also encountered the problem of finance. This was because the researcher in majority of cases had to rely on its personal finances to carry on the project. This was challenging as the researcher own`s finances prove to be insufficient.
- **Return rate of the questionnaire:** The rate of return of the questionnaire also proved to ba challenging factor to the researcher. During the fieldwork, a total of 160 copies of the questionnaire was administered to the participants. The return rate was not quite satisfactory as amongst the 160 questionnaires, only 154 came back fully answered, meanwhile 4 copies of the questionnaire sent out came back totally blank, and two copies of the questionnaire were incomplete. This might have affected the results of the study in one way or the other.

CONCLUSION

The outbreak of the COVID-19 pandemic raised more eyebrowls to countries in the Sahara Desert and across the Sahara Desert. The continuous thread presented by this pandemic forced nation worldwide to change their ways of doing things. This was the case with the educational sector whereby the traditional or classical method of teaching and learning was abandoned to the merit of more open and modern method of teaching and learning known as the distance education. Although distance education was already visible in some developed and less developed countires due to life challenges, this pandemic led to the intensification of distance education since physical contact could not more be possible. Distance education therefore proves to be an effective method through which education could continue despite the threads and menace represented by this world deadly disease. The effectiveness of the distance education became the central preoccupation of the states, policy makers, educationists, and stakeholders. To ensure the effectiveness of the distance education, a number of mechanisms were put forwards with much attention paid to the digital learning infrastructures. Digital learning infrastructure is believed to be a vital means for ensuring the effectiveness of distance learning center of Yaounde. The digital learning insfrastructures consists of the learning management system, the internet connectivity, and the digital learning devices.

This study therefore tackled the problem of the ineffectiveness of the distance learning education which is as a result of the poor nature of the distance learning infrastructures. The main purpose of this study was therefore to examine the impact of the distance learning insfrastructures on the effectiveness of the distance learning center of the ministry of secondary education of Yaounde. The study starts with an introduction which cut across the background, the problem statement, the research pupose, questions and hypotheses, the interest, the delimitation and the operational definitions of terms. The study also includes a critical review of literature which consisted of reviewing all the possible related works to the subject matter of the study. The review of literature provides the conceptual, the empirical and the theoretical review of the literature. The methodology provides the appropriate means used by the researcher to tackle the problem addressed. In this regards, the present study adopted a mixed research approach (combining the quantitative and the qualitative approaches) with a cross-sectional research design. The study was conducted in Yaounde precisely in the distance learning center of the ministry of secondary education. The study opted for the primary source and secondary source of data as sources of data. A questionnaire consisted of close ended

questions constructed with respect to the Likert scale of measurement was administered to the participants. This permited us to collect quanfiable data from the participants. For the qualitive part, a semi-structured interview guide was conducted with some participants of the study.
These two approaches permitted us to cross the results gotten from the both approaches. Through the simple random and stratified sampling techniques, a sample size of 160 participants was retained for the quantitative part while a total of three participants was selected for the qualitative part of the study. To test the validity of the instruments of data collection, content and face validity were deemed appropriate while the reliability of the data collection instruments was tested through a pilot study which results was analysed using SPSS, through the Cronbach`s alpha. Looking at the theoretical foundation of this study, three principal theories were adopted for this study. These theories include the transactional theory, the diffusion of innovation theory and the theory of Technology acceptance model. The data collected for the final report was analysed using two separate methods; that is, the statistical data analysis techniques (descriptive and inferential statistics) for quantitative data and the content analysis for the qualitative data. The data collected from the field and analysed either statistically or exploiting the content of interviews permited us to arrive at the following results.

The results of the findings of the present study reveal that learning management system with a positive variance, is a strong predictor of the effectiveness of the distance learning center of Yaounde of the ministry of secondary education. This result proves that learning management system has an impact on the effectiveness of the distance education. The results of the findings also reveal that Internet connectivity is also a positive predictor of the effectiveness of the distance learning center of the ministry of secondary education. The results of the findings once again reveal that the digital learning devices is equally a strong predictor of the effectiveness of the distance learning center of the ministry of secondary education. As such, all the alternative research hypotheses were validated which implies that distance learning infrastructures has a significant impact on the effectiveness of the distance learning center of the ministry of secondary education in particular and distance education in general.
Basing on the above results of the findings of this study, three key recommendations were directed towards the government and all the educational partners, which, if they are carefully implemented will boast the effectivity of the distance learning center of Yaounde. It was therefore recommended that in terms of the learning management system, the government through the pedsagogic inspectors and supervisors should make sure that there is a distance learning center in all the regions of the country. They should look forward to make sure that all

the platforms are accessible to the users. It is also recommended that the government and the educational partners should provide quality internet connection and guarantees access to all the users. This appear to be a little bit complex but it is very vital for the government to enure quality network connections both in the metropolitan cities and the hinterland or the country side. This will facilitate access and undeniably contribute to the effective of the distance education across the country. We equally recommended that the government and the educational community should provide quality and up-to-date digital learning devices such as eschoolbags, interactive boards, smart phones, laptops etc. which will enable access to the digital learning platforms to users. All these recommendations will prove very essential if they are well implemented.

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Appendix 1: Reseach Questionnaire

REPUBLIQUE DU CAMEROUN
Paix – Travail - Patrie

UNIVERSITE DE YAOUNDE I

FACULTE DES SCIENCES DE L'EDUCATION

DEPARTEMENT DE CURRICULA ET EVALUATION
…….

REPUBLIC OF CAMEROON
Peace – Work - Fatherland

UNIVERSITY OF YAOUNDE I

THE FACULTY OF EDUCATION

DEPARTEMENT OF CURRICULIUM AND EVALUATION
…….

Dear Respondent,

The questionnaire is developed for a Masters' dissertation in the Department of Curriculum and Evaluation (section B: Educational Management), Faculty of Education in the University of Yaoundé 1. At the end of the training, the student is expected to write and defend a dissertation in the partial fulfilment of the programme. The research is entitled**: DIGITAL INFRASTRUCTURAL DISPOSITION AND THE EFFECETIIVENESS OF THE DISTANCE LEARNING OF THE MINISTRY OF SECONDARY EDUCATION.** All information received remain confidential with the researcher and your privacy shall be appropriately secured in line with Cameroon law no 91/023 of December 1991. The questionnaire is designed to collect data strictly for academic purposes. Please answer directly and fully as possible.

Please tick (√) in the box corresponding to your most preferred respond: Strongly Disagree (SD), Disagree (D), Agree (A) and Strongly Agree (SA).

SECTION: A

S/N	Statements	Responses			
Learning management systems(LMS)		**SD**	**D**	**A**	**SA**
1	Learning management system promote active interactions between teachers and students				
2	Learning management system enhances collaboration between instructors				
3	Learning management platforms helps in reporting students' progress in learning				
4	Learning management system ensure effective instructional management processes				
5	Learning management system helps in uploading notes to enhance students effectiveness				
6	LMS improves on student assessments level				
7	Teachers and students confident is built through the integration of LMS				
8	Learning management system enhance course content management				
9	LMS facilitate knowledge sharing and acquisition among learners				

SECTION : B

Internet Connectivity		**SD**	**D**	**A**	**SA**
10	There exist up to date modems in the distance learning center				
11	The distance learning centre provide quality internet connection				
12	Distance learning Centre has free access to internet connection				
13	Service providers ensures sufficient network coverage				
14	There is Availability of funds for internet connectivity				

15	There exist quality human resources in managing connectivity				
16	Centre management guarantees equity in connectivity				

SECTION : C

Digital Devices		**SD**	**D**	**A**	**SA**
17	The distance learning Centre has high quality digital cameras for quality learning recordings				
18	There is the availability of white boards in the distance learning Centre				
19	There are multifunctional printers in the distance learning Centre				
20	High quality projectors are used to present lessons				
21	Lessons recorded are of good sound quality				
22	The distance learning centre has up-to-date computer device				
23	The centre intent to adopts artificial intelligences devices for students learning				

SECTION: D

Effectiveness Of Distance Learning		**SD**	**D**	**A**	**SA**
24	The distance learning Centre is well structured				
25	There are competent human resources in the Centre				
26	There is regular maintenance of the structure				
27	There is easy access to the structure for all stakeholders				
28	The center ensures an effective managerial operation				
29	The Centre practices both online and traditional methods of learning				
30	There are secured databases content management in the centre				

SECTION E

Demographic Information

Please kindly place a tick in the right box.

AGE: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61+ ☐

SEX: Male ☐ Female ☐

Level of Education: Dipes 1 ☐ Bsc ☐ Msc ☐ Dipes 2 ☐

Position occupy: Student ☐ staff ☐ teacher ☐ Inspector ☐

Years of experience: 1-5 ☐ 6-10 ☐ 11-15 ☐ 16+ ☐

Thanks for your Assistance

Appendix 2 : Semi-structured interview guide

REPUBLIQUE DU CAMEROUN
Paix – Travail - Patrie

UNIVERSITE DE YAOUNDE I

FACULTE DES SCIENCES DE L'EDUCATION

DEPARTEMENT DE CURRICULA ET EVALUATION
.....
MANAGMENT DE L'EDUCATION

REPUBLIC OF CAMEROON
Peace – Work - Fatherland

UNIVERSITY OF YAOUNDE I

THE FACULTY OF EDUCATION

DEPARTEMENT OF CURRICULIUM AND EVALUATION
.....
EDUCATIONAL MANAGEMENT

Semi structured interview guide for administrators and inspectors in the distance learning Centre

Dear participant,

This interview is developed for a master dissertation in in the Department of Curriculum and Evaluation (section B: Educational Management), Faculty of Education at the University of Yaoundé 1. At the end of the training, the student is expected to write and defend a thesis in partial fulfillment of the Program. The study centers on "***Digital Infrastructural Disposition and The Effectiveness of the Distance Learning of the Ministry of Secondary Education*.**"** All information received remain confidential with the researcher and your privacy shall be appropriately secured in line with Cameroon law no 91/023 of December 1991. The interview guide is designed to collect data strictly for academic purposes. Please answer directly and fully as possible.

Part 1: **Demographic Information**

Fill in the appropriate information

School/institution

……

Discipline……

……

Administrative

position……

……

Sex: Male, Female……

…..

Start time ----------End Time ----------

Digital Infrastructural Disposition

Questions

1) How do you perceive the learning management systems in the distance learning Centre, and how effective and efficient are these learning management systems?

2) What are prospects in the development of modern learning management systems that are adaptable to context?

3) In terms of availability and performance, what is your appreciation on internet connectivity and what implication does it have on the distance learning Center in Cameroon secondary education.

4) How accessible and of what quality is internet connectivity in distance learning?

5) How is the provision of digital devices done, and which are the most required of these devices for better functioning of the Centre?

6) What are the challenges faced in the provision of these digital devices?

The Effectiveness of the Distance Learning Centre in Cameroon

7) What are the managerial dispositions and practices employed by the stakeholders to ensure the effectiveness of the distance learning centre in Cameroon?

8) How do you appreciate the human resources in the centre and the new perspectives put in place in the development of distance education in the Cameroon secondary school?

Thank You for Your Time