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EVALUATION

**AN EVALUATION OF THE CHALLENGES AND
PROSPECTS IN THE IMPLEMENTATION OF E-
LEARNING PROJECT IN SELECTED PUBLIC
SECONDARY SCHOOLS IN MFOUNDI DIVISION**

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Option: Conception and Evaluation of Educational Projects

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DECLARATION

I, BERIYNYUY EMMA ALCOLINE, the undersigned researcher, student of the Department of Curriculum and Evaluation, Faculty of Education, University of Yaounde 1, with the registration Number 21V3030, do solemnly declare on my honour that, this research work titled **“An Evaluation of the Challenges and Prospects in the implementation of E-Learning Project in Selected Public Secondary Schools in Mfoundi Division”**, under the supervision of Dr. SHAIBOU ABDOULAI HAJI, is a result of my original input. It has not been presented in any other institution for award of any certificate. This research project has been completed by duly acknowledged references. This has been done using the APA system and in accordance with anti-plagiarism regulations.

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CERTIFICATION

This is to certify that, BERIYNYUY EMMA ALCOLINE, student with registration number 21V3030, in the Department of Curriculum and Evaluation, Faculty of Education, University of Yaounde 1, has satisfactorily completed the requirements for the Master's in Education. This work titled "**An Evaluation of the Challenges and Prospects in the implementation of E-Learning Project in Selected Public Secondary Schools in Mfoundi Division**", under my guidance and supervision, was carried out in Mfoundi division, Centre region, Cameroon. This work is an original research product, and has not been submitted in part or full for any other Degree of this institution, or another University.

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DEDICATION

To my beloved Mother

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ABSTRACT

This study offers an evaluation of the challenges and potential opportunities related to the implementation of e-learning initiatives in selected public secondary schools located in the Mfoundi Division. The purpose of the research was to examine the effects of many elements on the implementation of e-learning initiatives. These factors included technological infrastructure, teacher preparedness, content and curriculum adaption, and administrative and regulatory obstacles. The study used a descriptive survey design and regression prediction approach for data collection. A total of 306 participants, including teachers, public servants, PTA members, and contract workers, were chosen as the sample size. These participants were picked from seven schools, which were representatives of the seven sub-divisions in Mfoundi. The study's results indicate that the presence of technological infrastructure in secondary schools has a statistically significant influence on the execution of e-learning initiatives. The study revealed that the preparedness of teachers also show a statistically significant influence on the effective execution of e-learning efforts. Furthermore, the key aspects that were found to influence the execution of e-learning initiatives include content and curriculum adaptation, as well as administrative and regulatory issues. Based on the aforementioned results, a number of suggestions are proposed. It is recommended that educational institutions engage in thorough needs assessments that span technical, pedagogical, and organisational dimensions in order to enhance their readiness for the implementation of e-learning. It is recommended that educators engage in ongoing professional development to acquire the essential skills required for effective utilisation of technology, instructional design, and online pedagogy. The acceleration of e-learning adoption is underscored by the emphasis on collaboration and the exchange of best practises across diverse stakeholders.

Keywords: *E-Learning, adoption, secondary schools, technological infrastructure, teacher readiness, content and curriculum adaptation.*

RÉSUMÉ

Cette étude évalue les défis et les opportunités potentielles liées à la mise en œuvre de l'apprentissage en ligne dans certaines écoles secondaires publiques du département de Mfoundi. Le but de la recherche était d'examiner les effets de plusieurs facteurs sur la mise en œuvre d'initiatives d'apprentissage en ligne. Les obstacles administratifs et réglementaires, la préparation des enseignants, l'adaptation du contenu et des programmes et l'infrastructure technique faisaient partie de ces facteurs. Pour la collecte de données, l'étude a utilisé une conception d'enquête descriptive et une méthode de prévision de régression. La taille d'échantillon était de 306 participants, y compris des enseignants, des fonctionnaires, des membres de la PTA et des travailleurs contractuels. Ces participants provenaient de sept écoles représentatives des sept sous-divisions de Mfoundi. Selon les résultats de l'étude, la présence d'infrastructures technologiques dans les écoles secondaires a une influence statistiquement significative sur l'exécution des initiatives d'apprentissage en ligne. Selon l'étude, la préparation des enseignants avait également une influence statistiquement significative sur l'exécution efficace des efforts d'apprentissage en ligne. De plus, l'adaptation du contenu et des programmes, ainsi que les problèmes administratifs et réglementaires, sont les principaux facteurs qui affectent l'exécution des initiatives d'apprentissage en ligne. Un certain nombre de suggestions sont faites en fonction des résultats mentionnés ci-dessus. Afin d'améliorer leur préparation à la mise en œuvre de l'apprentissage en ligne, les établissements d'enseignement devraient procéder à des évaluations approfondies de leurs besoins couvrant les dimensions techniques, pédagogiques et organisationnelles. Il est conseillé aux éducateurs de participer à un développement professionnel continu afin d'acquérir les compétences nécessaires pour utiliser efficacement la technologie, la conception pédagogique et la pédagogie en ligne. L'accent mis sur la collaboration et l'échange de bonnes pratiques entre diverses parties prenantes aide à accélérer l'adoption de l'apprentissage en ligne.

***Mots clés :** apprentissage en ligne, adoption, écoles secondaires, infrastructure technologique, préparation des enseignants, adaptation du contenu et des programmes.*

CHAPTER ONE

INTRODUCTION

The onset of the year 2020 was marked by the worldwide emergence of the coronavirus pandemic. Numerous nations have implemented measures of social distance in response to the proliferation of viral infections. Nations experiencing a significant increase in infection rates have implemented comprehensive measures to enforce a state of full lockdown. Educational institutions have undergone a temporary cessation of in-person activities and transitioned to a remote instructional approach. The Covid-19 epidemic has been accompanied by the implementation of e-learning, which has been made possible via the utilisation of technical breakthroughs, hence enabling the facilitation of education. In the present era, our culture is characterised by a strong emphasis on knowledge acquisition, with numerous nations making substantial investments in the field of eLearning education. E-learning is considered a fundamental basis for education and has the potential to enhance learning outcomes (Giesbers et al., 2013). It also has the capacity to improve learners' information technology (IT) skills (Håkansson-Lindqvist, 2015) as well as their programming skills (Williamson et al., 2018), both of which are crucial in contemporary society. Furthermore, the adoption of e-learning can contribute to the revitalization of the economy (European Commission, 2014).

Prior to the implementation of e-learning in educational institutions, students used to participate in lessons within traditional learning settings that did not incorporate digital technologies. The accessibility of online learning has significantly increased due to the proliferation of e-learning platforms. In contemporary times, the proliferation of digital technologies has exerted a profound impact on the field of education, surpassing any previous instances of influence. The use of digital technology in education encompasses the utilisation of laptops, Internet connectivity, and learning management systems (LMS), which have become prevalent in educational institutions across the Western hemisphere (Duval, Sharples, & Sutherland, 2017). According to Garrison and Kanuka (2004), digital learning is the deliberate incorporation of traditional classroom learning experiences with online learning activities. Certain scholars adopt a more methodical approach in examining digital learning. According to Graham (2006), digital learning is an educational approach that integrates traditional instruction with computer-mediated training.

The concept being discussed encompasses the spatial and temporal adaptability of technology-facilitated education. As Marsh (2001) states, it involves the integration of various instructional methods, such as self-paced learning, instructor-led sessions, online platforms, and traditional classroom settings. The aim is to create a training approach that is both flexible and cost-efficient, enabling a broad geographical reach and catering to diverse learning preferences and proficiency levels. Presently, the integration of digital technology within the realm of education is assuming a multifaceted role in the process of acquiring knowledge (Sprenger & Schwaninger, 2021). According to (Ronzhina et al. 2021), there is a shift from traditional learning methods to e-learning, resulting in various consequences. Furthermore, the COVID-19 pandemic has further aggravated the circumstances surrounding e-learning, resulting in significant implications. Consequently, it is unsurprising that there has been a growing adoption of this style of education (Choudhury & Pattnaik, 2020; Rodrigues et al., 2019). E-learning, as described by Holmes and Gardner (2006), is a structured learning approach that relies on electronic web-based platforms. The educational paradigm presented in this study incorporates four key components: learning material, information and communication technology (ICT) including the internet, digital platforms, and video audio teleconferencing (Holmes et al., 2019).

The learning model described in this study encompasses a meticulously organised and systematic approach to learning (Saripudin et al., 2020). The presence of a more streamlined learning process offers significant benefits in terms of providing students and teachers with access to crucial learning resources (Priatna et al., 2020). The enhancement of efficiency plays a crucial role in augmenting the effectiveness of learning, hence facilitating the process of achieving desired outcomes with greater ease and expediency (El-Sabagh, 2021). Numerous pertinent scholarly investigations concur that e-learning possesses extensive attributes and affords prospects for the implementation of an inventive, communicative, active, autonomous, introspective, and cooperative learning environment (Shah and Barkas, 2018; Wali & Popal, 2020). Similarly, the nature of education has undergone substantial transformation due to the convenience afforded to educators in accessing virtual classrooms from any location, without the need for physical presence (Osman, 2020). In contrast to traditional pedagogical approaches, the convenience of modern learning methods has a direct influence on enhancing flexibility in terms of time and location in

educational instruction, while maintaining the same level of educational quality (Lapitan et al., 2021).

Background of the Study

At the beginning of the surge in cases of the COVID-19 Pandemic in 2020, the implementation of learning using e-learning resulted in a setback. Based on empirical research in developing countries, especially Cameroon, e-learning during the COVID-19 period resulted in two sides of the conflict: the negative impact as a setback and the positive impact as an increase. The main problems related to e-learning readiness include the lack of support capacity in the form of accessibility and facilities and the low ability to use devices for network access (Hamid et al., 2020). Besides that (Hamid et al., 2020) declared an astonishing finding that student involvement in e-learning is more than seventy percent less effective. This continues in other evidence that also identifies problems with the decline of e-learning, including fatigue in body organs (Octaberlina & Muslimin, 2020), psychological disorders, especially mental and motivational (Atmojo & Nugroho, 2020), and internet connection stability (Febrianto et al., 2020). Over the last three years, there has been a shift in positive areas, although not evenly distributed, namely the increasing use of technology and the internet, followed by digital literacy skills (Fathoni et al., 2021). This means that the readiness for the implementation of e-learning is increasing.

According to the American Society for Training & Development's (ASTD) E-learning Glossary, e-learning covers a wide set of applications and processes such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via the Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, and CD-ROM (ASTD 2000). Various relevant studies impact as a setback and the positive impact as an increase. The main problems related to e-learning readiness include the lack of support capacity in the form of accessibility and facilities and the low ability to use devices for network access (Hamid et al., 2020). Besides that (Hamid et al., 2020) declared an astonishing finding that a student involvement in e-learning is more than seventy percent less effective. This continues in other evidence that also identifies problems with the decline of e-learning, including fatigue in body organs (Octaberlina & Muslimin, 2020), psychological disorders, especially mental and motivational (Atmojo & Nugroho, 2020), and internet connection stability (Febrianto et al., 2020).

Over the last two years, there has been a shift in positive areas, although not evenly distributed, namely the increasing use of technology and the internet, followed by digital literacy skills (Fathoni et al., 2021). This means that the readiness for the implementation of e-learning is increasing.

The most important thing to do is measure the readiness to implement e-learning project before starting it (Widyanti et al., 2020). Several important studies agree that the results reveal that the basic reason for failure in implementing e-learning project is the unpreparedness to implement e-learning (Coskun et al., 2018; Widyanti et al., 2020). The implication is that measuring the level of students and teacher's readiness must be done, starting from gap analysis to rearranging innovation to seek better integration of electronic learning (Alqahtani & Rajkhan, 2020; Nwagwu, 2020). Readiness in this context is also an assessment related to the overall availability of aspects in the realm of psychology, physical competence, and the availability of tools for the main learning needs (Holmes & Gardner, 2006). This is also confirmed by Mabur et al, 2021), and Watkins et al. (2008) e-learning readiness is the level of physical readiness that refers to the infrastructure at the institution to implement the e-learning process. That is, e-learning readiness refers to basic capital (psychology and skills) in human resources and important infrastructure which are the main needs. All aspects incorporated in the readiness must at least be fulfilled (Oketch et al., 2014).

However, the study from (Choudhury & Pattnaik, 2020) puts the main emphasis on preparing the provisions that students and teachers must have, considering that this is the most difficult thing to realize by the institutions and the students and teachers themselves. The main aspect that becomes an important provision for students and teachers is none other than the ability of technology and equipment to support the implementation of e-learning project (Al-araibi et al., 2019). According to (Elkaseh et al., 2015), technological competence is necessary to support its comprehensive implementation. In addition (Coskun et al., 2018; Nurtanto et al., 2021), indicate that the competence to use technology and its supporting equipment is a major requirement in implementing e-learning, so that they are able to experience comprehensive benefits from it. The benefits of comprehensive e-learning can be fulfilled when students and teachers have the skills that make it easier for them to access and use internet-based digital technology.

In addition to the need for technological capabilities and supporting equipment, other aspects also need to review the readiness to carry out e-learning. Aspects of support from students and teachers that refer to their psychological conditions are very important in increasing e-learning readiness. Student satisfaction as a user of electronic lecture system services is an important aspect that must be provided by the institution (Pereira et al., 2015). Student satisfaction as a user expresses students' feelings about the compatibility between expectations and reality received from lecture services. This suitability is very important to be given to students by the institution. Yilmaz (2017) states that spurring students to learn optimally during online learning is to monitor and evaluate their satisfaction. This is important as an effort to control the learning carried out by students so that their readiness for learning is high. To provide sufficient satisfaction during learning to students (Topal, 2016) identifies efforts that educational institutions can make, namely providing good facilities, infrastructure, and accessibility. Generally, online learning is an alternative method, but in the COVID-19 pandemic, it is the only effective and efficient way to consider the risk of transmission and the fatal impact. Thus, online learning becomes a primary need, and it is important to reveal the psychological condition of students. Thus, the shortcomings of online learning can be overcome.

Other psychological aspects were also identified by research (Yilmaz, 2017), namely learning motivation to strengthen students' willingness to online learning. (Maldonado et al., 2011) define motivation as referring to the self-stimulation of learning activities. Furthermore, learning motivation was identified as being able to boost various learning needs, including needs in terms of learning readiness. Motivation is fundamental in stimulating activity for web-based and application-based electronic learning. This is relevant to the evidence from (Wang et al., 2021), which revealed that during distance learning during the COVID-19 pandemic, students decreased their learning readiness due to decreased motivation. Then (Fierro-Suero et al., 2020) interviewed several students, finding that they needed sufficient motivation to navigate electronic learning. However, learning motivation has a different direction, namely increasing motivation and decreasing motivation due to stress conditions or loads that exceed normal limits. Finally, both orientations have the potential to focus on learning during the COVID-19 pandemic. So, students' motivation in e-learning is one of the important considerations to be involved.

Theoretical background

This section of the study describes briefly the different theories that have influenced the growth of e-learning in education and how they are related to this study. The theories that will be applied in this study include; The Information system success model (ISSM) by DeLone and McLean 1992, Technology Acceptance Model (TAM) by Davis 1989, Diffusion of innovation theory (DIT) by Rogers 2003.

In 1992, DeLone and McLean (1992) had proposed an Information system success model (ISSM) for measuring IS success in organizations to acquire the net benefit. They suggested that IS success is a multifaceted and symbiotic paradigm. Therefore, it is indispensable to study the interrelationships among those dimensions and control them. Subsequently, numerous scholars suggested some reforms to this model (Al-Shargabi & Sabri, 2016; Sabri, 2016; Al-Shargabi & Sabri, 2015). Consequently, in 2003, DeLone & McLean (2016) incorporated some of the changes that scholars suggested and accordingly restructured their old model with the updated (ISSM). They decided to augment the dimension of service quality, user satisfaction, intent to use, and net benefit thereof. The new model cited that service, system, information quality, system use, and user satisfaction are the critical success factors that lead to net benefits of using IS.

The researchers argued that if IS success evaluation is desired then, service, system, information, and quality is the impacting factor of its subsequent use. User satisfaction is the outcome of positive or negative benefits which will govern to promote the use of IS (DeLone & McLean, 2016). Information System Success Model provides a complete understanding of effective e-learning implementation success by identifying, describing, and explaining relationship factors critical for implementing e-learning and evaluating the information system. The study has adopted the “Information System success” model to assess administrative and policy challenges and technological infrastructure influencing e-learning implementation in secondary schools since the taxonomy of the model’s factors is essential for e-learning implementation in secondary schools. DeLone and McLean observed the Information System success literature and developed a comprehensive taxonomy of factors contributing to the technology’s success. In addition, the IS model comprises hardware and software tools that are used to train personnel by providing them with relevant skills and knowledge to facilitate planning, control, coordination, and decision-making in an institution.

The technology acceptance model was developed based on the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980) and the Theory of planned behavior (Ajzen, 1985, 1991). The technology acceptance model is based on the assumption that the use and acceptance of new technologies can be explained by the individual user's internal beliefs, attitudes, and intentions and thus can be instrumental in predicting future use of technology (Davis, 1989; Davis et al., 1989; Turner et al., 2010). TAM has four internal constructs that can explain the actual use of new technologies such as perceived usefulness, perceived ease of use, attitude toward use, and behavioral intention to use (Davis, 1989). TAM uses behavioral intention as both a dependent construct and an independent construct. Behavioral intention becomes a dependent variable when predicting these two constructs (perceived usefulness and perceived ease of use) and as an independent variable when it predicts the actual use of new technology (Davis, 1989; Davis et al., 1989). Perceived usefulness and perceived ease of use are considered the most reliable determinant of the behavioral adoption of any new technology (Davis, 1989).

A revised TAM was later proposed (TAM2) which excluded attitudes toward use and added new constructs such as experience and subjective norm with the core ideology of the model remaining the same (Turner et al., 2010; Venkatesh & Davis, 2000). Since its development decades ago, TAM has been adapted, replicated, and validated across multiple different fields of study such as e-commerce (Alves & Reis, 2020; Huong et al., 2020), e-governant (Alkrajji, 2020; Mensah & Adams, 2020), e-learning (Al-Fraihat et al., 2020; Tawafak et al., 2020), and electronic and mobile health (Dahleez et al., 2020; Klingberg et al., 2020) adoption research. This extensive and multiple validations of TAM is a testament to its robustness in providing reliable results outcomes that can better explain the individual user's intention to use new technology. In the context of this study, the technology acceptance model (TAM) is suitable in addressing the degree of teacher readiness on e-learning adoption.

Rogers' DIT (2003) is a well-established empirical framework (Miller, 2015) that conceptualizes the process of innovation diffusion, and can likewise be applied to the process of innovation adoption, specifically to the adoption of educational technology in the field of education (Jwaifell & Gasaymeh, 2013). Most recently, DIT was applied to examine the adoption of online proctored

examinations during the COVID-19 pandemic (Raman et al., 2021) and to the adoption of experiential learning via live-in-labs (Raman et al., 2020). It is worth noting that although various theoretical frameworks address innovation adoption, they all conceptualize the factors that affect the use or acceptance of the innovation, whereas this study's focus is on the entire process of innovation adoption. Thus, for instance, the Technology Acceptance Model (Venkatesh et al., 2003; TAM) describes two innovation factors (namely, perceived ease of use and perceived usefulness). The Unified Theory of Acceptance of Technology (UTAUT), which was developed by integrating theories such as the Theory of Reasoned Action (TRA), TAM, Theory of Planned Behavior (TPB), and the Diffusion of Innovation, explores additional innovation factors (Raman et al., 2021). Some of these theoretical frameworks were employed recently to examine the factors affecting the acceptance and usage of online educational tools in the context of the COVID-19 pandemic (Alshurafat et al., 2021; Wohlfart et al., 2021). We found the DIT theory to be the most suitable framework for this study's purpose, which is to evaluate the process of e-learning project adoption.

According to the DIT theory, the decision process for innovation adoption consists of the following five stages. (1) The Knowledge Stage involves gaining cognitive knowledge, during which the learner is exposed to the innovation, becomes aware of it (awareness knowledge), and seeks information about ways to use it efficiently (how-to knowledge). To increase the likelihood that individuals will adopt the innovation, they must have a sufficient level of how-to knowledge before attempting to use the innovation independently. (2) The Persuasion Stage is emotion-focused, as it is at this phase that attitudes about the innovations are formed. At this stage, the learner experiences uncertainty and consequently, may be influenced by social encouragement to use the innovative tool, as well as by peer-group members favorable subjective assessments of the instrument. (3) The Decision Stage is when the individual decides whether to adopt or reject the use of the innovation, whereby the likelihood of choosing to adopt it increases with the number of prior opportunities to try it out. Ultimately, the decision is affected by three types of motives: personal desire, peer pressure, and/or pressure from an authority figure.

In our context, this five stages of DIT theory detailly explain our objective 3 which talks about content and curriculum adaptation in implementing e-Learning project.

During the pandemic, the decision to adopt technology was derived from the unique social situation and was often dictated by authority figures (the school principal, the Ministry of Education); hence, it is interesting to examine how each aspect affected the adoption process. (4) The Implementation Stage is when the individual uses the innovation and examines the outcomes. Consequently, at this stage, it is essential that users receive feedback, as well as assistance and support, from those leading the transition, as this will help decrease uncertainty among the new users. Another facilitating element at this stage is “reinvention,” whereby the users adapt and change the instrument according to their needs. The greater the number of adaptations introduced, the greater too is the likelihood that the tool will be used consistently. Given that ML inherently uses numerous apps, there are multiple ways to make adaptations, which makes it an optimal platform. (5) In the Confirmation Stage, the users reflectively examine the process and its outcomes, seeking confirmation for their decision as they consolidate their final attitudes.

The decision to adopt technology in general and that of ML, in particular, has been examined in previous studies using Rogers’ theoretical framework (Sahin, 2006) and, recently, a questionnaire was developed based on this theory, to examine the adaptation of ML in the field of education (Celik et al., 2014). Nevertheless, as mentioned, only a few studies examined the adoption and implementation process among PSTs and ISTs in schools (Bano et al., 2018), and even fewer examined the process of adopting ML in times of crisis that involve the transition to distance learning. The comparison between PSTs’ and ISTs’ perceptions regarding ML adoption is especially important, given that previous studies have demonstrated that teachers and students are influenced by different factors when adopting technology (Mac Callum et al., 2014). More recently, a few studies have argued that conducting a comparative analysis of the views of teachers vs. students engaged in adopting innovative technology is imperative (Dolenc et al., 2021; Kovacs et al., 2021; Šorgo et al., 2021). Thus, for example, a study that examined educator’s and student’s views regarding the online education imposed during the COVID-19 pandemic found that while some views were shared by the two groups, in other respects, they differed substantially, thus underscoring the need to explore both perspectives to fully understand the issue.

Specifically, students' views were usually related to the learning process (e.g., concentration), while educators focused mainly on organizational aspects and study materials (e.g., copyright).

Another recent study showed that teachers scored higher than their students on measures of personal innovativeness in the context of adopting information technology. This kind of difference could lead to conflicting expectations between teachers and learners (Šorgo et al., 2021). Another recent comparative study explored the similarities and differences between teacher's and learner's perceptions at three different educational levels (Kovacs et al., 2021).

Statement of the Problem

The implementation of e-learning initiatives in secondary schools represents a noteworthy and dynamic educational framework, offering the potential for improved learning opportunities and expanded availability of educational materials. Nevertheless, this change is not devoid of its challenges. Despite the increasing enthusiasm around the adoption of e-learning, secondary schools face a multitude of challenges that hinder the effective application of this educational approach. The issues at hand cover a range of factors, including technology limits, inequities in resources, attitudes of both teachers and students, and the imperative for the implementation of effective techniques. Concurrently, overcoming the aforementioned issues is crucial to fully capitalise on the potential advantages of e-learning, which encompass enhanced academic achievements and heightened student involvement. In order to enhance the efficiency and sustainability of e-learning efforts in secondary schools, it is imperative to conduct a thorough evaluation of the current difficulties and prospects.

This evaluation will provide valuable insights that can inspire the development of informed strategies and suggestions aimed at optimising the adoption of e-learning project. In fact, e-learning tools are playing a crucial role during and after this pandemic. E-learning systems can assist learning providers to manage, plan, deliver and track the learning and teaching process.

Furthermore, it aims to help teachers and schools facilitate students learning during periods of school closure. In addition, most of these systems are free which can help ensure continuous learning during this Coronavirus pandemic. However, the provision and usage of online learning materials in e-learning system is becoming the main challenge for many schools in the post COVID-19 pandemic. E-learning system is an important source of information, due to its ubiquity (availability anywhere and anytime), low cost, ease of use and interactive character. E-learning system such as Blackboard, Moodle, Google Classroom have several fantastic features that would

be valuable for use. (Ülker & Yılmaz., 2016) mentioned that one approach to e-learning is the use of learning management system (LMS).

Thus, e-learning refers to offer, organize and manage e-learning activities within a system, such as student enrolment, exams, assignments, course descriptions, lesson plans, messages, syllabus, basic course materials, etc. (Haghshenas 2019). By converting from traditional learning, this will enable learner's access to e-learning systems like Blackboard 24 h per day, and present several benefits such as increase effectiveness and efficiency of learning services through improved connectivity with teachers and better access to learning materials (Idris and Osman 2015). Since the success of e-learning system depends on teachers' willingness and acceptance to use this system (Almaiah & Jalil 2014; Almaiah & Alismaiel 2019; Shawai & Almaiah 2018) a lack of e-learning system usage hampers the realisation of benefits (Almaiah et al. 2019a; Almaiah et al. 2019b; Almaiah & Al-Khasawneh 2020). This results in an unsuccessful system and is a waste of stakeholders money (Naveed et al. 2017). Research on this topic is still at its infancy, where the views of the teachers are not fully studied (Tarhini et al. 2017; Almaiah and Alamri 2018). Studying e-learning adoption can lead schools to better understand their student's needs, and eventually lead to a successful e-learning system (Alksasbeh et al. 2019; El-Masri & Tarhini 2017).

To the best of our knowledge, there has not been a thorough analysis of challenges and factors influencing the usage of e-learning system in post COVID-19 pandemic; despite that, e-learning systems were introduced in many schools almost 3 years ago. This dissertation examines the key challenges and prospects that institutions encounter while implementing e-learning initiatives, such as technological infrastructure, Administrative and Policy Challenges. Additionally, the study explores the prospects of e-learning, including the Degree of teacher readiness, Content and Curriculum adaptation.

Objectives of the Study

General Objective

To evaluate the challenges and prospects of the e-learning project implementation in selected public secondary schools in mfoundi division.

Specific Objectives

To examine the impact of technological infrastructure in secondary schools on the process of implementing e-learning project.

To assess the degree of readiness exhibited by secondary school teachers in implementing e-learning project.

To examine the impact of Content and Curriculum Adaptation on the process of implementing e-learning project.

To examine the impact of Administrative and Policy Challenges on the process of implementing e-learning project.

General Research Question

What are the challenges and prospects of the e-learning project implementation in selected public secondary schools in mfoundi division?

Specific Research Question

What are the impacts of technological infrastructure in secondary schools on the implementation e-learning project?

What is the degree of readiness exhibited by secondary school teachers in implementing e-learning project?

What are the impacts of Content and Curriculum Adaptation on the process of implementing e-learning project?

What are the impacts of Administrative and Policy Challenges on the process of implementing e-learning project?

Research Hypothesis

General hypoyhesis

Challenges and prospect has a statistically significance impact on the implementation of e-learning project in selected public secondary schools in mfoundi division.

Specific Research Hypothesis

H₀₁:Technological infrastructure in secondary schools has no statistically significant impact on the implementation of e-learning project.

H_{a1}:Technological infrastructure in secondary schools has a statistically significant impact on the implementation of e-learning project.

H_{o2}:Teachers readiness exhibited no statistically significant impact on the implementation of e-learning project.

H_{a2}:Teachers readiness exhibited a statistically significant impact on the implementation of e-learning project.

H_{o3}:Content and Curriculum Adaptation has no statistically significant impact on the implementation e-learning project.

H_{a3}:Content and Curriculum Adaptation has a statistically significant impact on the implementation of e-learning project.

H_{o4}:Administrative and Policy Challenges has no statistically significant impact on the implementation of e-learning project.

H_{a4}:Administrative and Policy Challenges has a statistically significant impact on the implementation of e-learning project.

Scope and Delimitations

This study was delimited to e-learning implementation with respect to technological infrastructure, teacher's readiness, content and curriculum adaptation and administrative and policy challenges. Geographically, the study was delimited to selected government bilingual high schools with respect to only the English sub-system of education in Mfoundi Division of the Centre Region of Cameroon. The population comprised all teachers.

Significance of the study

This study will be helpful to a wide range of stakeholders within the education sector. It will help the institutions and their administrators comprehend the difficulties faced across the entire region regarding student access to e-learning. This study will also help the ministry of secondary education understand the drawbacks of the e-learning project and a way to mitigate the challenges of adopting e-learning.

The results of this research study might provide a model that institutions can use to predict students' success based on their engagement and levels of satisfaction. The research would be particularly useful to the ministry of secondary education and administrators designing instructional approaches that foster the alignment of student engagement and student satisfaction in the use of e-learning.

Besides, the study will also help parents to anticipate various challenges that come with such abrupt changes in the education sector and remain as vigilant as possible. Additionally, the potential findings could lead to positive social change in the way that schools approach the process of learning and instruction for the benefit of students in online learning environments.

This study will provide readers with an important reference point that provides insights into how students engage with digital technologies and ways to design agile learning environments that cater to diverse student learning preferences. Finally, the study will contribute to the available body of literature on implementing e-learning project for educational purposes and factors to consider while implementing online learning initiatives.

Operational Definitions of Terms

Technological skills: Technological skills refer to the basic level to the highest level and depth of digital technology (Arifin et al., 2020; Astuti et al., 2022; Mutohhari et al., 2021; Sutiman et al., 2022).

Technological infrastructure

Technological infrastructure refers to the components that make the operation and management of enterprises or institutions with the use of IT services and IT environments possible. This infrastructure includes all hardware, software, networks, and facilities institutions use to create, test, deliver, control, and support IT services.

Teacher's readiness

Teacher readiness to adopt e-learning can be broadly defined as “the state of institution preparation” to adopt e-learning (Martin et al., 2019). Therefore, teacher's perceptions of their readiness and that of their institution relates to beliefs about their preparedness

Administrative and policy challenges

Administrative and policy challenges refers to the plans or course of action developed by an institution to guide actions towards achieving objectives.

Content and Curriculum Adaptation

Content encompasses knowledge, procedures, skills, attitudes, abilities, and values necessary to achieve the curricular goal. In general, content and curriculum adaptation involves differentiation to meet the needs of all the students. Which is often characterized by equal access.

e-learning implementation

The term 'e-Learning' is a contraction of 'electronic learning' and includes all forms of technology-enhanced learning. On the other hand, e-Learning is also described as the delivery of various education services through digital technology (Sharma and Hardia, 2013).

CHAPTER TWO

LITERATURE REVIEW

This chapter review literature on the challenges and prospects of e-learning project adoption. This chapter presents the conceptual framework: e-learning, e-learning systems, review by objectives, the theoretical framework, and empirical review of studies relating to this research

Conceptual framework

E- Learning

The application of e-learning in schools continues to develop and become an alternative priority in the covid-19 pandemic. Researchers are constantly studying to ensure effective online learning. The use of e-learning provides opportunities for students to learn independently, openly, and self-regulated learning in control of their learning success. E-learning is all learning activities that use the help of electronic technology, which can be applied in conventional education and distance education. Combining network and multimedia technology with pedagogy, andragogy and heutagogy approaches that requires utilization of internet technology support. The use of e-learning in distance learning becomes formalized instructional learning, where time and geographic situations that limit learning between educator and student cannot be directly contacted (King et al., 2001). The educational process, all or part of teaching is carried out separately in space and time, through artificial medium electronics or print (UNESCO, 2002). Institution-based formal education separately between educator and student and telecommunication media in the learning process (Simonson et al, 2006; Schlosser & Simonson, 2009).

As a planned teaching and learning process, the teaching takes place in a different place between educator and student media communication through technology specifically organized by education organizers (Moore & Kearsley, 2011). Organized learning programs, where educators and students are physically separated (Newby et al., 2000). Referring to Blaschke (2012), e-learning in distance education is more precise in the form of Heutagogy learning theory, because students are required to determine the achievement of independent learning outcomes. He also stated that in a distance education environment, students need to understand that the distance education learning environment is different from traditional learning environments. In a

heutagogical approach to learning, learners are highly autonomous and self-determined and emphasis is placed on development of learner capacity and capability with the goal of producing learners who are well-prepared for the complexities of today's workplace.

The role of teachers in e-learning is not only to upload learning materials that can be accessed online by students, but also to design, prepare materials, evaluate, establish communication, collaborate, and manage other aspects of learning. In e-learning there must be active participation interactions and engagements involving students, teachers and content. E-learning is flexible, but requires conformity with the characteristic of students with different knowledge, learning style preference, e-literacy, time management, organizational support, and interaction using online technology. The involvement of active partitioning of students with subject matter, has an important impact on career decisions that students will make in the future (Kori et al, 2016). Teachers need to find ways to keep students engaged and motivated in hybrid learning (Handelsman et al, 2005; Highley, 2014; Wang & Eccles, 2013) to avoid students becoming discouraged, when they feel their learning speed is slower than others, especially with reduced or absence of face-to-face interactions with lecturers or fellow students (Jordan, 2015; Manjoo, 2015; Sunar et al, 2017).

E-learning Systems (ELS)

Presently, the e-learning system is supposedly the most prevalent Internet based learning setting which aids in efficient time usage and boundary less learning (Sabri, 2016; Martin, Modi & Feldman, 2021). Nevertheless, these systems are successful subject to user acceptance and satisfaction. ELS users can access the system via Internet portals to reap the benefits of the information, lessons learned, knowledge, and skills. E-learners can access the courses either directly (live) or by the uploaded and posted content on the portal (accessed offline at a later time). These are later assessed by a variety of different methods on the knowledge obtained. This establishes the fact that ELS proves to be the best effective learning milieu. During the learning process, different system users have the flexibility of direct or indirect interactions with their peers (Alhomod & Shafi, 2013; Yakubu & Dasuki, 2018; Sabri, 2016; Opoku, Pobee & Owusu Okyireh, 2020).

E-learning systems provide solutions that deliver knowledge and information, facilitate learning, and increase performance by developing appropriate knowledge flow inside organizations (Menolli et al. 2020). Putting into practice and appropriately managing technological solutions, processes, and resources are necessary for the efficient utilization of e-learning in an organization (Alharthi et al. 2019). Examples of e-learning systems that have been widely adopted by various organizations are Canvas, Blackboard, and Moodle. Such systems provide innovative services for students, employees, managers, instructors, institutions, and other actors to support and enhance the learning processes and facilitate efficient knowledge flow (Garavan et al. 2019). Functionalities such as creating modules to organize mini course information and learning materials or communication channels such as chat, forums, and video exchange, allow instructors and managers to develop appropriate training and knowledge exchange (Wang et al. 2011). Nowadays, the utilization of various e-learning capabilities is a commodity for supporting organizational and workplace learning. Such learning refers to training or knowledge development also known in the literature as learning and development, HR development, and corporate training: (Smith and Sadler-Smith 2006; Garavan et al. 2019) that takes place in the context of work.

Previous studies have focused on evaluating e-learning systems that utilize various models and frameworks. In particular, the development of maturity models, such as the e-learning capability maturity model (eLCMM), addresses technology-oriented concerns (Hammad et al. 2017) by overcoming the limitations of the domain-specific models (e.g., game-based learning: Serrano et al. 2012) or more generic lenses such as the e-learning maturity model (Marshall 2006). The aforementioned models are very relevant since they focus on assessing the organizational capabilities for sustainably developing, deploying, and maintaining e-learning. In particular, the eLCMM focuses on assessing the maturity of adopting e-learning systems and adds a feedback building block for improving learners' experiences (Hammad et al. 2017). Our literature review builds on the previously discussed models, lenses, and empirical studies, and it provides a review of research on e-learning capabilities with the aim of enhancing organizational learning in order to complement the findings of the established models and guide future studies.

E-learning systems can be categorized into different types, depending on their functionalities and affordances. One very popular e-learning type is the learning management system (LMS), which

includes a virtual classroom and collaboration capabilities and allows the instructor to design and orchestrate a course or a module. An LMS can be either proprietary (e.g., Blackboard) or open source (e.g., Moodle). These two types differ in their features, costs, and the services they provide; for example, proprietary systems prioritize assessment tools for instructors, whereas open-source systems focus more on community development and engagement tools (Alharthi et al. 2019). In addition to LMS, e-learning systems can be categorized based on who controls the pace of learning; for example, an institutional learning environment (ILE) is provided by the organization and is usually used for instructor-led courses, while a personal learning environment (PLE) is proposed by the organization and is managed personally (i.e., learner-led courses). Many e-learning systems use a hybrid version of ILE and PLE that allows organizations to have either instructor-led or self-paced courses.

Besides the controlled e-learning systems, organizations have been using environments such as social media (Qi and Chau 2016), massive open online courses (MOOCs) (Weinhardt and Sitzmann 2018) and other web-based environments (Wang et al. 2011) to reinforce their organizational learning potentials. These systems have been utilized through different types of technology (e.g., desktop applications, mobile) that leverage the various capabilities offered (e.g., social learning, VR, collaborative systems, smart and intelligent support) to reinforce the learning and knowledge flow potential of the organization. Although there is a growing body of research on e-learning systems for organizational learning due to the increasingly significant role of skills and expertise development in organizations, the role and alignment of the capabilities of the various e-learning systems with the expected competency development remains underexplored.

E-learning Systems to Enhance Organizational Learning

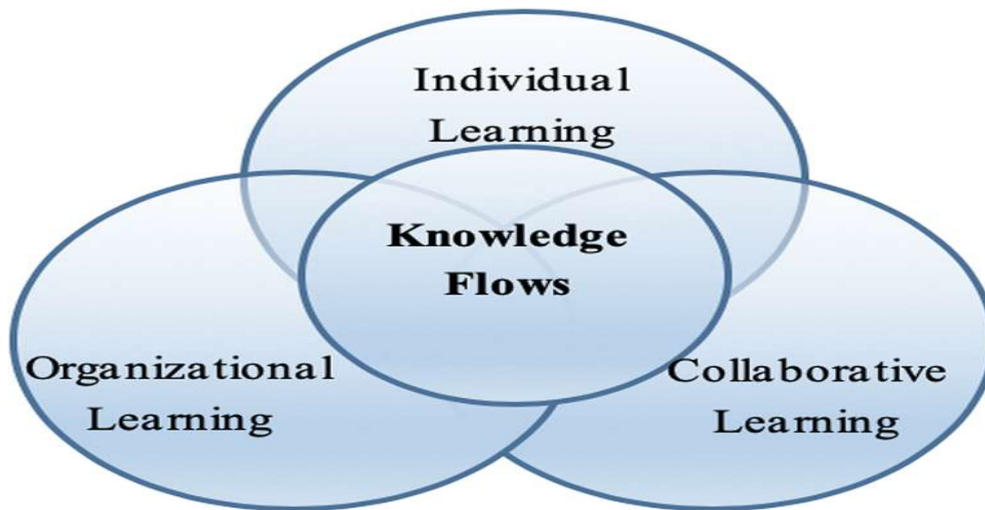
When considering the interplay between e-learning systems and organizational learning, we observed that a major challenge for today's organizations is to switch from being information-based enterprises to become knowledge-based enterprises (El Kadiri et al. 2016). Unidirectional learning flows, such as formal and informal training, are important but not sufficient to cover the needs that enterprises face (Manuti et al. 2015). To maintain enterprises' competitiveness, enterprise staff have to operate in highly intense information and knowledge-oriented environments. Traditional learning approaches fail to substantiate learning flow on the basis of

daily evidence and experience. Thus, novel, ubiquitous, and flexible learning mechanisms are needed, placing humans (e.g., employees, managers, civil servants) at the center of the information and learning flow and bridging traditional learning with experiential, social, and smart learning. Organizations consider lack of skills and competences as being the major knowledge-related factors hampering innovation (El Kadiri et al. 2016). Thus, solutions need to be implemented that support informal, day-to-day, and work training (e.g., social learning, collaborative learning, VR/AR solutions) in order to develop individual staff competences and to upgrade the competence affordances at the organizational level.

E-learning-enhanced organizational learning has been delivered primarily in the form of web-based learning (El Kadiri et al. 2016). More recently, the TEL tools portfolio has rapidly expanded to make more efficient joint use of novel learning concepts, methodologies, and technological enablers to achieve more direct, effective, and lasting learning impacts. Virtual learning environments, mobile-learning solutions, and AR/VR technologies and head-mounted displays have been employed so that trainees are empowered to follow their own training pace, learning topics, and assessment tests that fit their needs (Costello and McNaughton 2018; Mueller et al. 2011; Muller Queiroz et al. 2018). The expanding use of social networking tools has also brought attention to the contribution of social and collaborative learning (Hester et al. 2016; Wei and Ram 2016). Contemporary learning systems supporting adaptive, personalized, and collaborative learning expand the tools available in eOL and contribute to the adoption, efficiency, and general prospects of the introduction of TEL in organizations (Cheng et al. 2011). In recent years, eOL has emphasized how enterprises share knowledge internally and externally, with particular attention being paid to systems that leverage collaborative learning and social learning functionalities (Qi and Chau 2016; Wang 2011).

This is the essence of computer-supported collaborative learning (CSCL). The CSCL literature has developed a framework that combines individual learning, organizational learning, and collaborative learning, facilitated by establishing adequate learning flows and emerges effective learning in an enterprise learning (Goggins et al. 2013), in Fig. 1.

Fig. 1: Representation of the combination of enterprise learning and knowledge flows



Representation of the combination of enterprise learning and knowledge flows. Adapted from (Goggins et al. 2013) Establishing efficient knowledge and learning flows is a primary target for future data-driven enterprises (El Kadiri et al. 2016). Given the involved knowledge, the human resources, and the skills required by enterprises, there is a clear need for continuous, flexible, and efficient learning. This can be met by contemporary learning systems and practices that provide high adoption, smooth usage, high satisfaction, and close alignment with the current practices of an enterprise. Because the required competences of an enterprise evolve, the development of competence models needs to be agile and to leverage state-of-the art technologies that align with the organization's processes and models. Therefore, in this paper we provide a review of the eOL research in order to summarize the findings, identify the various capabilities of eOL, and guide the development of organizational learning in future enterprises as well as in future studies.

Architecture of current E-learning systems

Many conventional frameworks have been used to create and improve e-learning system effectiveness. One is based on service-oriented architectures (SOA) that allow to easily extend the capabilities and functionalities of the system by dynamically adding services. For example, (Fajar et al. 2018) present a SOA system architecture and reference for an e-learning system, which consists of six components: data layer, resource layer, application layer, business process layer, presentation layer and governance layer. The data of each layer are treated as the service in the SOA system, which makes it more reusable, flexible and accessible to extended tools. This method allows business and wider society to improve e-learning and offer affordable education. Similarly,

(González et al., 2009) extend existing e-learning systems to external mobile scenarios based on SOA as well. The architecture ensures the independence of e-learning systems, mobile applications and external applications, and provides a reliable data exchange and interoperability between them. Furthermore, (Kappe & Scerbakov, 2017) present an innovative object-oriented architecture for the implementation of e-learning systems on a single software platform to meet the requirements of various e-learning scenarios. Abstract data objects (ADOs) that encapsulate private memory together with some methods are widely used as the main components of functional objects like courses, announcements, curriculum and so on. The implementation shows that this architecture is highly modular since documents and objects can be created independently but also re-used through a flexible nesting or containment mechanism.

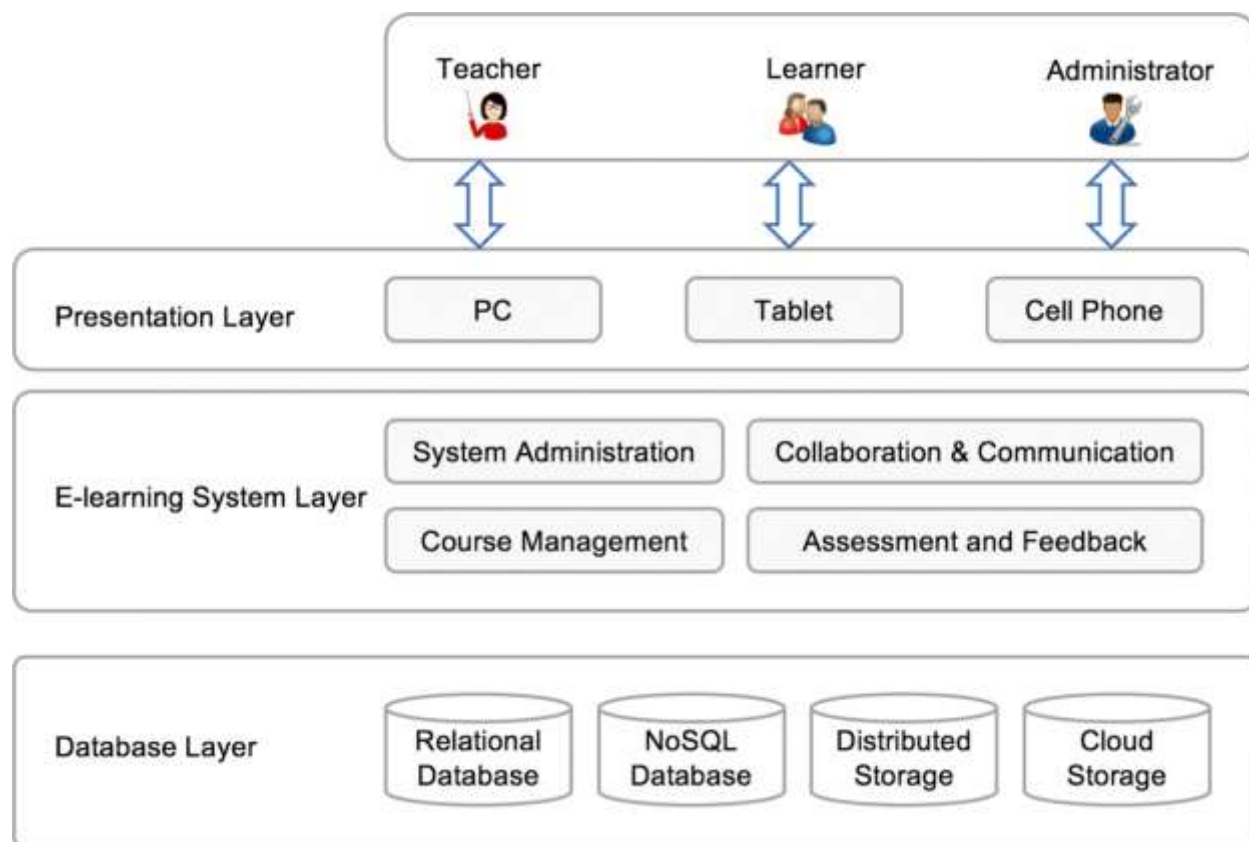
Recently, the availability of high speed networks, low-cost computers and storage devices has resulted in the significant advances in the cloud computing technology, which is the on-demand usage of a network of remote servers hosted on the internet to store, manage, and process data, rather than on one or more local servers. (Riahi, 2015) reviewed recent cloud-based systems and proposed an e-learning cloud architecture, which includes hardware resource layer, software resource layer, resources management layer, service layer and business application layer. They also conclude several advantages of cloud-based e-learning like low cost, improved performance and compatibility, information security and benefits for both educators and students. Other researches (El Mhouti et al., 2018; Masud & Huang, 2012; Riahi, 2015; Sun et al., 2015; Chao et al., 2015; Hendradi et al., 2020; Rani et al., 2015) also focus on combining e-learning systems with cloud computing. There are two advantages in doing so. Firstly, it is easy to create and maintain, and the investment cost can be reduced significantly using the pay-as-you-go method. Also, it allows to scale the services according to the need. (Sun et al., 2015) introduce a cloud-based virtual learning environment called MLaaS, which aims to provide adaptive micro learning contents and customized learning route for every single learner.

Education data mining scheme is used to discover features of learning resources and understand learners' behaviors. In addition, (Chao et al., 2015) propose a cloud-based ecosystem called CLEM for teachers and learners. Their implementation shows that the cloud-based platform gathers heterogeneous and distributed devices in a common pool that makes computational resources more

accessible and sharable. Furthermore, (Jeong et al., 2013) introduce a private-cloud-based e-learning system with six components: a private cloud platform, an XML based common file format, an authoring tool, a content viewer, an inference engine and a security system. By using these components, it can deliver and share various types of educational resources effectively. However, according to some literatures (El Mhouti et al., 2018; Laisheng & Zhengxia, 2011), the challenges of cloud-based e-learning system are mainly related to cloud privacy, security and confidence. At the same time, these concerns also provide opportunities for e-learning promotion and development in cloud computing environment.

Based on previous researches, we conclude a general framework for current e-learning systems in Fig. 2, which basically consists of three logical layers contributing to better teaching and learning effectiveness: presentation layer, e-learning system layer and data layer.

Fig. 2: Presentation layer, e-learning system layer and data layer.



The presentation layer

The presentation layer focuses on the human computer interaction by providing accessible user interface and learning resources to end users (García-Holgado & García-Peñalvo, 2018). It aims at improving the usability, accessibility, credibility and the user experience of the learning ecosystems. Firstly, it provides a unified interface for all the services or functionalities provided by the lower layers and hide system complexity from users. Users can utilize this interface to construct and control the contents of e-learning systems. The feedback from the e-learning system layer is delivered through this interface. Secondly, due to the prevalence of various mobile devices (e.g. mobile phones, laptops, tablets and other portable devices), the presentation layer should ensure that e-learning systems support mobile learning paradigm (Schuck et al., 2017). In other words, e-learning systems are adaptable to distinct screen sizes, which allows learners to gain any information flexibly. Also, mobile learning has been proved to be able to improve student participation and engagement during learning process, while learners have high levels of motivation and satisfaction (Cheng et al., 2015). It also has a positive influence on learners' academic performance (Han & Shin, 2016). Therefore, it is necessary to use proper front-end techniques such as HTML, XHTML, CSS, and JavaScripts to support mobile learning, in which presented pages can be rendered properly on a browser to meet the compatibility requirements of devices.

The E-learning system layer

The e-learning system layer aims at synthesizing educational resources by way of various functions such as course enrolment and management, user profile and activities, teaching or learning assessment and feedback, user communication or collaboration and so forth. It can also be an integration of related components which support instructional model or learning model (Lu et al., 2015). Users are able to choose the components to satisfy the different needs for teaching and learning. For most MOOCs and LMSs, this layer plays an important role between the presentation layer and the database layer. Learning and teaching information including users profile, learning resources, teaching and learning activities is collected and passed through e-learning system layer. It is also a teaching and learning platform that enable each learner to access specific education resources flexibly.

The database layer

The database layer hosts data generated by using e-learning systems. It is the critical place where education data is collected, stored and used. Due to the individual differences, collecting the massive data and retaining the diversity and dynamic features is very important. Additionally, all the collected data need to be stored until their use. Alternatively, some processed results may be put to use immediately, while most of them will serve some purposes later on. The main benefit is that it enables the collected or processed data to be accessed and retrieved easily. Usually, existing solutions for e-learning storage mainly rely on relational database, such as Mysql (Wangmo & Ivanova, 2017) and Oracle (Datta & Bhattacharyya, 2018). Moodle's database is typically MySQL or Postgres, and can also be Microsoft SQL Server or Oracle. Sakai and Blackboard can be deployed in a SQL or Oracle environment as well. Also, NoSQL databases are increasingly used for large sets of distributed data due to flexible and scale-out architecture. They work as a complementary technology for the relational databases system and are suitable for distributed applications with the demand of high data scalability and availability (Davoudian et al., 2018). For example, MongoDB is choosed by Open edX for storing large files which are text files, PDFs, audio/video clips, etc.

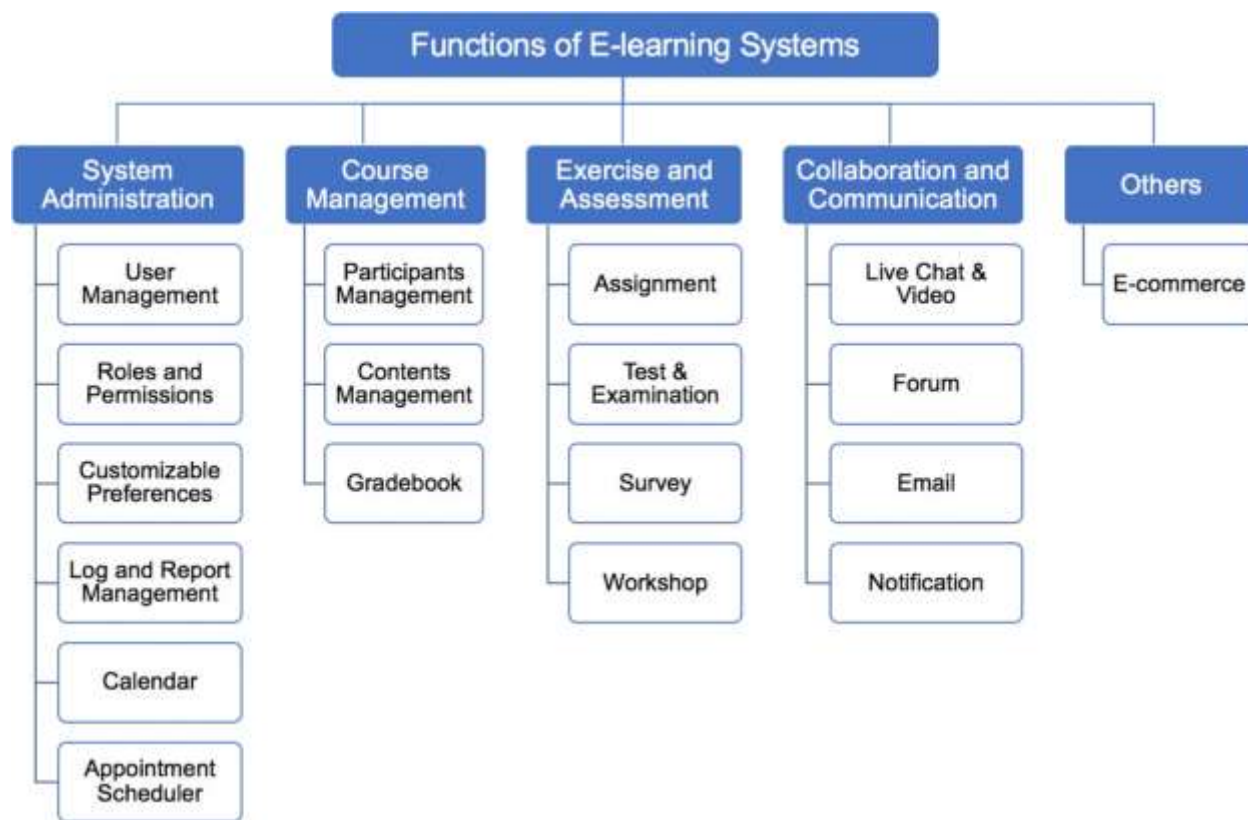
Additionally, distributed storage technology is increasingly used to replace traditional local storage. Some run on top of file systems while others work as standalone systems. For example, (Zhang et al., 2020) use distributed storage technologies for experimental education systems. Specifically, the interplanetary file system (IPFS), an external storage server and external cloud storage are combined for storage management. Among them, IPFS determines the overall performance of the storage module and contributes to system reliability and flexibility. Additionally, a file table is defined to manage each learning content such as documents, video and problem books in a distributed database. (Kawato et al., 2020) create an e-learning system by implementing Apache Cassandra, which is an open-source distributed database system to handle large volumes of data. By combining distributed hash tables (DHT), which hold information of the connected computer nodes, it is able to share various education resources spanning multiple servers. (Otoo-Arthur & van Zyl, 2020) present a framework on a distributed and parallel computing environment to provide new value to teaching and learning process.

Moreover, cloud storage as a large scale distributed storage paradigm is also used to education system, in which learning resources is stored on remote storage systems. Compared with traditional storage ways, it has many advantages in terms of scalability, flexibility, safety, ease of use and cost saving. (Sun et al., 2015) deploy Mobile MOOC learning on the Amazon EC2, and Amazon S3 is considered as the MOOC learner and course data storage because of its robustness and mature disaster recovery mechanisms. (Jeong et al., 2013) propose a content-oriented smart education system based on a small-scale, private cloud. A common file format based on XML are defined as a means of representing data and meta - data. The Document Type Definition (DTD) and the eXtensible Style sheet Language (XSL) are used to described the schema and styles for the XML document structure separately, which enables the same content can be viewed on multiple devices. Furthermore, (Rani et al., 2015) deployed e-learning system on remote cloud host, where all required learning resources are stored. They also build a simple MySQL on the cloud host for authentication of the system. By doing so, an expanded and secure environment is built to raise e-learning system.

Functions of E-learning systems

The functions of e-learning systems depend on its potential usage such as system scale requirement, organizational objectives, online training strategy and desired pedagogical outcomes. (Cavus & Zabadi, 2014) summarize that standard LMSs should have various tools for e-learning systems. They compare six popular open source LMSs in terms of video services, discussion forum, file exchange, email, realtime chat and so forth, and discover that communication tools provided by Moodle and ATutor are efficient, but it is not easy to obtain information on Claroline and Sakai due to their complex webpages. Similarly, (Chung et al., 2013) suggest that LMSs should have five components: transmitting course content, creating a discussion, evaluating students, evaluating courses and instructors, and creating computer-based instruction. However, most of the existing e-learning systems do not contain all the features in a single system. So, we highlight the general function components (Fig. 3) that most e-learning systems have to support teaching and learning process.

Fig. 3: General Function Components



System administration

This module includes a full range of functions for the management and configuration of system parameters and attributes in terms of users, courses grades, appearance reports and so forth. It covers components such as user authentication, user management, roles and permission management, customizable preferences, log and report management, calendar and appointment scheduler.

User management: For e-learning users, email or mobile phone-based self-registration authentication method is commonly adopted to fulfill user authentication. Also, a category hierarchy is usually built to organize users from different organizations. Common operations such as adding, deleting, modifying and querying related to user management are supported. Normally, there are several categories of e-learning users including administrators, instructors, teaching assistants (TAs) and learners. The administrators set up and configure the system. The instructors

prepare the lessons and access the learners' progress. TAs assist instructors with instructional responsibilities. Learners are anyone interested in learning and being educated in the courses.

Roles and permissions: E-learning systems usually support several standard user roles and has the potential to create an unlimited number of additional roles. Therefore, it is necessary to control users' access rights only to the information they need and to prevent them from accessing information that does not pertain to them. For example, role based access control (RBAC) is used to control client access and consents in DidaTec LMSs platform (Laura et al., 2018). Another example is that the Access Control List (ACL) is used to maintain the user information and their permissions, while group key is utilized to secure course materials and to ensure that only approved participants have access to it (Kanimozhi et al., 2019).

Customizable preferences: Personalized setting for user profiles and system preferences such as privacy, design and layout of the websites is allowed to enhance users' experience.

Log and report management: Event log analysis is displayed through graphical user interface to assist teaching and learning. Also, analysis reports are available and exported to help administrators and teachers to make decisions based on the statistical results.

Calendar: It displays a consolidated view of all the course-related events by day, week, or month in the e-learning system. It allows users to view the available learning programs or courses with specific due dates. Also, the calendar usually automatically synchronizes with other teaching or learning activities such as syllabus, assignments, tests, and grades. In the case that users create, change, or delete the date of an activity in the LMS, the change will show up in calendar and vice versa. Finally, systems such as Moodle and Coursera also allow users to export calendar, so they may be imported into other calendar programs, as a backup or to create a copy. Conversely, other agendas can also be imported to calendars in LMSs to facilitate time management in some university (Mei, 2016).

Appointment scheduler: It helps teachers schedule appointments with their students. Teachers specify time slots and locations for online or offline activities and students choose for their attendance.

Course management

It is a basic but most important component of an e-learning system (Cavus & Zabadi, 2014), which mainly refers to create, organize and deliver various coursework. Most LMSs allow users to add course material from various sources in different formats such as text, graphics, audio, video and so forth. Platforms like Moodle, Open edX allow to use the SCORM (Shareable Content Object Reference Model) standard for its online courses. The benefit is that it provides a standardized course model that supports the reusability of learning objects. For example, multiple individual lessons can be stringed together into a complete course. Participants are also encouraged to have more interactivity within e-learning systems. With the proper authoring tool, they can create their own courses and eliminate the need to outsource course development. Similarly, (Gamalel-Din, 2010) tailor course materials by drawing multimedia Learning Objects(LO) from LO repositories, which are composed of small granular multimedia objects. This idea helps teachers to find the best available assets and LOs for course design. Students are also able to get tailored learning strategy based on their abilities and previous knowledge. Basically, the specific functions of course management are as follows.

Participants management: It enables an administrator or teacher to easily enrol, view, filter, edit and delete participants for each course, and also group participants or invite learners. It is also a centralized place where teachers are able to trace student's attendance, increase student enrollment and avoid high drop-out rates during the course. By comparing user activity and identifying attendance trends, regular attendance of all students is recorded and ready for further analysis. Since student attendance is strongly linked to learning outcome, it is also necessary for teacher to give a warning to those with poor attendance during online learning.

Contents management: Contents are organized in descriptive categories so that users can easily find their desired resources. Both static contents and interactive resources are delivered according to student's needs. Some contents might be made either for a restricted audience or for a wider population, either as a free offering or as paid courses. Generally, a LMS allows course creators to freely structure their e-learning offerings in a manner that best fits their purposes and requirements. Also, instructors can trace the progress of each course and adjust their pedagogical strategy accordingly.

Gradebook: It is a central location where teachers can manage grades for courses and track student activities relative to gradable items. It plays a critical role in performance monitoring and feedback seeking associated with self-paced learning practices.

Exercise and Assessment

This module utilizes some testing and evaluation capabilities to monitor, track and evaluate the effectiveness of the e-learning process. Most e-learning systems support learning assessments periodically and some of them even support the teachers to identify gaps or intervene when necessary. Generally, a broad range of e-learning assessment methods are considered in terms of learners' progress and performance. Some offer built-in auto-graded evaluation tools (Baturay, 2015), such as quizzes, tests, assignment, group exercises, examinations and surveys so that both instructors and students can track the learning performance in gradebook easily. Some even have diagnostic assessments to evaluate the level of knowledge of learners and assign suitable level to them. Furthermore, peer assessment (Lynda et al., 2017) is widely used in MOOC platforms which involves learners in grading and giving feedback from the work of their peers. It is also recognized as one important feature that affects the effectiveness of e-learning systems. For example, Coursera has regarded peer review as a scalable and sustainable way to guide students in assessing each other's job as well as providing feedback. Lastly, evaluation reports used to assess e-learning are generated to query and display data in graphs and charts, allowing users to easily spot teaching or learning trends or issues. Additionally, this report should reflect the user performance on both individual and group level from multiple perspectives and monitor if the learners achieve their required objectives. Generally, the following activities are normally used to perform assessment and feedback.

Assignment: It allows learners to submit their work online and teachers to grade and give response. Teachers are allowed to select excellent assignments to share with all students enrolled in the courses.

Test and examination: It is necessary to assess course quality and learning outcomes. Teachers are allowed to create quizzes that are made up of a wide range of questions derived from a question bank. This enables a question to be re-used in different quizzes and facilitate the teaching process.

Examinations are also conducted online to assess student performance. Furthermore, a remote proctor or students' webcam can be used to monitor the student's activities and the surroundings during the examination, which is an effective solution to maintain academic integrity for e-learning examination.

Survey: It is used to help teachers to gather information from students and reflect on their own teaching. It is also used to identify certain trends that may be happening among course participants.

Workshop: It allows the learners to perform peer assessment activity according to teacher's guidance.

Collaboration and communication

Effective collaboration and communication help the transfer, sharing and co-construction of knowledge as well as the sharing of experiences in teacher-student and peer-to-peer relationships (Chiu & Hew, 2018). There are various communication tools in existing e-learning systems that encourage participants to support each other in the learning process.

Live chat & video: Live chat is an instant messaging application that allows users to discuss in real time while they participate in the teaching and learning process. It usually supports features such as real time chat monitor, chat history, file sharing and so forth. A platform-independent and web-based instant messaging can be embedded to support convenient communication among users. The chat tool (Bagarukayo et al., 2014; Carmona et al., 2008) can be integrated as a synchronous, live communication way to aid interaction and collaboration among e-learning users. It allows students and teachers to interact in real time, such as conducting group discussions or study sessions effectively. Live video tools such as Microsoft Teams, Skype, Zoom and Tencent Meeting are increasing used as communication tools for e-learning especially during COVID-19 pandemic. According to (Alameri et al., 2020), 80.7% of participants agree that Moodle, Microsoft teams and Zoom platforms enhance the communication between teachers and students in higher education. Learners are easy to concentrate on classes by constructing visual presentations. Most students believe Moodle, Microsoft teams and Zoom platforms are critical for them to handle learning process and they will be an indispensable part for online learning.

Forum: It provides space where students and teachers can discuss a specific topic or a group of topics to exchange their ideas. Three types of forums can be built: public forum, course forum and class forum. A three-level forum can contribute significantly to successful collaboration and community building in an online environment. Forums are usually integrated into the e-learning systems (Kakasevski et al., 2008; Baturay, 2015) . It helps learners to exchange their ideas and knowledge effectively so that they are not constrained in a passive role but can instead help each other and engage in active ways. Also, forums allow instructors to post course-related questions that can be accessed and discussed by learners. Then the extensions of questions and ideas for interaction are available regardless of whether the instructor is available. Furthermore, forums can also be split into several subforums to provide specific discussions. For example, Coursera provides a default partition of subforums, which includes study groups, general discussions, lectures, assignments, logistics and feedback (Rossi & Gnawali, 2014). The instructors are also allowed to customize the subforums flexibly.

Email: The traditional email has been widely used by Moodle, Blackboard and Open edX and other LMSs (Kakasevski et al., 2008; Bagarukayo et al., 2014). It supports instructors to send email to individual learner or a group of students in the course without launching a separate email program.

Notification: It alerts users about events or activities update in the system.

Others

E-commerce: E-commerce exists in some e-learning systems especially MOOC platforms. It provides sophisticated business transaction functionalities such as payment processing, shopping cart, and customer analytics capabilities. In MOOC platforms, to complete a course or learning module, users need to provide their user profiles and make a one-time payment or agree to a monthly subscription. To earn a degree or a certificate, users also need to pay tuition fees accordingly. E-commerce integrated LMSs usually allow learners to carry out all their transactions starting from registration to making the payment through a single portal, which in turn helps improve user experience.

E-learning system usage

The success of any information system depends on the usage of the system by users (Almaiah 2018). Thus, in the context of e-learning system, student's acceptance of e-learning is considered as one of the main criteria for the success e-learning system. Several studies in the literature have addressed issues related to e-learning adoption in many countries over the world. For instance, in Malaysia, Al-Rahmi et al. (Almaiah and Man 2016) used the TAM with IDT model to investigate the critical factors that affect the use of e-learning system Malaysian students. The results revealed that relative advantages, observability, trialability, perceived compatibility, complexity, and perceived enjoyment are the factors that play a significant role in students' decision to use e-learning system in Malaysia. (Salloum et al. 2019) used UAE as a case study for a quantitative investigation. The results indicated that four factors (innovativeness, quality, trust, and knowledge sharing) were observed to achieve better e-learning system acceptance among students. (Al-Gahtani 2016) investigated the factors influencing student acceptance of e-learning based on TAM3. He found the most significant determinants of e-learning acceptance were playfulness, self-efficacy and anxiety, while using computers, perceptions of external control, subjective norms and perceived usefulness.

However, in the context of Saudi Arabia, social influence, demonstrability and perceived enjoyment were not related to the acceptance of e-learning systems. Another study conducted by Almaiah and Almulhem (Almaiah et al. 2016a), they proposed new framework using Delphi method to determine the success factors of e-learning system implementation in Saudi Arabia. The results highlighted 11 critical factors grouped into four domains that cover website quality, technology options, top management support, and e-learning awareness by academic faculty and students. (Bellaaj et al. 2015) used the Unified Theory of Acceptance and Use of Technology (UTAUT) model to explore the factors affecting students' use of e-learning systems at the University of Tabuk, Saudi Arabia. They found that expectations regarding performance and effort had a strong influence on e-learning acceptance. In another study in Azerbaijan, (Chang et al. 2017) found subjective norms, experience and enjoyment influenced acceptance of e-learning. (Abdullah and Ward 2016) also investigated factors influencing e-learning acceptance using TAM. Their findings revealed that self-efficacy; subjective norms, enjoyment, anxiety and experience with using computers had a significant effect on students' acceptance of e-learning. Similarly,

(Alhabeeb and Rowley 2017) found that academic staff knowledge of learning technologies, student knowledge of computer systems and technical infrastructure, were significant factors in facilitating the successful acceptance of e-learning.

Although numerous studies exist on e-learning adoption, the current study aims to add new contribution to the existing literature on the investigation of the main challenges and factors influencing e-learning successful adoption in new context, which is secondary schools, which may set an example for other developing countries.

E-Learning Infrastructure

E-learning relies on technology: It requires hardware, software, and network infrastructure. Most e-learning environments today are Web-based, i.e., they are accessed via Web browsers (using HTTP) over a TCP/IP network such as the Internet or an intranet (Piotrowski, 2010). The author goes on to state that the functionality of e-learning platforms typically includes access to learning content and tests, communication and collaboration tools for students, and course management and assessment facilities for instructors. E-learning platforms may also include administrative functionality or interfaces to administrative systems for managing student admissions and enrollment for resource planning, accounting, etc.

2.2.8 Importance of e-learning

A large number of students who graduate from senior secondary schools cannot go to reputable schools creating a gap between the high demand for better education and limited resources available. E-learning is believed to be a promising approach since it offers students ways to interact with experienced teachers and professors. This helps to broaden the scale of secondary education. The level of e-learning adoption in developing countries cannot be matched to that of developed countries because of the lack of facilities such as infrastructure technology, low connectivity and low levels of training.

Nonetheless, developing countries need to bridge this digital divide by pursuing vigorously any home grown solutions which maximize the use of infrastructure and technology (Dadzie, 2009) and enhance the quality of online learning offered to all. Benchmarking as a method for quality enhancement has until now not been very commonly used in higher education (Ossiannilsson, 2012) and especially not with regard to e-learning. Quality assurance, quality indicators, benchmarks and critical success factors for e-learning have not been taken seriously into account

in regular quality assurance within higher education, though few methods have so far focused on parameters to quality assurance governing e-learning. One of the sides of Quality Management points to the effectiveness of change management, higher academic standards, increased number of staff and student satisfaction (Pavla, 2014). Nevertheless, criteria based on ease, new forms of interaction, flexibility, accessibility and personalization and other pedagogical aspects relevant for e-learning are missing. Additionally, there is a lack of experiences and theoretical framework about the value and impact of benchmarking e-learning in higher education (Ossiannilsson, 2010a, 2011). (Tarus et al 2015) in their journal entitled challenges of implementing e-learning in kenya summarised the importance/benefits of e-learning as follows:

- Ease of access to information,
- The potential for interactivity amongst and between learners and teachers,
- Enables conduct of lessons from a remote location and extends geographical access to education,
- Content is more timely, consistent and dependable with potential for re-use,
- Combination of both synchronous and asynchronous learning,
- Supports student centered e-learning paradigm and students can learn at their own pace,
- Increases access to learning and training opportunity,
- E-learning lowers costs and improves cost-effectiveness of educational resources,
- Offers the combination of education with work and family life,
- Scalability: e-learning solutions are highly scalable,
- Facilitates the management of student records and tracking students' progress.

Benefits of E-Learning

There is considerable research in the field of e-Learning. This research shows that, in comparison with traditional education, e-Learning has many benefits: Time and location flexibility: E-Learning eliminates the obstacle of time and location/distance by providing an opportunity for virtual learning, part-time learning, and for on-job learning; for the people who cannot physically go to education institutions (Zhang & Nunamaker, 2003; Koller, Harvey & Magnotta, 2008). E-learning also provides quick reference, which means learners can quickly and conveniently check the sources of information and/or meaning of difficult words and terms which students don't understand, while they are on the internet (Kruse, 2002). Also, in an e-learning environment,

students can mostly choose what they want to learn and when students want to learn, this considerably reduces stress and burden on the students.

Cost and time savings: E-Learning saves time and money. Learning can take place at any location, and at any time. Students using e-Learning do not have to travel to a specific location, which will result in significant time and cost savings on indirect expenses (Khirallah, 2000). E-learning also allows the material to be reviewed by the student multiple times in different locations, thus saving academic time/cost, teaching content, and/or time and cost traveling between physical locations.

Collaborative learning environment: E-learning encourages and facilitates learners in asking questions. Due to learners not being surrounded by colleagues, they are more willing to ask questions they would not be able to ask in conventional classrooms due to social influences (Hiltz & Benbunan-Fich, 1997). Arbaugh (2000) measured engagement in online courses by calculating the amount of time students spent on the course web-site, students generally showed a fairly high level of perceived learning. When students spend time in an engaging learning environment, as in e-learning, where they have control over accessing the learning material and choosing the learning resources, they spend more time in that environment. In this process, they are exposed to the learning material more than they would in a traditional environment; resulting in high level of perceived learning.

Better interaction and access to the instructors: Through e-Learning environments, learners can obtain more guidance and help from instructors via online platforms. E-learning provides greater opportunities for tutors/lecturers to communicate with students than in a traditional classroom (Hiltz & Wellman, 1997; Kim, Liu, & Bonk, 2005). Students can ask questions through e-mail or they can post questions in an online forum. Similarly, tutors can mark assignment and exams and give feedback online.

Unlimited use of learning materials: E-Learning allows unlimited access and retrieval of electronic learning materials, which means students can retrieve information repeatedly at any time from the system website (Zhang & Nunamaker, 2003). In a traditional learning environment, if students miss a class, it becomes very difficult to get the lecture resources for that class session.

Moreover, the lecturer cannot repeat that lecture for each and every student who missed that lecture. This is very convenient in an e-learning environment, because the learning resource for all class sessions are available online, for students to access anytime. This may include reading material and/or video lectures. Many times, students need to go over some lecture again, as they may forget or do not understand it well. In this case, also, online resources are very useful. Many benefits of e-learning can solve the prevailing issues in the education sector. However, when we look at the actual situation, we find that e-Learning has not been as successful, as it promised or has the potential to be, which means that there are issues with e-Learning implementation. In the following section, we will look at the e-Learning challenges and barriers.

Barriers/Challenges in E-Learning

Technology Infrastructure

In the present world, where information is just one mouse click away, the speedy and compatible hardware is vital for e-learning success (Little, 2003). The main hurdle in eLearning system deployment and success, which most of the institutions faced, is the problem of outdated and lack of access to technology infrastructure (Alshwaier, Youssef & Emam, 2012). As a result, the teachers, and more importantly learner's learning experience via elearning is impacted due to a lack of technological infrastructure (Naidu, 2003).

Bandwidth and Connectivity Issues

E-learning is mostly dependent upon the internet. Accordingly, bandwidth and internet connectivity is another issue/challenge that commonly exists (Nor & Mohamad, 2013). Video conferencing, which is used for live lectures, requires high-speed internet. Therefore, it becomes infeasible for those students, who have slow speed internet that hinders content delivery (Baker, 2003). Even though high-speed internet is available in the major cities, many people, especially in rural areas, only have access to slow speed internet, which results in a decrease in student engagement; as they cannot download content due to slow internet speeds (Ali, 2004).

Virus Attack

An increasingly common issue is virus attacks. This problem can destroy data, which can make e-Learning challenging (PRAKASAM, 2013). Most viruses are spread through the internet, so unknowledgeable students, or students running older technology, are not keen in connecting to the internet; as students are concerned viruses may infect their computer which can cause trouble and/or damage their devices. Accordingly, virus protection and/or development of trust issues that can impact the ongoing usage of e-learning (Qureshi, Ilyas, Yasmin & Whitty, 2012).

Faculty Effort

Many of the attempts to implement e-Learning systems have failed due to not accomplishing anticipated learning objectives (Surry, Ensminger & Jones, 2005). A key object, that is often disappointing, is the level of support and effort given by the teachers; i.e. the staff who deliver lectures via the Learning platform (Inglis, 2007). The role of faculty in e-Learning is very crucial, but most of the cases found in literature, students suffer from the lack of support from faculty members, which ends in the failure and/or existence of complex obstacles in e-learning (Teo, 2011; Surry, Ensminger & Jones, 2005).

Quality of Content

Quality of learning content varies significantly in normal cases. This variance in quality is largely due to a lack of expertise and for effort invested by the teachers, and administration, in the effective development of e-Learning content (Tricker, Rangecroft, Long & Gilroy, 2001; Andersson & Grönlund, 2009; Park, 2009). Lack of expertise and resource investment results in low interactivity and/or negative perception by students towards e-Learning (Veeramani, 2010).

Insufficient Computers

Lack of computer and software availability is an issue that is discussed by many authors (Zhang, Zhao, Zhou & Nunamaker Jr, 2004; Anstead, Ginzburg, Mike & Belloli, 2004; Shea, Pickett, & Li, 2005; Usun, 2006). Students, especially in developing countries, face issues with the limited number of computers within their homes, and number of computers available at institutes,

compared to the number of students; making use of e-learning and/or blended learning a challenge (Pegrum, Oakley, & Faulkner, 2013; Tedre, Ngumbuke, & Kemppainen, 2010).

Inequality of Access to the internet

E-Learning allows learner flexibility of the time and space in obtaining an education (Zhang & Nunamaker, 2003; Koller, Harvey & Magnotta, 2008), but learner's inability to have access to the internet is becoming a major issue (Okine, Agbemenu, & Marfo, 2012). In developing countries, the main hurdle that students face when using or trying to adopt e-learning is inequality to access the internet (Salawudeen, 2010); a facilitating condition. The number of computers, not driven by behavioural intention, with internet connectivity, are often limited in institutions, especially in developing countries, and not every student gets the opportunity to access the internet. Moreover, many students do not have access to the internet in their homes, which becomes a challenge. People who can afford to have computers and internet availability at home, therefore, sadly get more opportunities to access e-learning opportunities.

Computer Literacy

There is a significantly low level of computer literacy amongst people living in both developing and developed countries (Andersson & Grönlund, 2009; Sharma, 2003; Nor & Mohamad, 2013). Computer literacy is necessary to ensure the success of distance education; as users have to have enough computer literacy to use the technology being engaging in the use of e-learning tools (Kerka, 1999).

Student Motivation

The motivation of the student is one of the factors that directly impact the success of e-learning system in any education institute because students are the ultimate users of all learning systems and processes (Park, 2009; Macpherson, Elliot, Harris & Homan, 2004; Aldrich, 2003). It is been found that students who are more motivated perform well compared to those who are not highly motivated (Andersson & Grönlund, 2009; Hepworth & Duvigneau, 2013).

Administrative Support

E-Learning systems are not necessarily always designed to support students and teachers, elearning tools also help administrative staff in enrolment, assessment, and access to course content (OECD, 2005). (Inglis 2007) discussed that there is a need for administrative and technical issues to be considered carefully, whilst developing and/or planning any e-learning / learning-management system. To be successful, of an e-learning system requires that administrative support is provided to all teachers and/or to students.

Cost

In developing countries, students have to face the cost of internet connection and/or affordability issues (Andersson & Grönlund, 2009); as using technology information communication technology (ICT) can result in high infrastructure/overhead costs (Nor & Mohamad, 2013). Another cost-related issue that institutions face in developing countries is the high cost of setting up the e-Learning system; often caused by an unavailability of low-cost alternatives (Tedre, Ngumbuke & Kempainen, 2010).

Language barrier

Language Barrier; English is not the first language of most of the developing and/or Asian-countries; for example, it is not the first language in Pakistan (Sue & Okazaki, 1990; Yen, 2015; Cenoz, 2015; Yeh, 2014; Bell, Dzombak, Sulewski & Mehta, 2012; Shukr & Roff, 2015). Lack of learning material and content in the local language can decrease the ability to ensure growth, interest, and adoption of developed e-Learning solutions (Sharma, 2003; 2012), especially as English generally is dominant on the internet and/or in academic e-learning system domains (Ali, 2004).

Challenges of E-learning systems

E-learning systems have profoundly changed the traditional methods of teaching and learning by offering enhanced access to information and interactive resources at all levels of education. They are a supplementary offer to traditional education and to some extent, have the ability to substitute it. Despite the advantages it offers, there are still some pedagogical and technical problems that need to be addressed. (Moubayed et al., 2018) analysing several challenges from different aspects,

which includes transmission/ delivery, personalisation, enabling technologies, collaborative/ cooperative learning facilitation, and evaluation & assessment. (Islam et al., 2015) also discuss some challenges existing in the success of e-learning, which are mainly related to technology, learning style, training and management. During the Covid-19 pandemic, e-learning faces more challenges as a massive adoption of online education. (Hamdan et al., 2020) analyze several challenges and obstacles including the lack of access to ICT tools, the adequate training for teachers using technological devices, the limited budget for digital devices and poor e-learning environment. (Oryakhail et al., 2021) investigate barriers that hinder the implementation of e-learning in Afghanistan secondary Education. This research shows specific challenges related to e-learning adoption in some selected secondary schools in Mfoundi division.

One major concern for e-learning systems adoption is content and curriculum adaptation. That is to use new pedagogy and cognitive approaches to achieve efficient transmission and delivery of e-learning system resources. Since e-learning is quite different from face-to-face education, the courses have to be adapted more attractive or interactive for students, which could be a challenge for teachers who have been used to traditional teaching. E-learning systems require a different approach to pedagogy instead of simply uploading large amounts of resources onto the e-learning systems. (Bari et al., 2018) state that there is no adequate design strategies adapted to the e-learning process and the evaluation of its success implementation. (Andersson, 2008) and (Moubayed et al., 2018) also discover that some hands-on courses conducted through face-to-face teaching can be difficult to carry out on e-learning systems so that the students cannot fully grasp the content as they learn from traditional classroom-based training. For example, practical lessons or laboratory works are difficult to be conducted on e-learning system (Karjo et al., 2021).

Moreover, readiness exhibited by secondary school teachers, is a major concern. Discovering useful information that can be utilized to help teachers determine proper pedagogical strategies and achieve better learning outcomes is also difficult in an e-learning environment (Islam et al., 2015). However, using big data based statistical and mathematical procedure to identify and extract valuable knowledge from large data source is a feasible solution to solve the problem related to “information overload” (Brajkovic et al., 2018). Furthermore, compared with traditional classroom, it is quite difficult for teachers to track or monitor student progress in e-learning system. AI

provides a solution to this problem (Klašnja-Milićević & Ivanović, 2021). It allows teachers to monitor or assess student progress timely. If there is a problem with student performance, AI can be used to alert teachers and assist students based on their strengths and weaknesses.

Another major concern of e-learning is human resistance, which refers to lack of motivation for both students and teachers. For students, the lack of learning motivation and persistence has been researched widely. Since e-learning is self-regulated learning, unmotivated learners may get behind without adequate supervision and guidance. Some statistics show that there is a high dropout rate on MOOCs platforms, which means the majority of students who signed up the course in the beginning could not finish in the end. For example, The Open University found out that only 6.5% of those enrolled students complete the course (Jordan, 2014). The number of enrolments decreases over time and is strongly linked with the duration of the course. As a result, e-learning ends up with a high dropout rates and low effectiveness.

To overcome this hurdle, it is important to stimulate the deep motivations that drive the learners to study or induce them to drop out based on data analysis methods. Also, some kind of useful interventions like self-regulated learning can be delivered to potentially prevent learners' dropout behavior (Min & Nasir, 2020). Based on (Hapsari et al., 2021), the heavy workloads and more time requirement for teachers have been a challenge affecting the adoption of e-learning. E-learning acceptability is important to the success of e-learning (Hapsari et al., 2021). If teachers have confidence in e-learning and are willing to master both technical and conceptual issues, it will be easy to achieve e-learning success.

Also, with the rapid development of technologies, e-learning systems grow dramatically in terms of the services offered and the available contents generated. Therefore, ensuring that the e-learning system has the means to adapt to the evolving scalability and robustness needs is particularly crucial. According to (Hapsari et al., 2021; Oryakhail et al., 2021; Hamdan et al., 2020; Karjo et al., 2021), lack of reliable internet connection has been a common problem among e-learning challenges. Also, the lack of technological infrastructure is one of the major problem faced by some selected secondary schools in Mfoundi division that affects both teachers and students in the adoption of e-learning project.. If e-learning infrastructure fail to handle requests from thousands

of users simultaneously, the system timeout or latency will definitely lead to the interruption of e-learning. Thus, we need to consider how to optimize various hardware or software resources to meet the storage and network requirements as well (El Mhouti et al., 2018). Technologies like cloud computing (Riahi, 2015; El Mhouti et al., 2018; Masud & Huang, 2012; Sun et al., 2015; Chao et al., 2015) have been introduced to provide efficient scalable architecture for e-learning systems.

Moreover, discovering useful information that can be utilized to help teachers determine proper pedagogical strategies and achieve better learning outcomes is also difficult in an e-learning environment (Islam et al., 2015). However, using big data based statistical and mathematical procedure to identify and extract valuable knowledge from large data source is a feasible solution to solve the problem related to “information overload” (Brajkovic et al., 2018). Furthermore, compared with traditional classroom, it is quite difficult for teachers to track or monitor student progress in e-learning system. AI provides a solution to this problem (Klašnjaja-Milićević & Ivanović, 2021). It allows teachers to monitor or assess student progress timely. If there is a problem with student performance, AI can be used to alert teachers and assist students based on their strengths and weaknesses.

Lastly, several social challenges faced in the adoption of e-learning cannot be ignored. Firstly, the cost for e-learning is an issue. (Hamdan et al., 2020) find financial cost for students from low-income families might prevent them from online education. Students need more financial support to purchase computers or stable internet connection services. Secondly, cyber security and privacy is another social challenge facing e-learning. For example, live video applications like Zoom and Microsoft Teams have end-to-end encryption for videos or calls, which ensures the content is encrypted before it's sent and decrypted only by the intended recipient. However, for most e-learning systems, cyber security and privacy is an optional function which might place the systems and information at risk. Thus, it's critical to choose the reliable e-learning system and tighten up the security and privacy of online education.

Previous researches have discussed the barriers from educators' perspectives (Mercader & Gairín, 2020, Aldosemani, 2020; O'Doherty, Dromey, Loughheed, Hannigan, Last, & McGrath, 2018)

regarding online learning. Several researches have revealed that many dimensions of barriers concerning the implementation online learning such as: technology infrastructure, course content (Ozudogru & Hismagnolu, 2016); technical support (Poon & Koo, 2010); lack of ICT skills, bandwidth issue and connectivity (Gutierrez-Santiuste & Gallego-Arrufat, 2016); student readiness (Unal et al, 2013); pedagogical model (Govender & Chitanana, 2016); engaging students online; lack of feedback (Guy, 2012); quality of course content (Mtebe & Raisamo, 2014); and level of knowledge of teacher (Dogan, 2015). Among these strands of study, teachers' opinion on barriers of online learning during pandemic in secondary schools in Indonesia seems to be out of concern. Moreover, the literature and empirical research concerning on barriers of online learning in geography subject was rarely found. Previous studies have discussed dimension of barriers in separate or partial studies. Therefore, the current study aims to analyze the implementation and barriers experienced by teachers in online learning based on TIPEC (Technological, Individual, Pedagogical and Enabling Conditions) framework. Findings of this research may help government and practitioners to improve education policies and responsive to facilitate online learning.

Current trends

Modern e-learning has evolved as a multi-disciplinary process including pedagogy, psychology, various aspects of computer science and many other fields of engineering. Both pedagogy and technology factors have been considered in these trends. Concepts like blended learning, adaptive learning have been introduced to change the traditional in-class education into competency-based education. Also, the wide use of e-learning systems has resulted in huge amount of data generated. By applying data-intensive approaches to educational resources, we can get better understanding of learners, educational settings, and the education results and then improve the teaching and learning process.

Blended learning

Blended learning (or hybrid learning) has evolved from the original computer-based learning environment. It combines the benefits of classroom learning with the advantages of e-learning to ensure an effective learning environment. In other words, learning activities take place inside and outside the classroom. Especially during the COVID-19 pandemic, some or even all classroom teaching are replaced with online teaching (Müller & Mildenerger, 2021; Prahmana et al., 2021)

and evaluating the effectiveness of blended learning have been studied widely. Normally, there are many education and technology elements that can be incorporated in learning and teaching processes based on different learning purpose. According to (Valiathan, 2002) and (Prahmana et al., 2021), there are three blended learning models: skill-driven, attitude-driven and competency-driven.

- Skilled-driven model—: It aims at providing students specific knowledge and skills, while teachers give feedback and guidance.
- Attitude-driven model—: It enables learners to gain new attitude and behaviors, and interaction and collaboration between learners and teachers plays an important role.
- Competency-driven model—: It aims at transferring learners tacit knowledge by observing and interacting with experts on the job.

Unlike traditional education where the classroom focus is on the teacher, blended learning allows the use of digital texts and tools, and the students become the protagonist of their own learning process, constructing their own knowledge together with the teachers. This mix between classroom learning and e-learning facilitates the students to carry out a more direct and flexible learning style that matches students' diverse needs.

Adaptive learning

Traditionally, a standard e-learning system does not consider individual differences of learners and treat all learners equally. However, adaptive learning or personalized learning aims to tailor massive information to them based on their features, preferences, background and learning behaviors (Aroyo et al., 2006; Gomede et al., 2021; Mavroudi et al., 2018). In order to do so, adaptive learning basically utilizes a data-driven method to identify the students' needs faster, and therefore enable the delivery of personalized learning at scale. It also needs differentiated teaching strategies and smart feedback to build learner skills (Sonwalkar, 2013). For instance, algorithms are used to evaluate students' current learning conditions using online tests, thus adapted modules will be provided to identify their learning gap and improve learning outcomes. According to (Onah & Sinclair, 2015) , the most common adaptive method for course development have the following

aspects: the adaptive hypermedia information retrieval system; adaptive annotation system; adaptive recommendation system; adaptive web navigation; adaptive feedback. (Oxman et al., 2014) conclude that at least three components are needed for an adaptive system.

- a content model to structure the provided contents,
- a learner model to understand learner's abilities, and
- an instructional model to match the content with learners in a dynamic and personalized way.

Generally, adaptive learning can support adjustments in faculty role, allow creative teaching methods, and facilitate learning process in multiple ways.

Theoretical Framework

The Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was developed and validated as means to predict the behavioral intention of the use of new technology within an organizational context (Davis, 1989; Davis et al., 1989). The technology acceptance model was developed based on the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980) and the Theory of planned behavior (Ajzen, 1985, 1991). The technology acceptance model is based on the assumption that the use and acceptance of new technologies can be explained by the individual user's internal beliefs, attitudes, and intentions and thus can be instrumental in predicting future use of technology (Davis, 1989; Davis et al., 1989; Turner et al., 2010). TAM has four internal constructs that can explain the actual use of new technologies such as perceived usefulness, perceived ease of use, attitude toward use, and behavioral intention to use (Davis, 1989). TAM uses behavioral intention as both a dependent construct and an independent construct. Behavioral intention becomes a dependent variable when predicting these two constructs (perceived usefulness and perceived ease of use) and as an independent variable when it predicts the actual use of new technology (Davis, 1989; Davis et al., 1989). Perceived usefulness and perceived ease of use are considered the most reliable determinant of the behavioral adoption of any new technology (Davis, 1989).

A revised TAM was later proposed (TAM2) which excluded attitudes toward use and added new constructs such as experience and subjective norm with the core ideology of the model remaining

the same (Turner et al., 2010; Venkatesh & Davis, 2000). Since its development decades ago, TAM has been adapted, replicated, and validated across multiple different fields of study such as e-commerce (Alves & Reis, 2020; Huong et al., 2020), e-government (Alkrajji, 2020; Mensah & Adams, 2020), e-learning (Al-Fraihat et al., 2020; Tawafak et al., 2020), and electronic and mobile health (Dahleez et al., 2020; Klingberg et al., 2020) adoption research. This extensive and multiple validations of TAM is a testament to its robustness in providing reliable results out comes that can better explain the individual user's intention to use new technology.

Perceived usefulness

Perceived usefulness is defined as the degree to which the individual user believes that the use of new technology will contribute greatly to improving his or her work performance (Davis, 1989). As new technologies spring up, users will be attracted to use it more when they appreciate that using it will bring in more benefits particularly in terms of completing their tasks efficiently and effectively. Perceived usefulness is considered as a key determinant that can influence the adoption of new innovative technologies that is user-friendly and provides more freedom (Pikkarainen et al., 2004). It thus follows that the greater the perceived usefulness of e-learning systems, the more positive attitudes and intention to use will be demonstrated. Studies have found that there is a direct relationship between perceived usefulness and the intention to adopt an e-learning system (Al-Fraihat et al., 2020; Al-Rahmi et al., 2018; Mohammadi, 2015; Tarhini et al., 2017). Accordingly,

Perceived ease of use

Perceived ease of use is one of the key determinants of the intention to use and it is defined as the perception of the individual user that the use of a new technological system would be free from effort (Davis, 1989). The ease of use associated with a new technology couple with its user-friendly features will encourage more participation and adoption. That is the greater the perceived ease of use of an e-learning system, the more positive intentions users will harbor toward its adoption and it can influence the user's perception of the usefulness of the e-learning system (Davis, 1989; Mohammadi, 2015). Previous studies have demonstrated that perceived ease of use has a direct significant impact on the intention to use (Chang et al., 2017; Tarhini et al., 2017) and perceived usefulness (Mohammadi, 2015; Salloum, Al-Emran, et al., 2019).

Computer self-efficacy

Self-efficacy is considered to be instrumental in the decision of the user to adopt any new technology. It is seen as a vital concept in social learning theory and it is defined as an individual user's belief that he or she can perform or undertake a particular task successfully (Bandura, 1977). Computer self-efficacy is thus considered as the individual perception that he or she has the needed capabilities to undertake any course of action successfully through the mediated medium of computer systems and applications. In the context of e-learning, computer self-efficacy is seen as the college students' self-confidence in their abilities to perform learning tasks through an e-learning system (Abbad et al., 2009). Students with strong potential and skills in completing an e-learning task through an e-learning system will develop a more positive perception of its ease of use and usefulness (Abbad et al., 2009). Prior studies have shown that there is a direct impact of self-efficacy on the perceived usefulness (Sánchez & Hueros, 2010) and ease of use (Abbad et al., 2009; Ibrahim et al., 2017) of an e-learning system.

Internet experience

The extent of internet experience that users possess has the potential to influence their apprehension of the ease of use and usefulness associated with any particular technology such as an e-learning system. Having the right internet experience will empower users to search for information and manipulate web browsers to navigate to obtain accurate information and services. It is estimated that users with low levels of internet experience will search and acquire information and services less efficiently as compared to users with rich internet experience (Frias et al, 2008). This is because inexperienced users may have less knowledge of the system and thus may not have the same skills the experienced users may have which may result in difficulty managing information flow (Chevalier & Kicka, 2006; Frias et al., 2008; Liu & Shrum, 2009). Prior research has demonstrated that internet experience is instrumental in determining both perceived usefulness and ease of use of an e-learning system (Abbad et al., 2009).

Technical support

Technical support is considered crucial to the adoption of e-learning and teaching development and delivery (Moule et al, 2011). Without the provision of adequate technical support, the

development of e-learning and teaching platforms will be a challenge. Since users who lack the needed technical support will be deprived of the chance to use e-learning systems (Moule et al., 2011). The provision of the right technical support for users of any e-learning system will enhance the perception of users toward the perceived usefulness and ease of use of an e-learning system. It has been revealed that technical support has a direct significant impact on the usefulness (Abbad et al., 2009; Ngai et al., 2007) and ease of use (Hsia et al., 2014; Ngai et al., 2007) associated with an e-learning system.

Related Literature on Technology Acceptance

Information systems (Davis, Bagozzi, & Warshaw, 1992), library information studies researchers and practitioners (Kim, 2005; Park et al., 2009; Spacey, Goulding, & Murray, 2004; Starkweather & Wallin, 1999; Totolo, 2007), and education researchers (Cetron, 2007; Dasgupta, Granger, & McGarry, 2002; Lin, Chan, & Jin, 2004; Williams, 2009) have paid considerable attention to technology acceptance. (Hendrick and Brown 1984) define technology acceptance as a person's psychological state in regards to their voluntary use of or intention to use a specific technology. (Venkatesh, et. al., 2003) describe research into technology adoption, acceptance, and use as "the most mature research area in contemporary information systems research literature". However, technology acceptance research related to mobile information technologies using information systems (IS) theory is very limited, and researchers such as (Wang, Wu, and Wang 2008) suggest that further research is needed on the acceptance and use of mobile learning using traditional IS models. Mobile technologies provide new methods for accessing and interacting with information and broaden the means of communication and collaboration among students and between faculty and students. The design, development, distribution, implementation, and support of technology are expensive investments for institutions such as colleges. The only way innovative information technology will reach its full potential and support this is if students and faculty accept and value it.

There are numerous IS theories and models designed to assist in understanding how and why people accept technology and the intention to use and actual use of it. For instance, technology acceptance theory has been used as a framework to examine library staff attitudes toward the Internet (Spacey, et al., 2004), acceptance of web-based subscription databases (Kim, 2005),

acceptance of digital libraries in developing countries (Park, et al., 2009), faculty responses to library technology (Starkweather & Wallin, 1999), social inclusion of digital libraries in academic and clinical settings (Adams, Blandford, & Lunt, 2005), and the role of self-efficacy in electronic library usage (Aafaqi & Ramayah, 2004). (Venkates et. al. 2003) describe technology acceptance research as the most mature research area in IS literature. However, (Taylor and Todd 1995) states that assessing the value of information technology to organizations (e.g., colleges, schools, libraries, public schools) and understanding the determinants of that value are keys to acceptance, integration, and use of the technology.

The technology acceptance model is based on the assumption that the use and acceptance of new technologies can be explained by the individual user's internal beliefs, attitudes, and intentions and thus can be instrumental in predicting future use of technology (Davis, 1989; Davis et al., 1989; Turner et al., 2010).

In relations to this study, the technology acceptance model addresses the issue of readiness exhibited by secondary school teacher in Some selected secondary schools in Mfoundi division. It provides a description of the applications and services developed, adapted and implemented to create the ALTER-NATIVA technology and it also shows the perceptions of teachers in terms of the level of importance and satisfaction after using the technological infrastructure.

TAM has four internal constructs that explain the actual use of new technologies such as perceived usefulness, perceived ease of use, attitude toward use, and behavioral intention to use (Davis, 1989). TAM uses behavioral intention as both a dependent construct and an independent construct. Behavioral intention becomes a dependent variable when predicting these two constructs (perceived usefulness and perceived ease of use) and as an independent variable when it predicts the actual use of new technology (Davis, 1989; Davis et al., 1989). Perceived usefulness and perceived ease of use are considered the most reliable determinant of the behavioral adoption of any new technology (Davis, 1989).

To address this concern, there have been numerous theories and models designed to assist in understanding information technology acceptance, seeking, exchange, and use. Researchers have used theories like the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), The Theory of Planned Behavior (TPB), and Diffusion of Innovation to better understand

the diffusion of innovations, how and why technology is accepted, and the intentions of individuals to use and the use of technology (Ajzen & Fishbein, 1980; Dillon & Morris, 1996; Lee, Kozar, & Larsen, 2003; Lucas & Spitler, 1999; Rogers, 1995; Venkatesh, et al., 2003).

Rogers' diffusion of innovation theory

Rogers' DIT (2003) is a well-established empirical framework (Miller, 2015) that conceptualizes the *process* of innovation diffusion, and can likewise be applied to the process of innovation adoption, specifically, to the adoption of educational technology in the field of education (Jwaifell & Gasaymeh, 2013). Most recently, DIT was applied to examine the adoption of online proctored examinations during the COVID-19 pandemic (Raman et al., 2021) and to the adoption of experiential learning via live-in-labs (Raman et al., 2020). It is worth noting that although various theoretical frameworks address innovation adoption, they all conceptualize the *factors* that affect the use or acceptance of the innovation, whereas this study's focus is on the entire *process* of innovation adoption. Thus, for instance, the Technology Acceptance Model (Venkatesh et al., 2003; TAM) describes two innovation factors (namely, perceived ease of use and perceived usefulness). The Unified Theory of Acceptance of Technology (UTAUT), which was developed by integrating theories such as the Theory of Reasoned Action (TRA), TAM, Theory of Planned Behavior (TPB), and the Diffusion of Innovation, explores additional innovation factors (Raman et al., 2021). Some of these theoretical frameworks were employed recently to examine the factors affecting the acceptance and usage of online educational tools in the context of the COVID-19 pandemic (Alshurafat et al., 2021; Wohlfart et al., 2021).

In addition, according to the DIT theory, the decision process for innovation adoption consists of the following five stages. (1) The Knowledge Stage involves gaining cognitive knowledge, during which the learner is exposed to the innovation, becomes aware of it (*awareness knowledge*), and seeks information about ways to use it efficiently (*how-to knowledge*). To increase the likelihood that individuals will adopt the innovation, they must have a sufficient level of *how-to knowledge* before attempting to use the innovation independently. (2) The Persuasion Stage is emotion-focused, as it is at this phase that attitudes about the innovation are formed. At this stage, the learner experiences uncertainty and, consequently, may be influenced by social encouragement to use the innovative tool, as well as by peer-group member's favorable subjective assessments of

the instrument. (3) The Decision Stage is when the individual decides whether to adopt or reject the use of the innovation, whereby the likelihood of choosing to adopt it increases with the number of prior opportunities to try it out. Ultimately, the decision is affected by three types of motives: personal desire, peer pressure, and/or pressure from an authority figure.

During the pandemic, the decision to adopt technology was derived from the unique social situation and was often dictated by authority figures (the school principal, the Ministry of Education); hence, it is interesting to examine how each aspect affected the adoption process. (4) The Implementation Stage is when the individual uses the innovation and examines the outcomes. Consequently, at this stage, it is essential that users receive feedback, as well as assistance and support, from those leading the transition, as this will help decrease uncertainty among the new users. Another facilitating element at this stage is “reinvention,” whereby the users adapt and change the instrument according to their needs. The greater the number of adaptations introduced, the greater too is the likelihood that the tool will be used consistently. Given that ML inherently uses numerous apps, there are multiple ways to make adaptations, which makes it an optimal platform. (5) In the Confirmation Stage, the users reflectively examine the process and its outcomes, seeking confirmation for their decision as they consolidate their final attitudes.

The decision to adopt technology in general and that of ML, in particular, has been examined in previous studies using Rogers’ theoretical framework (Sahin, 2006) and, recently, a questionnaire was developed based on this theory, to examine the adaptation of ML in the field of education (Celik et al., 2014). Nevertheless, as mentioned, only a few studies examined the adoption and implementation process among PSTs and ISTs in schools (Bano et al., 2018), and even fewer examined the process of adopting ML in times of crisis that involve the transition to distance learning. The comparison between PSTs’ and ISTs’ perceptions regarding ML adoption is especially important, given that previous studies have demonstrated that teachers and students are influenced by different factors when adopting technology (Mac Callum et al., 2014). More recently, a few studies have argued that conducting a comparative analysis of the views of teachers vs. students engaged in adopting innovative technology is imperative (Dolenc et al., 2021; Kovacs et al., 2021; Šorgo et al., 2021). Thus, for example, a study that examined educators’ and students’ views regarding the online education imposed during the COVID-19 pandemic found that while

some views were shared by the two groups, in other respects, they differed substantially, thus underscoring the need to explore both perspectives to fully understand the issue. Specifically, students' views were usually related to the learning process (e.g., concentration), while educators focused mainly on organizational aspects and study materials (e.g., copyright).

Another recent study showed that teachers scored higher than their students on measures of personal innovativeness in the context of adopting information technology. This kind of difference could lead to conflicting expectations between teachers and learners (Šorgo et al., 2021). Another recent comparative study explored the similarities and differences between teachers' and learners' perceptions at three different educational levels (Kovacs et al., 2021). The examination of the ML adoption process is of particular interest given the advantages of ML and the need to enhance our theoretical understanding of the characteristics of this process in times of crisis. Gaining a better understanding of the adoption process can help improve the design of teacher education programs, to promote the effective use of ML in teaching, for both routine and emergency conditions. Specifically, gaining insight into the ML adoption process will help design better instructional approaches in the classroom, improve students' learning experience, as well as enhance teachers' ability to use mobile educational technology effectively when teaching. Additionally, understanding the ML adoption process may help online learning instructors and developers integrate ML into future hybrid or online programs (Aguilera-Hermida et al., 2021). Innovative use of digital technology, including mobile game-based learning, was mentioned by scholars as a leading principle for addressing many of the problems of modern civilization (Šorgo et al., 2021) and as a particularly relevant solution to the challenges posed by the COVID-19 pandemic (Abdel-Hameed et al., 2021; Krouska et al., 2022).

Related Literature on e-Learning and DIT

As a result of a detailed literature research, it was seen that there is lack of study relevant about e-learning using DIT. (Celik et al.,2014) developed a mobile learning adoption scale (MLAS) on the basis of DIT. The reliability of the scale was determined through item, test-retest reliability and internal consistency analyses. Total correlation for this scale was positive. Another study about online learning in higher education, Shea et al. used Roger's model to explore the adoption and diffusion of online teaching in higher education. They reached 913 professors from community

colleges, four years colleges and university centers to test what factors have significant effect on faculty satisfaction on online teaching. As a result, they indicated that interaction, technical support and opportunities are the key factors (Shea, & Sau Li, 2005). Researchers frequently prefer combining the theories to explain the user acceptance of m-learning. For example, (Alharbi & Drew 2014) integrated Unified Theory of Acceptance and Use of Technology and Information System Success Model to develop a framework that assist in understanding students' behavioral intention to use m-learning systems in a higher education setting. (Pina 2015) explained the perceptions of professors about using mobile devices. Through exploratory interviews based on DIT and related studies 18 professors made their consideration.

Teacher interest and institutional support are determinant as the most significant factors on acceptance of m-learning. Another study conducted with the combination of Extended Technology Acceptance Model (E-TAM) and DIT (Cheng, 2015). Results show that learners can judge m-learning by how well it meets their perceived compatibility and they will regard m-learning as a useful. Contrary to the existing literature, our study aims to explain user's m-learning acceptance by using only DIT. For further studies, another least preferred such as Motivational Theory or Information System Success Model can be used to clarify perceptions of students or academic staff towards to m-learning.

However, after carefully reviewing this theory, we noted that Rogers' DIT Theory, can better addresses not only the factors influencing technological infrastructure and content and curriculum adaptation on the process of implementing e-learning project but also the entire process. Thus, we found the DIT theory relevant as it also relates to the speech made by the minister of secondary education Professor Nalova Lyonga on digitalisation for the academic year 2022-2023. The minister laid more emphasis on the adoption of technology by secondary school teachers and the integration of new innovations into the curriculum so as to help learners bridge the technology gap towards Advanced countries and achieve greater and better results needed to live in the 21 century (digitalised World).

Relative Advantage

Relative advantage refers to the degree to which an innovation is perceived as providing more benefits than its predecessor (Moore & Benbasat, 1991). Prior researches suggest that when user perceives relative advantage or usefulness of a new technology over an old one, they tend to adopt

it (McCloskey, 2006; Rogers, 2003). This feature of Roger's topology has been studied by various researchers in the context of mobile banking adoption (Lin, 2011; Al-Jabri and Sohail, 2012); e-learning & blended learning (Tshabalala, et al. 2014); electronic commerce (Seyal and Rahman, 2003; Ndayizigamiye and McArthur, 2014); Web-supported instructions (Soffer et al. 2010) and mobile learning (Mcconatha et al. 2008).

Compatibility

(Clarke 2000) found ease of use to be one of the five significant factors that determined general use of wireless handheld devices. An individual might have a higher intention to adopt mobile learning if they think mobile learning is easy to operate. Again, (Lu & Viehland 2008) found a support in their m-learning study in New Zealand.

Complexity

(Cheung et al. 2000) defined complexity where an innovation could be considered relatively difficult to understand and use. They found that complexity influenced the adoption of Internet use. (Chau & Hu 2001) and others had demonstrated that attitude towards using a technology was the significant determinant of behavioral intentions. A vast body of research had suggested that there was a strong support to ease the use of this new technology on its adoption (Luarn & Lin 2005; Wang et al. 2009). (Chau & Hu 2001) also found that users were more likely to use new innovation if they had strong feelings of easiness with those innovations.

Observability

(Rogers 2003) defined the observability as the degree to which the results of an innovation are viable to others. Role modeling (or peer observation) is the key motivational factor in the adoption and diffusion of technology (Parisot, 1997). Similar to relative advantage, compatibility, and trialability, observability also is positively correlated with the rate of adoption of an innovation. (Al-Jabri and Sohail 2012) used this in the context of mobile banking and found that it was significant.

Trialability

According to (Rogers 2003), trialability is the degree to which an innovation may be experimented with on a limited basis, where trialability is positively correlated with the rate of adoption. Therefore, more an innovation is tried, the faster its adoption. Potential adopters who were allowed to experiment with an innovation would feel more comfortable with it and were more likely to adopt it (Agarwal & Prasad, 1998; Tan & Teo, 2000).

Adoption and usage of ICT in Education

Determinants to the adoption and usage of ICT in Education have been studied over the last years. Among these determinants are training and professional development opportunities, level of technical support, ICT infrastructure, proper curricula, available time, confidence, resistance to change, attitudes, and beliefs (SALAM et al., 2018). It is worth mentioning that these determinants comprehend from individual traits and preferences from a micro perspective to macro conditions, such as national regulations. All these conditions and their interplay matter when studying the ICT usage in Education and its effects. Within the technology acceptance perspective, many studies in Education have been produced, most of them applying TAM to e-learning (Granić; Marangunić, 2019). According to (Granić & Marangunić 2019), TAM and its variations represent a credible model for facilitating the assessment of diverse learning technologies, and its core constructs are robust in learning settings. The TAM's predominance in Education seems not to differ from other sectors. The model is pervasive across sectors and ICT types. Taking the central constructs perceived ease of use and perceived usefulness, it is coherent with expectancy theory to assume that user's perception of how easy it is to use technology and how useful this is in achieving practical goals are relevant on motivating the user to adopt this technology, not only in Education but in all sectors.

Regarding external factors (those excluding perceived ease of use and perceived usefulness), the most used ones in TAM models for e-learning are self-efficacy, subjective norm, enjoyment, computer anxiety, and experience (Abdullah; Ward, 2016). Also, these factors seem to matter for individual motivation in general, not only in Education. Even though TAM is the most-used theory in ICT acceptance research in Education, some studies have used UTAUT as the ground theory

(Kayali; Alaaraj, 2020). Some studies have applied UTAUT key constructs (performance expectancy; effort expectancy; social influence; and facilitating conditions) to evaluate e-learning adoption, such as the use of interactive whiteboards among teachers (Šumak; Šorgo, 2016), and the application of social media in research practices (Gruzd; Staves; Wilk, 2012). Also, some studies approximate resistance perspective, but without necessarily using the IS resistance approach models and even using acceptance perspective elements. (Torres, Evans and Schneider 2019) identify institutional-related barriers of institutional culture, faculty self-efficacy, and a lack of institutional support as the leading causes of implementation and adoption challenges in Education. (Muqtadiroh et al. 2019), on the other hand, propose that perceived threat, perceived usefulness, perceived inequity, and behavior intention are resistance factors to ICT usage in Education.

Retaking the expectancy theory, resistance determinants as uncertainty about technology's value, negative attitude, low self-efficacy, and lack of support are compatible with the constructs of perception of effort needed, performance level, and its outcomes in Education, which explains motivation (in this case, to resist to ICT in Education).

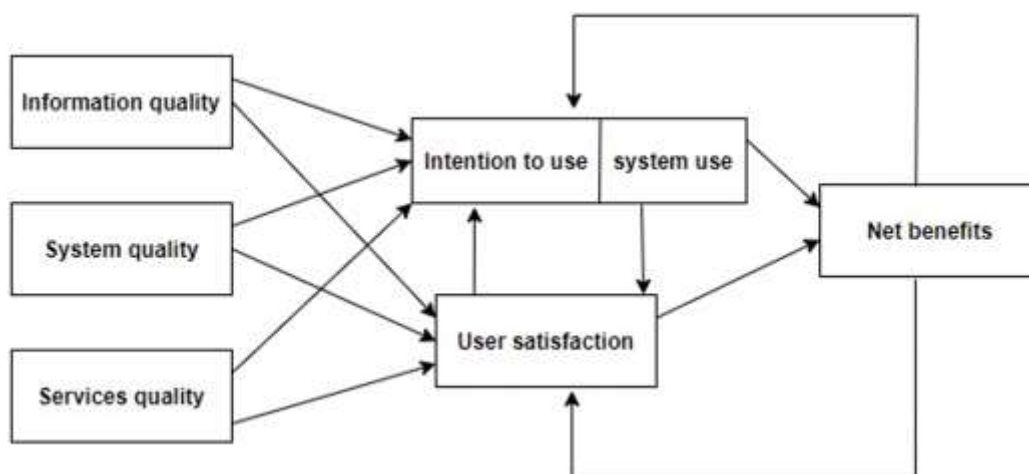
Information system success model (ISSM)

In 1992, (DeLone & McLean 1992) had proposed an Information system success model (ISSM) for measuring IS success in organizations to acquire the net benefit. They suggested that IS success is a multifaceted and symbiotic paradigm. Therefore, it is indispensable to study the interrelationships among those dimensions and control them. Subsequently, numerous scholars suggested some reforms to this model (Al-Shargabi & Sabri, 2016; Al-Shargabi & Sabri, 2015; Sabri, 2016). Consequently, in 2003, (DeLone & McLean 2016) incorporated some of the changes that scholars suggested and accordingly restructured their old model with the updated (ISSM) as illustrated in Fig. 5. They decided to augment the dimension of service quality, user satisfaction, intent to use, and net benefit thereof. The new model cited that service, system, information quality, system use, and user satisfaction are the critical success factors that lead to net benefits of using IS. The researchers argued that if IS success evaluation is desired then, service, system, information, and quality is the impacting factor of its subsequent use. User satisfaction is the

outcome of positive or negative benefits which will govern to promote the use of IS (DeLone & McLean, 2016).

Furthermore, this model illustrated in Fig. 4 is not limited to SME proprietor contentment only, yet it could be implemented and extended to placate the other users in industries, enterprises, and organizations by toting up other dynamics like hardware, software, network, security, policy, privacy, upper administration support, and structural traditional dynamics that influence IS evaluation (Kademete & Twinomurinzi, 2019).

Fig. 4: Updated DeLone and McLean information system success model (ISSM).



The updated ISSM and its success dimensions are listed below:

Information Quality: The level at which specific information obtained from the IS come to an agreement with the users' anticipations and desires in terms of timeliness, accurateness, safety, significance, intuitiveness, and information consistency. **System Quality:** The level at which the IS system executes and functions aligned with the accord, convenience, simplicity of use, browsing, and learning, response time, and effectual consumption.

Service quality: The level at which the ICT center provides the system support which lays emphasis on the learning process and service accurateness and sustainability. While IS runs for steadiness, dependability, swift retrieval, speediness, and fortification of the communal networking system.

System use: The function quality acuity for communal networking, proficient penetrating, information interchange, identity management, background cognizance, network cognizance, and contact management.

User satisfaction: The degree of gratification provided to students regarding usefulness and efficacy by a comprehensive social networking quality system.

Intention to use: The user's learning alacrity to use and continue to use e-learning applications.

Net benefits: It is the critical measure of triumph since it amplifies the negative and positive steadiness triumph of the system upon the users.

The IS recognizes the ISSM to be one of the most prominent models around. Further, its expediency has been quoted, verified, and established in several varied sectors including the academic institutions (Al-Shargabi & Sabri, 2015; Donovan et al., 2018; Hamidi & Jahanshaheefard, 2019; Martin, Modi & Feldman, 2021). Notably, this is the most popular model ever established that has been in use on a frequent basis for testing the gratification levels of users, owners, and customers. Technology and human communication have a forecast divergence which is the subject of key disagreement between IS and schools (Kock, 2015; Al-Shargabi & Sabri, 2016; Yakubu & Dasuki, 2018). The school's key objective in establishing didactic guidance to both technology and management is based on e-learning acceptance by student's affirmative attitude and willingness. Consequently, this study aims to offer an ISSM based evaluation model. Figure 5 above, illustrates the proposed model in this study for e-learning success evaluation from the student's viewpoint. It describes and evolves measures of information, service, and system excellence and correlating impacts. There is an emergent requisite for e-learning adoption assessment based on previous studies and discourse.

This study has evolved six sets of ISSM based factors that contribute to e-learning project in selected Secondary Schools in Mfoundi Division. Those factors are information quality, system quality, service quality, student satisfaction, system use, and net benefit to using ELS. According to the literature (Yakubu & Dasuki, 2018; Al Zoubib & Jali, 2014; Martins et al., 2019; Opoku,

Pobee & Owusu Okyireh, 2020), it is believed that there is a scarcity in the literature case studies in Arab countries and further debate about the e-learning system with an Information system is a prerequisite. The implementation of the model should be bespoke according to the socio-economic, cultural, psychographic, geographic, and demographic conditions in the Arab countries in order to circumvent failures keeping in view the inferences of the literature (Alhomod & Shafi, 2013; Al-Kofahi, Hassan & Mohamad, 2020; AlMulhem, 2020).

The current study, therefore, embraces the Information system's success model in assessing the administrative and policy challenges influencing e-learning Implementation in secondary schools in Mfoundi division. The key variables in the model are critical for e-learning implementation in secondary schools (Net benefits). The Information Success model utilizes a multidimensional approach appropriate for different e-learning implementation contexts. Therefore, the model has established justifiable recommendations applicable to the current dispensation of e-learning implementation. Thus, the need to assess administrative and Policy challenges influencing e-learning Implementation in secondary schools in Mfoundi division.

The primary research objective is to propose a research model which applies Information system adoption combined with literacy philosophies for further usage comprehension. To accomplish this objective, an empirical study was conducted on selected Secondary Schools in Mfoundi Division. A systematic literature review of some articles related to e-learning systems adoption and information system success model (ISSM) is summarized as a Theoretical foundation as shown in Table 1 below. By utilizing the Scopus database. This study is based on articles and conference papers from the years 2013 to 2023.

Table 1: The adoption of an E-learning system with an Information system success model perspective in the literature review.

Literature	The result	Year	Factors
Saputra et al., (2020)	The study showed that the education quality and service quality in ISSM has positive effects on student's satisfaction while using e-learning.	2020	Performance Expectancy; Effort System quality, information quality and service quality affects user satisfaction and actual usage

Martins et al., (2019)	This model provides an elucidation to the incongruous literature outcomes regarding the overall user consummation quality versus usage as per actual. Finally, the study accomplished with the discoveries about the impact of technology disruption upon the behaviors of the online learners.	2019	System quality, information quality and service quality, user satisfaction, and actual usage
Pérez-Pérez, SerranoBedia & García-Piqueres, (2020)	The findings of this study revealed that the quality of the information is the most proper indicator of students' satisfaction, while satisfaction is the most applicable determining factor of perceived learning results.	2020	Course quality, system quality, information quality, and corresponding impacts.
Alksasbeh et al., (2019)	An eminence attributes model for MSNs for higher education learning environment was suggested in this study.	2019	System quality, information quality, network quality, service quality, user satisfaction, and behavioral intention to use.
AlMulhem, (2020)	The result of this study revealed that quality factors (course content quality, system quality, and service quality) have a positive and significant impact on students' satisfaction with e-learning system quality.	2020	SD phase, MLD phase, LCD phase
Yakubu & Dasuki, (2018)	The objective of this study was to test the acceptance factors for Canvas learning management system for the students of a private university in Nigeria.	2018	System quality, information quality, service quality, user satisfaction, behavioral intention, and actual usage
Opoku, Pobe & Owusu Okyireh, (2020)	This was the first ever kind of study endeavored to analyze the acceptance of e-learning by the lecturers with the implementation of Information System Success and Technology Adoption Models in a University in Ghana.	2020	System quality, perceived usefulness, service quality, information quality, lecturers' satisfaction, intention to use, and actual usage
Sandjojo & Wahyuningrum, (2016)	The findings of this study showed that e-learning advantages can be effectively executed and clarified by its independent variables based on the information system model.	2016	System quality, information quality, service quality, user satisfaction, and behavioral intention

Eom, (2013)	This study tested the predetermined IS success model in an e-learning context, which is a strictly involuntary use setting. The investigation of this study provided empirical proof to support an alternative DSS assessment model that can replace “system use” as the pivotal element of IS success model, with “perceived usefulness”	2013	System quality, perceived usefulness, service quality
Effendy, Kurniawati & Priambada, (2021)	The results of this study showed that e-learning student satisfaction was impacted by service quality, information quality, and quality of education. Simultaneously, the intention to use is impacted by the quality of education. Likewise, user satisfaction and intention to use e-learning influence the real use of e-learning. This study is explored to aid leaders of higher education to more readily understand the adequacy of using elearning by students.	2021	System quality, information quality, network quality, and service quality, user satisfaction, and behavioral intention to use.
Ahmed & Seliaman, (2017)	Study results showed that the main indicators of students' continued intention to use E-learning systems are Perceived Benefits, Perceived Satisfaction, and Academic Motivation. The impact of each Tasktechnology fit, Performance expectancy, Knowledge Quality, and Information Quality on student's Perceived Satisfaction with utilizing Elearning systems was also additionally critical.	2017	System quality, perceived usefulness, service quality, information quality, lecturers' satisfaction, intention to use, and actual usage

Empirical Review

Pedagogical e-learning

The best approach to be adopted to achieve effective learning is known as pedagogy (Hussein & Al-Chalabi, 2020; Tarno et al., 2011). The creation of multi-faceted pedagogical practices through the utilization of ICTs can empower students and learners to achieve higher learning and interaction (Aljaber, 2018; Portuguese Castro & Gomez Zermeno, 2020). One of such efforts in creating a good pedagogical system is what is called computer-supported collaborative learning (CSCL) which is intended to create dominant learning and communication atmosphere via the application of integrated collaborative learning and the use of ICT (Lin & Lin, 2019; Lukas & Yunus, 2021). The CSCL can drive better peer interaction and group work, and promote higher levels of dissemination and sharing of knowledge and expertise within the learning society (Lukas & Yunus, 2021; Wahyuningtyas & Idris, 2020). Pedagogy is fundamental and instrumental in achieving well-desired learning outcomes (Manazir & Rubina, 2020; Olaniran, 2009). Pedagogy thus needs the teacher to understand how students learn to integrate, design, and deliver course materials and mentor students adequately (Ananga, 2020; Olaniran, 2009). Pedagogy is therefore instrumental and the cornerstone to the development and diffusion of e-learning technology since without it the desired learning outcomes cannot be achieved (Monjaraz-Fraustro et al., 2021; Olaniran, 2009). E-learning systems must be designed to meet the different approaches to pedagogy especially in areas such as individual and group interaction and online assessment (Ananga, 2020; Olaniran, 2009).

An e-learning pedagogy should have the following characteristics; learner-centered, engaged and active, constructive, situated and contextual, social and collaborative, reflective, and timely feedback mechanism (Dehtiarova et al, 2020; Vrasidas, 2004; Yelland & Tsembas, 2008). Achieving a good pedagogical e-learning environment may be hampered by lack of; adequate skills and knowledge required to design and teach virtually, support and training required for developing e-learning instructions, real-time face to face interaction, requisite design and development tools to effectively deliver teaching online, good technological infrastructure and incentives, and compensation as motivation for teachers to delivery lectures online (Enbuska et al., 2018; Monjaraz-Fraustro et al., 2021; Vrasidas, 2004).

Technical training

Technical support and training are integral components of the development, implementation, and integration of ICT in the education environment but this element is overlooked by my stakeholders (Nawaz & Qureshi, 2010; Taat & Francis, 2020). Training challenges have to do with the training requirement that will enable the teacher to adapt to and learn the features and function appropriately to use the system effectively (Hadullo et al., 2018; Olaniran, 2009). Familiarity with technology is vital in achieving a successful learning experience in the e-learning system (Beinicke & Bipp, 2018; Olaniran, 2009). With adequate availability of technical support, it can influence the extent of participation and readiness toward the adoption of e-learning systems and is considered as one of the cardinal factors in the success of e-learning systems (Alhomod & Shafi, 2013).

The issue of technical support and training is vital for both students and teachers. The technical training and support for teachers are required to empower the teacher with the needed resources and technical knowledge as well as skills for the successful integration of technology in the traditional classroom systems (Ayu, 2020; Farhan et al., 2019). On other hand, for students, technical support and training facilitate their acquisition of knowledge and skills in their learning and academic targets (Portuguez Castro & Gomez Zermeno, 2020). It can cover areas such as installations, operation, maintenance, security, and network system management, and hard and software challenges (Maatuk et al., 2021).

Review studies on E-learning system challenges

E-learning usage and adoption among users is a challenging issue for many schools, both in developed and developing countries, but it is likely to be less of a concern in developed countries over the willingness of their students to accept and use the e-learning system, as significant progressive steps have already been taken, according to literatures, in this regard (Almaiah et al. 2016b). (Eltahir, 2019) indicated that the challenges of adopting e-learning system in developing countries, however, remain a reality due to the digital divide with the developing countries.

Our existing literature review identified several challenges related to adopting the e-learning system. After this review, we noted that these challenges could be classified into four categories namely (1) technological challenges, (2) individual challenges, (3) cultural challenges and (4) course challenges. We found also that these challenges are very different from one country to another country, due to different culture, context and readiness. For example, lack of ICT knowledge, poor network infrastructure and weakness of content development were the main challenges of e-learning system adoption in developing countries (Aung and Khaing 2015). Another study revealed that system characteristics, internet experience and computer self-efficacy were the main issues that impede the successful adoption of e-learning system in Pakistan (Kanwal and Rehman 2017). A similar study conducted in Kenya identified three main challenges of e-learning are inadequate ICT infrastructure, lack of technical skills and financial constraints (Tarus et al. 2015). A study by Kisanga and Ireson (Mulhanga & Lima 2017) identified that poor interface design; inadequate technical support and lack of IT skills are the primary barriers that hinder the successful implementation of existing e-learning projects. (Mulhanga and Lima; Kenan et al. 2013) claimed that cultural, political, and economical constraints are the main reasons to fail the e-learning initiatives in Libya.

In the same way, Kenan et al. (Chen and Tseng 2012) classified the challenges that affect the actual use of e-learning into four categories: management challenges, technological challenges, implementation challenges and cultural challenges. Despite these efforts, none of these studies have investigated the actual challenges that face users during the use of e-learning system. A study conducted by (Al-Araibi et al. 2019), which puts the technological issues as the main criteria for the success of e-learning system, indicated that 45% of e-learning projects in developing countries are total failures, 40% are partial failures, while only 15% are successful. Therefore, based on these findings, along with other studies, many researchers in the field of IS/IT have conducted researches in order to look into the challenges to the successful implementation of e-learning system initiatives (Al-Araibi et al. 2019).

Table 2 summarizes the common issues that caused the low usage and adoption of e-learning system.

Reasons of E-learning failures	Description	Literature
Technological Challenges	Students facing technological difficulty in using e-learning system	Almaiah and Almulhem (2018) Almaiah and Alyoussef (2019), Al-Araibi et al. (2019), Gutiérrez-Santiuste and Gallego-Arruf (Ali et al. 2018a), Mtebe and Raisamo (2014),
Lack of technical support	Unavailability of technical staff and lack support of facilities to perform various activities and (installation, operation, maintenance, network administration and security) Slow speed of internet and high internet traffic during e-learning experience.	Eltahir (2019), Esterhuyse and Scholtz (2015), Islam et al. (2015), Al-Azawei et al. (2016), Nwabufo et al. (2013)
Lack of Awareness	Students lacking awareness of internet skills and reluctance of students in taking responsibility for their own e-learning	Bozkaya and Kumtepe (Bozkaya et al. 2012), Nagunwa and Lwoga (Lwoga and Nagunwa 2012), Alajmi et al., (Ali et al. 2018b), Nwabufo et al. (2013), Al-Araibi et al. (2019), Naveed et al. (2017), Kisanga and Ireson (2015), Al Gamdi and Samarji (2016).
Schools Readiness	Students possessing inconsistent e-learning readiness over time	Al-Araibi et al. (2019), Eltahir (2019), Naveed et al. (2017), Stoffregen et al. (2016), Al-Azawei et al. (2016), Kisanga and Ireson (2015), Al Gamdi and Samarji (2016)
Quality Content	Course Content having less quality in terms of interactivity	Almaiah and Almulhem (2018), Mtebe and Raisamo (2014), Almaiah and Alyoussef (2019), Almaiah, Jalil and Man (Almaiah et al. 2016a)
Localization of content	Lack of Customization/Adaptability of	Voogt et al. (2013), Lester and Perini (2010), Kwofie and Henten (2011), Ozudogru and

	course content according to students requirements	Hismanoglu (2016), Almaiah and Almulhem (2018), Mtebe and Raisamo (2014), Almaiah and Alyoussef (2019) Almaiah and Man (2016)
Course content	Lack of relevance, accuracy of course content and misalignment of course content with learners' need	Voogt et al. (2013), Lester and Perini (2010), Kwofie and Henten (2011), Ozudogru and Hismanoglu (2016), Almaiah and Almulhem (2018), Mtebe and Raisamo (2014), Almaiah and Alyoussef (2019) Almaiah and Man (2016)
IT skills of Faculty members	Weak IT skills of faculty members	Almaiah and Alyoussef (2019), Iqbal and Ahmad (2010), Radijeng (2010), Nawaz and Khan (2012)
Faculty members acceptance of e-learning systems	Teachers' lacking technology acceptance	Vershitskaya et al. (2020), Teo (2011), Almaiah and Almulhem (2018)
Low Level of knowledge of faculty members	Instructors lacking grip on course content while delivering an e-learning session	Uppal (2017), Marzilli et al. (2015), Almaiah and Alyoussef (2019)
Faculty member effort	Lack of effort and support being put faculty members in use of e-learning	Pegrum et al. (2013), Teo and Wong (2013), Güllü et al. (2016), Marzilli et al. (2015), Almaiah and Alyoussef (2019)
lack of security and privacy concerns	Openness of e-learning systems challenging security of personal information of students/staff/faculty	Kwofie and Henten (2011), Ozudogru and Hismanoglu (2016), Almaiah and Almulhem (2018), Mtebe and Raisamo (2014), Almaiah and Alyoussef (2019) Almaiah and Man (2016)
Lack of technological infrastructure	Refers to the hardware, software, facilities, and network capabilities within the university	Almaiah and Almulhem (2018), Mtebe and Raisamo (2014), Almaiah and Alyoussef (2019), Almaiah et al. (2016a)

Table 2 presents a comparison between nine studies regarding the main challenges of the e-learning system usage and adoption through conducting empirical studies to identify the issues in developing countries that are affecting low adoption by users, according to literature reviews. Six studies identified that technological challenges such as lack of technological infrastructure, lack of security and privacy concerns are among the most significant reasons for the failures of e-

learning adoption, while three studies identified lack of student's awareness as being responsible for the failure of e-learning adoption. Three studies mentioned that school's readiness is one of the most significant reasons for the failures of e-learning adoption. However, the problem of low usage and adoption still exists due to some factors that cause learners' reluctance to use the new technology in Jordan, similar to other developing countries (Al-Khasawneh & Obeidallah 2019; Almaiah & Al Mulhem 2019). Therefore, empirical researches are important to identify the main challenges that faces the e-learning system usage during COVID-19 pandemic in order to help decision makers in schools to overcome the issue of low usage of e-learning system, which is the objective of this research.

CHAPTER THREE

METHODOLOGY

This section discusses the research methodology used for collecting and analyzing data. It reveals the processes used to collect data from the field. The section opens with a description of the research design and how the study was carried out. Next, we discussed the study area, the population of the study, the target population, and the accessible population from which our sample size was derived. We then received the sample and the sampling techniques that were employed. The data-gathering tools and methods for validating them were discussed. The processes for administering the instruments were also discussed, data analysis techniques elucidated, ethical considerations, and reiteration of the hypothesis.

Research Design

A descriptive survey design was employed for this study, and a regression prediction design was used to gather data. Using descriptive design and regression analysis, you can predict results and elucidate the effect of independent variables on the dependent variable. Researchers use the regression test to predict the effect of two or more variables or sets of scores (Creswell, 2012). According to (Amin 2005), a research design is a strategy that details information on a certain issue and should be gathered and processed. It is a broad framework that describes the steps that will be taken to collect the data needed to respond to the research question or hypothesis. (Amin 2005) claims that a research design outlines the steps the researcher will take, from writing or creating the hypothesis to the final data analysis. Data is gathered using a quantitative approach to ascertain whether and how strongly the variables affect each other (Technological Infrastructure, Teacher Readiness and Training, Content and Curriculum Adaptation, Administrative and Policy Challenges, Overall Impact and Effectiveness). At the end of this research, quantitative data was collected and analyzed, and the findings were generalized to the entire study population. With prediction design, researchers aim to predict outcomes by employing specific factors as predictors rather than merely associating variables. Therefore, prediction studies are valuable because they aid in predicting or anticipating future behavior.

Area of Study

The purpose of this section is to describe the study area in terms of locality, topography, and history. A research area is a physical site where a study or a current research project is being conducted. This research was done in the Mfoundi division in Cameroon's Center Region. The researcher's familiarity with the study area because of its accessibility. Selecting a locality other than delegations could have required more time and prolonged the data collection process.

Population of Study

According to (Amin 2005), a population is the totality of all the components relevant to certain research. When concluding a sampling study, the researcher is interested in the entirety or aggregate of things or people with one or more traits in common (Amin, 2005). (Asiamah et al. 2017), believe that population members must share at least one common attribute. This characteristic qualifies participants as population members. Five thousand six hundred and ninety-seven (5697) teachers from public and private institutions in Mfoundi make up the study population (Division of personnel, the divisional delegation of secondary education, 2023).

Target Population

The researcher intends to generalize the findings to this population. The target population, often known as the parent population, may not always be reachable to the researcher (Amin, 2005). For (Asiamah et al. 2017), the set of people or participants with particular traits of interest and relevance is referred to as the target population, and it is the portion of the general population that remains after it has been refined. The researcher must therefore identify and exclude members of the general population who might not be able to share experiences and ideas in sufficient clarity and depth from the target population. Thus, the target population of this study comprises ten (10) public schools drawn from the seven subdivisions of Mfoundi division. Teachers were chosen because they are the sole guarantors of quality education in the country, which is why emphasis should be placed on pedagogic supervision of the teaching and learning process.

Table 3: Distribution of target population

No	Name of School	Sub-division where it is located	Target Population
1.	Government Bilingual High School Emana	Yaounde 1	175
2.	Government Bilingual High School Nyom	Yaounde 1	85
3.	Government Bilingual High School Nkol-Eton	Yaounde 2	183
4.	Government Bilingual Practising High School Yaounde	Yaounde 3	245
5.	Government Bilingual High School Ekounou	Yaounde 4	195
6.	Government Bilingual High School Mimboman	Yaounde 4	170
7.	Government Bilingual High School Yaounde	Yaounde 5	199
8.	Government Bilingual High School Etoug-Egbe	Yaounde 6	285
9.	Government Bilingual High School Mendong	Yaounde 6	277
10.	Government Bilingual High School Ekorezock	Yaounde 7	164
	Total		2077

Source: Division of personnel, the divisional delegation of secondary education 2023

Table 3 shows the total number of teachers in all the Government Bilingual High School in Mfoundi. Therefore, ten (10) government bilingual high schools in Mfoundi have a total population of two thousand and seventy-seven teachers.

Accessible population

This is the population from which the sample is actually drawn (Amin,2005). (Asiamah et al., 2017) corroborate this by postulating that after eliminating every member of the target population who might or might not engage in the study or who cannot be reached during that time, the accessible population is then reached. The last group of participants is the one from whom data is gathered by polling either the entire group or a sample taken from it. If a sample is to be taken from it, it serves as the sampling frame. People eligible to engage in the study but unable to participate or would not be available at the time of data collection are referred to as the accessible population. The accessible population of this study is drawn from seven (07) government bilingual high schools where teachers of the English sub-system of education were targeted. The researcher, therefore, had access to 1438 teachers drawn from the seven (07) schools, as seen below.

Table 4: Distribution of accessible population per school

No	Name of school	Sub-division where it is found	Accessible population
1	Government bilingual high school Emana	Yaounde 1	175
2	Government bilingual high school Nkol-Eton	Yaounde 2	183
3	Government bilingual practicing high school Yaounde	Yaounde 3	245
4	Government bilingual high school Ekounou	Yaounde 4	195
5	Government bilingual high school Yaounde	Yaounde 5	199
6	Government bilingual high school Mendong	Yaounde 6	277
7	Government bilingual high school Ekorezock	Yaounde 7	164
	Total		1438

Source: Division of personnel, divisional delegation of secondary education 2023

Table 4 above shows the accessible population, which is 1432 in the targeted seven schools.

Sample of the study

The sample of this research work was drawn from the accessible population of 1438 teachers of the English sub-system of education from the seven schools the researcher had access. (Amin 2005) views a sample as a portion of the population whose results can be generalized to the entire population. The author adds that a sample can also be considered representative of a population. (Majid 2018) corroborates this by asserting that because the community of interest typically consists of too many people for any research endeavor to involve as participants, sampling is a crucial tool for research investigations. A good sample is one that statistically represents the target population and is sizable enough to provide an answer to the research issue.

The sample size was determined using Krejcie & Morgan table (1970), which constituted 306 teachers, civil servants, PTA or contract workers are drawn from seven schools representing the seven sub-divisions in Mfoundi. They were drawn in such a way that all teachers of GBHS should be represented.

Table 5: Distribution of sample per school

No	Name of school	Sub-division	Accessible population	Sample
1	Government bilingual high school Nkol-Eton	Yaounde 2	183	44
2	Government bilingual high school Emana	Yaounde 1	175	44
3	Government bilingual practicing high school Yaounde	Yaounde 3	245	45
4	Government bilingual high school Ekounou	Yaounde 4	195	44
5	Government bilingual high school Yaounde	Yaounde 5	199	44
6	Government bilingual high school Mendong	Yaounde 6	277	45
7	Government bilingual high school Ekorezock	Yaounde 7	164	40
	Total		1432	306

Sampling technique

Every research involves, to some degree or another, a sampling process. Sampling is one of the most important steps in research; when carefully done, it will lead to valid results. Sampling is a process of selecting representative portions of a population that permits the researcher to make utterances or generalisations concerning the said population. It can also be the process of selecting elements from a population so that the sampled elements selected represent the population. Sampling is involved when any choice is made about studying some people, objects, situations, or events rather than others. A good sample should be representative of the population from which it was extracted. Regardless of the sampling approach, the researcher should be able to describe the characteristics and relate them to the population (Amin,2005).

Sampling techniques refer to the various strategies a researcher uses to draw out a sample from the parent population of the study (Amin,2005). There are two main sampling techniques; probability and non-probability techniques. The sampling technique suitable for this study is probability sampling, in which all the elements of the population have some probability of being selected. Probability sampling will provide a base for the researcher to make generalizations about the population.

The type of probability sampling technique employed in this research is simple random sampling (SRS). (Amin 2005) opined that a simple random sample is a sample obtained from the population in such a way that samples of the same size have equal chances of being selected. The researcher

proceeded through this method by selecting the accessible population comprising seven government bilingual high schools in Mfoundi Division. This was done through the random number method, in which (Amin 2005) says if there are numbers that identify the elements of the population, then the random number method will be appropriate. The researcher proceeded as follows; The numbers 01, 02, 03, 04, 05, 06, 07, 08, 09 and 10 were attributed to all the government bilingual high schools in the Mfoundi division on folded pieces of paper in a basket. The researcher pleaded with two neighbors who randomly selected 3 and 4 schools each from the basket. These seven schools were selected to represent the seven schools used in the accessible population.

Through this technique, no school or teacher was left out, ensuring the representativeness of all government bilingual high schools in the Mfoundi division.

Instrument for Data collection

An instrument is any tool that has been methodically built to collect data and should be gathered accurately. The questionnaire is the tool utilized to gather data for this investigation. According to Amin's definition from 2005, a questionnaire is a professionally crafted tool used to gather data in line with the research questions and hypothesis requirements. He continues by saying that a questionnaire can be considered a self-report tool used to collect data on factors of interest in research. A questionnaire is a useful tool for gathering survey data, providing structured, frequently numerical data, being able to be administered without the researcher's presence, and frequently being comparatively simple to analyze, as (Cohen et al. 2007) reiterated. It is a tool for gathering data with specific questions that the respondent must answer and then return to the researcher. There are two different kinds of questionnaires: closed and open-ended. The type of study is the only factor influencing the questionnaire selection. This study will use closed-ended questions, including Likert-style rating scales and dichotomous questions. These closed questions are simple to code and take little time to complete.

According to (Creswell, 2009), a questionnaire takes a quantitative approach to measure perceptions and provides data upon which generalizations can be made on the views of a given population on a particular phenomenon. In this study, self-administered questionnaire was preferred, given that the targeted respondents could read and express themselves effectively. The

researcher used a self-administered questionnaire to capture the teachers' views on the evaluation of the challenges and prospects in the adoption of e-learning project in selected public secondary schools in Mfoundi Division. It is a rigorous instrument prepared by the researcher about the research problem under investigation, which is to be used to collect information from respondents. It consists of a carefully selected set of questions or statements requiring respondents' answers. The collection of the research-developed questionnaire titled:

Table 6: Variables and statements

Variables	Statements
Technological Infrastructure	1, 2, 3, 4, 5
Teacher Readiness and Training	6, 7, 8, 9, 10
Content and Curriculum Adaptation	11, 12, 13, 14, 15
Administrative and Policy Challenges	16, 17, 18, 19, 20
Overall Impact and Effectiveness	21, 22, 23, 24, 25

All the five-cluster had five statements each, all relating to the research questions that guided the study. The response format for all the clusters are based on a four-point scale of strongly agree (SA), Agree (A), Disagree (D) and strongly disagree (SD). In other words, the higher the aggregate scores on the rating scale, the more positive the response of the subjects and the lower the score, respondents indicated their level of agreement by ticking (√) on the rating scale.

Table 7: Questionnaire options and corresponding weights on the Likert scale

Option	Weight
Strongly Agree (SA)	4 Points
Agree (A)	3 Points
Disagree(D)	2 Points
Strongly Disagree (SD)	1 Point

Table 6 shows how the questionnaire was weighted with the various options, from 4 points for SA to 1 point for SD.

Validation of the Instrument of data Collection

According to Amin (2005), validation refers to the accuracy of the instrument in measuring what the researcher intends to measure. Validity refers to measurement instrument and the level to which it saves the purpose of it design. The validity of the instrument can be affirmed with the reason that the questions were simple, understandable and easy for the respondents to answer. Face validity was adopted this was done by giving the initial draft of the questions to expert raters and

were kindly requested to examine the adequacy of the statement relevance and suitability of language, structuring and sequencing of ideas and appropriateness of the instrument.

The comments and observations of these experts were used for modifications of the instrument. They modified some of the research questions and improved on the clarity of the questionnaire statements and the clarity of the response scale format of strongly Agree (SA), Agree (A), Disagree (D) and strongly Disagree (SD). Their comments were incorporated in the revised version of the questionnaire statements. Our method of distributing questionnaires to the respondent was face-to-face distribution. We later collected the questionnaire in a week. This was to give room for the respondents to take their time in filling the questionnaires without any inconvenience.

Face Validity

The questionnaire was carefully studied by specialists in instrument development and the supervisor in charge of the dissertation for examination and screening in case of any error. Some were adjusted, maintained and others disqualified.

Content Validity

The statements on the questionnaire were examined by the supervisor in relation to the objective of our work. After proper examination and acceptance of the statements, the content of the instruments was made valid. It was distributed to Teachers of the selected schools and were collected a week after. During the exercise, the researcher permitted the respondents to pose questions where necessary. At the end, most of the copies were collected and the return rate was recorded.

Pilot Study

The researcher then conducted a pilot test in Government Bilingual High School Etoug-Egbe which did not constitute part of the sample. We did pilot study because we wanted to develop and test the adequacy of the research instrument. It might also give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated. The teachers responded and the internal consistency of the clusters were determined using Cronbach alpha which gave us

a reliability of .874. The coefficient for the clusters was high enough for the study to realize the instrument because it reveals a complete understanding of the content of the questionnaire. This procedure ensures the content validity of the instrument.

Reliability of the study

The questionnaire was pre-tested with comparable respondents drawn from outside the area of the study. Results of the pilot testing were used in computing relevant reliability. The instruments were trial tested using 10 teachers in Government Bilingual High School Etoug-Egbe. The teachers responded and the internal consistency of the six clusters was determined using Cronbach alpha which gave us a reliability of .874. The coefficient of the clusters was high enough for the study to utilize the instrument. After using the questionnaire for the study, we had a Cronbach alpha of .879 implying the instrument was reliable.

Method of data collection.

The researcher took an authorization of research from the Dean of the Faculty of Education from the University of Yaounde 1. She first of all went to the Centre Regional Delegation for Secondary Education of Mfoundi Division, where she carried out documentary research on statistics of teachers in the division. She went to the schools and obtain permission from the principals. The permission was granted. As far as questionnaire administered were concern, they were distributed to all the teachers of the school's concern and was collected after with a research confirmation signed by the principals of the respective schools. During the exercise, the researcher permitted the teachers to ask questions where necessary. At the end, most of the copies were collected. This gave a return rate of 90.84%

The return rate of the instrument

The return rate indicates the number of questionnaires that were received at the end of the research after the questionnaires were administered to respondents. The return rate for this study was calculated using a simple percentage based on the formula below:

$$R = \frac{\sum RQ}{\sum AQ} \times 100\%$$

Where;

R= Return rate

$\sum RQ$ = Sum of questionnaires returned

$\sum AQ$ = Sum of questionnaires administered

% = Percentage expressed as a hundred

The rate of return of questionnaires for this study was calculated as follows;

Total number of questionnaire administered = 306

Total number of questionnaires returned= 278

Therefore, return rate is = $278/306 * 100 = 90.84\%$

Methods of data analysis

This study made use of a method of data analysis by which each hypothesis is taken and material to answer or provide a test is provided. Consequently, a regression method was used. Data were presented using tables and descriptive statistics like percentages, frequencies, and means were used. Correlation as well as the statistically more advanced method of multiple regression analyses was used in data analyses.

A regression method was the main method used in this study. Regression methods form the backbone of most of the analyses in research. In general, these methods are used to estimate associations between variables, especially when one or more of these variables are continuous. To answer the research question on how the independent variables, affect the dependent variable, a standard multiple regression analysis was conducted on the data in SPSS. The multiple regression analyses attempt to find out whether independent variables are able to predict the dependent variable and which of those independent variables is the strongest predictor of the dependent variable, in this case, teacher's effectiveness, and is, therefore, the most suitable analysis tool for the current research (Pallant, 2005).

CHAPTER FOUR

FINDINGS

This study aimed to evaluate the challenges and prospects of the e-learning project adoption in selected public secondary schools in Mfoundi Division. This chapter seeks to answer the questions raised in the study and test the research hypotheses.

Data Screening

The data was screened for univariate outliers of the returned questionnaire, there were neither outliers nor missing values. Hence the analysis of the study will be based on a total of 278 questionnaire.

Demographic characteristics

Table 8: Frequency and Percentage Distribution of Respondents based on Gender

Gender of participants	Frequency	Percent
Male	100	36.0
Female	178	64.0
Total	278	100.0

The table represents the sex distribution of respondents. In the context of this study, we used a population of 278 respondents. According to the table, 100 of the respondents are male while 178 of the respondents are female, making a percentage of 36 and 64, respectively. This variation is due to the fact that there are more females than males in the sample schools. This indicates that most of the teachers in secondary schools in Mfoundi-Division are females. Similar results are illustrated in the figure below.

Fig. 5: Frequency and Percentage Distribution of Respondents based on Gender

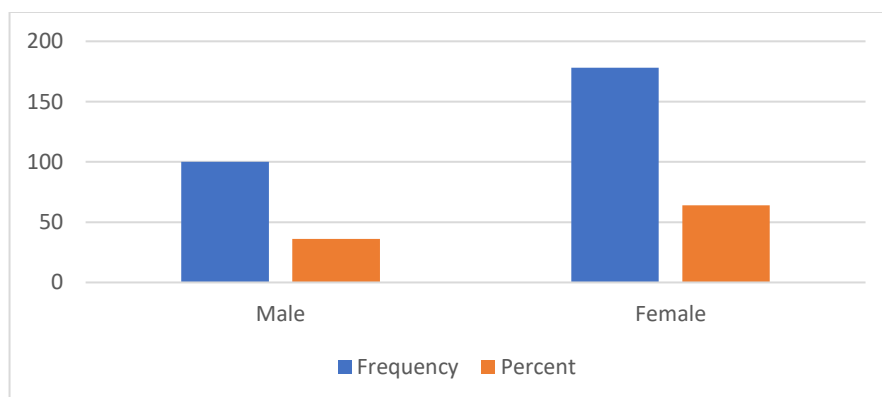
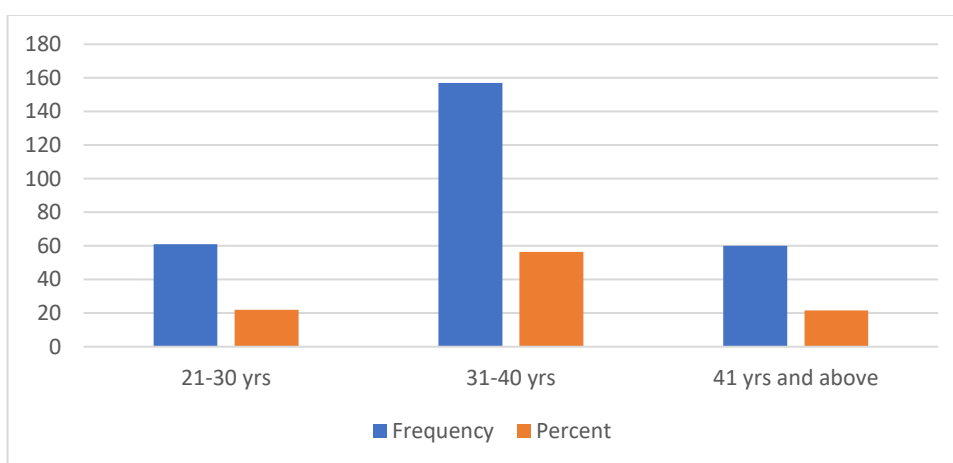


Table 9: Frequency and Percentage Distribution of Respondents based on Age Group

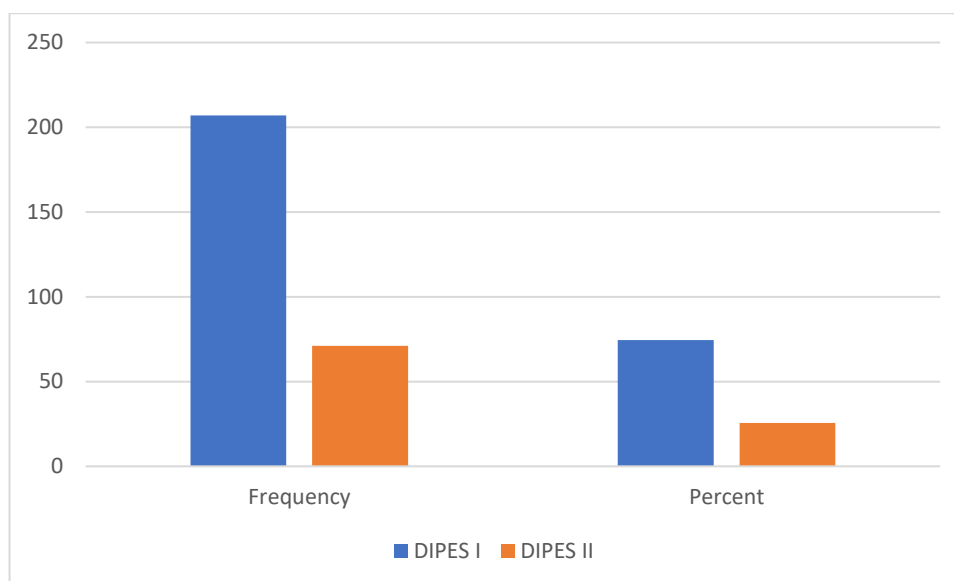
Age	Frequency	Percent
21-30 yrs	61	21.9
31-40 yrs	157	56.5
41 yrs and above	60	21.6
Total	278	100.0

The result shows that 21.9 % of the teachers are 21 to 30 years, 56.5% have ages between 31 to 40 years, and 21.6% have ages between 41 years and above.

Fig. 6: Frequency and Percentage Distribution of Respondents based on Age Group**Table 10: Frequency and Percentage Distribution of Respondents based on Qualification**

Qualification of Teachers	Frequency	Percent
DIPES I	207	74.5
DIPES II	71	25.5
Total	278	100.0

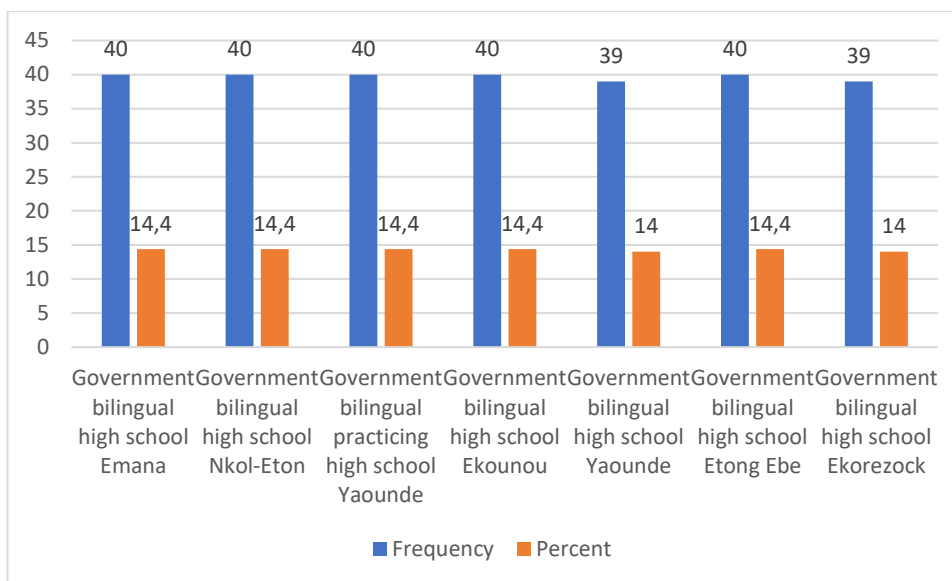
With respect to qualification, more than half of the respondents (74.5%) are holders of DIPES I, and 25.5% are holders of DIPES II.

Fig. 7: Frequency and Percentage Distribution of Respondents based on Qualification**Table 11: Frequency and Percentage Distribution of respondent base on schools**

Name of School	Frequency	Percent
Government bilingual high school Emana	40	14.4
Government bilingual high school Nkol-Eton	40	14.4
Government bilingual practicing high school Yaounde	40	14.4
Government bilingual high school Ekounou	40	14.4
Government bilingual high school Yaounde	39	14.0
Government bilingual high school Etong Ebe	40	14.4
Government bilingual high school Ekorezock	39	14.0
Total	278	100.0

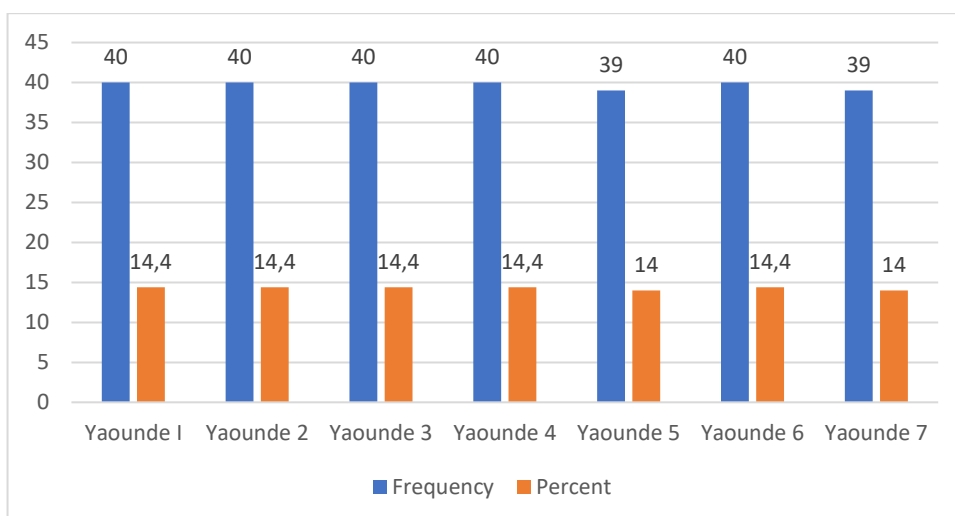
The above table represent the seven selected bilingual secondary school in Mfoundi Division, questionnaire was distributed in these schools. Government bilingual high school Emana with a frequency of 40, giving a percentage of 14.4, Government bilingual high school Nkol-Eton with a frequency of 40, giving a percentage of 14.4, Government bilingual practicing high school Yaounde and Government bilingual high school Ekounou both with a frequency of 40 giving a percentage of 14.4, Government bilingual high school Yaounde with a frequency of 39 giving a percentage of 14.0, Government bilingual high school Etong Ebe with a frequency of 40 giving a percentage of 14.4, and Government bilingual high school Ekorezock with a frequency of 39 giving a percentage of 14.0.

This same result is represented in the figure below.

Fig. 8: Frequency and Percentage Distribution of Respondents based on Qualification**Table 12: Frequency and Percentage Distribution table on School Location**

Location of school	Frequency	Percent
Yaounde 1	40	14.4
Yaounde 2	40	14.4
Yaounde 3	40	14.4
Yaounde 4	40	14.4
Yaounde 5	39	14.0
Yaounde 6	40	14.4
Yaounde 7	39	14.0
Total	278	100.0

According to the table above, questionnaire was distributed in seven sub division that make up Mfoundi Division. These sub divisions were Yaounde 1 with a frequency of 40, giving a percentage of 14.4, Yaounde 2 with a frequency of 40, giving a percentage of 14.4, Yaounde 3 and Yaounde 4 both with a frequency of 40 giving a percentage of 14.4, Yaounde 5 with a frequency of 39 giving a percentage of 14.0, Yaounde 6 with a frequency of 40 giving a percentage of 14.4, and Yaounde 7 with a frequency of 39 giving a percentage of 14.0. This same result is represented in the figure below.

Fig. 9: Frequency and Percentage Distribution based on School Location**Answer to research questions****Research Question 1: What are the impacts of technological infrastructure in secondary schools on the implementation e-learning project?.**

Five items were designed in the questionnaire to respond to this section. From the table below, two of the five items designed to answer this question has a mean below the 2.5 cut-offs.

Table 13: Frequency and percentage of technological infrastructure and e-learning project

No	Item	SA		A		D		SD		M	SD
		f	%	f	%	f	%	f	%		
1	Our school has the necessary technological infrastructure to support effective e-learning.	19	6.8	162	58.3	41	14.7	56	20.1	2.52	.890
2	Internet connectivity has hindered the successful implementation of e-learning.	8	2.9	128	46.0	106	38.1	36	12.9	2.39	.746
3	Inadequate availability of computers for teachers has been a challenge.	19	6.8	151	54.3	57	20.5	51	18.3	2.50	.870
4	The school provides reliable access to necessary e-learning tools and resources	19	6.8	118	42.4	91	32.7	50	18.0	2.38	.857

5	Technical support is readily available to address e-learning-related issues.	16	5.8	122	43.9	97	34.9	43	15.5	2.40	.817
	Grande mean						2.44				
	SD						.529				

According to the data shown in the table, it can be seen that a majority of respondents, namely 65.1%, hold the belief that the educational institution has the essential technical infrastructure required for facilitating e-learning. Approximately 34.9% of the participants expressed apprehensions regarding the educational institution's electronic learning framework. The average score is 2.52, suggesting a generally favourable feeling, although with some levels of dissent. The calculated standard deviation (SD) of 0.890 indicates a moderate level of variability in the viewpoints. A significant proportion of the participants, namely 48.9%, have expressed apprehensions over the potential hindrance of e-learning due to issues related to internet access. A majority of respondents, namely 51.1%, do not consider internet access to be a problem. The calculated mean score of 2.39 suggests a certain level of consensus in relation to the given statement. The calculated standard deviation (SD) of 0.746 indicates a lower degree of variability in the collected answers. A significant majority of participants, comprising 61.1%, concur that the insufficiency of computer resources accessible to educators poses a noteworthy obstacle.

A total of 38.9% of the participants expressed their disagreement with the aforementioned statement. The average score is 2.50, suggesting a reasonable level of agreement. The observed standard deviation (SD) of 0.870 indicates the presence of variability in the expressed viewpoints. A total of 49.2% of the participants expressed agreement with the notion that the educational institution offers dependable access to e-learning tools and resources. A total of 50.8% of the participants in the study conveyed their worries or expressed disagreement. The average score is 2.38, suggesting a moderate level of consensus but also considerable divergence of opinions. The calculated standard deviation (SD) of 0.857 indicates a modest level of variability in the replies. A significant proportion of the participants, namely 49.7%, expressed their agreement about the accessibility of technical help. A significant proportion, namely 50.3%, of the participants expressed apprehension over the accessibility of technical assistance. The calculated mean score of 2.40 suggests a moderate level of agreement among participants, but with some noticeable

discrepancies. The calculated standard deviation (SD) of 0.817 indicates a modest level of variability in the collected data. In general, the findings of the study indicate a certain level of consensus about the difficulties and assistance associated with the e-learning infrastructure and resources inside the educational institution. Nevertheless, it is important to acknowledge that there exists a discernible range of viewpoints, as seen by the standard deviations. The average score of 2.44 for the "Grande mean" indicates a modest degree of agreement or pleasure across all claims.

Research Question 2: What are the degrees of readiness exhibited by secondary schools teachers in implementing e-learning project?

Five items were designed in the questionnaire to respond to this section. From the table below, four of the five items designed to answer this question has a mean below the 2.5 cut-offs.

Table 14: Frequency and percentage of readiness exhibited and e-learning project.

No	Item	SA		A		D		SD		M	SD
		f	%	f	%	f	%	f	%		
1	Teachers have received sufficient training to effectively use e-learning tools and platforms.	20	7.2	170	61.2	56	20.1	32	11.5	2.64	.779
2	Lack of confidence among teachers in using e-learning tools has been a hurdle.	33	11.9	131	47.1	88	31.7	26	9.4	2.62	.814
3	Lack of familiarity among teachers in using e-learning tools has been a hurdle.	10	3.6	163	58.6	64	23.0	41	14.7	2.51	.787
4	Teachers are adequately supported in integrating e-learning into their teaching methods.	22	7.9	157	56.5	76	27.3	23	8.3	2.64	.746
5	There have been	9	3.2	137	49.3	96	34.5	36	12.9	2.43	.755

continuous professional development opportunities related to e-learning provided to teachers.	
Grande mean	2.57
SD	.472

According to the data shown in the table, it can be seen that a majority of respondents, namely 68.4%, expressed agreement with the notion that instructors had obtained an adequate level of training. A total of 31.6% of the participants expressed their disagreement or strong disagreement on the adequacy of the training provided. The calculated mean score of 2.64 suggests a mostly favourable mood and a high level of agreement among the participants. The calculated standard deviation (SD) of 0.779 indicates a certain degree of variety in viewpoints, however it is generally agreed upon that the level of training provided is satisfactory. A significant majority of participants, including 59% of the total respondents, expressed agreement (combining the responses of "Strongly Agree" and "Agree") with the notion that the lack of teacher trust has been a significant obstacle. A significant proportion of participants, namely 41%, expressed a dissenting viewpoint in relation to the aforementioned remark. The calculated mean score of 2.62 suggests a mostly favourable mood and a high level of agreement among the participants. The calculated standard deviation (SD) of 0.814 indicates a certain degree of variety in viewpoints. However, on the whole, there is a consensus that the lack of confidence is a significant obstacle. A majority of respondents, namely 62.2%, agree that the obstacle they have encountered is attributed to a lack of knowledge.

A total of 37.8% of the participants expressed their disagreement with the aforementioned statement. The average score is 2.51, suggesting a level of agreement that is somewhat lower compared to the preceding two statements. The calculated standard deviation (SD) of 0.787 indicates the presence of variety in the collected views. A majority of respondents, namely 64.4%, expressed agreement with the notion that instructors get sufficient assistance. A total of 35.6% of the participants expressed their disagreement with the aforementioned statement. The average score is 2.64, suggesting a generally favourable feeling and a high level of consensus. The

calculated standard deviation (SD) of 0.746 indicates a certain degree of heterogeneity in the expressed viewpoints. However, it can be concluded that there is a general consensus that the level of support is deemed satisfactory. A majority of respondents, namely 52.5%, expressed agreement with the presence of ongoing professional development opportunities. A total of 47.5% of the participants expressed their disagreement with the aforementioned remark. The calculated mean score of 2.43 suggests a level of consensus among participants, yet it also reveals a notable degree of divergence in opinions. The calculated standard deviation (SD) of 0.755 indicates a moderate level of variety in the viewpoints. In general, the findings of the survey indicate a prevailing favourable mood and consensus among participants with regards to teacher training and support for e-learning. Nevertheless, there exists a degree of heterogeneity in viewpoints, especially pertaining to the familiarity of teachers and the accessibility of ongoing professional development opportunities. The average score of 2.57 for the "Grande mean" signifies a modest degree of concurrence or contentment across all assertions, while the standard deviation of 0.472 shows a relatively limited range of variation in the replies.

Research Question 3: What are the impacts of Content and Curriculum Adaptation on the process of implementing e-learning project?

Five items were designed in the questionnaire to respond to this section. From the table below, three of the five items designed to answer this question has a mean below the 2.5 cut-offs.

Table 15: Frequency and percentage of content and curriculum adaptation and e-learning project.

No	Item	SA		A		D		SD		M	SD
		f	%	f	%	f	%	f	%		
1	The school has successfully adapted the curriculum for effective e-learning delivery.	13	4.7	165	59.4	73	26.3	27	9.7	2.59	.729
2	The school has developed appropriate e-learning content.	17	6.1	138	49.6	94	33.8	29	10.4	2.51	.763

3	The school has curated appropriate e-learning content.	4	1.4	141	50.7	110	39.6	23	8.3	2.45	.666
4	The school has aligned e-learning content with in-person teaching methods is a struggle.	8	2.9	128	46.0	109	39.2	33	11.9	2.40	.733
5	Lack of interaction between students and teaching staff	22	7.9	173	62.2	51	18.3	32	11.5	2.67	.783
	Grande mean						2.53				
	SD						.442				

The table above shows that 63.1% of respondents (Strongly Agree + Agree) believe that the school has successfully adapted the curriculum. 36.9% of respondents (Disagree + Strongly Disagree) have concerns about the adaptation of the curriculum. The mean score is 2.59, indicating a relatively positive sentiment and strong agreement. The standard deviation (SD) of 0.729 suggests some variability in opinions, but overall, there is agreement that the curriculum has been adapted effectively. 55.7% of respondents agree (Strongly Agree + Agree) that the school has developed appropriate e-learning content. 44.3% of respondents disagree with this statement. The mean score is 2.51, indicating some agreement but also a fair amount of disagreement. The standard deviation (SD) of 0.763 suggests moderate variability in opinions. 52.1% of respondents agree that the school has curated appropriate e-learning content. 47.9% of respondents disagree with this statement. The mean score is 2.45, indicating some agreement but also a fair amount of disagreement. The standard deviation (SD) of 0.666 suggests moderate variability in opinions. 49.0% of respondents agree that aligning e-learning content with in-person teaching methods is a struggle. 51.0% of respondents disagree with this statement. The mean score is 2.40, indicating some agreement but also a fair amount of disagreement. The standard deviation (SD) of 0.733 suggests moderate variability in opinions.

70.1% of respondents (Strongly Agree + Agree) believe that there is a lack of interaction between students and teaching staff. 29.9% of respondents (Disagree + Strongly Disagree) do not perceive a lack of interaction. The mean score is 2.67, indicating a relatively positive sentiment and strong

agreement regarding the lack of interaction. The standard deviation (SD) of 0.783 suggests some variability in opinions, but overall, there is agreement on this issue. Overall, the survey results suggest a mixed picture in terms of e-learning and curriculum-related aspects. While there is generally positive sentiment and agreement in some areas (e.g., curriculum adaptation, lack of interaction), there is also notable disagreement in other areas (e.g., development and curation of e-learning content). The mean score of 2.53 for the "Grande mean" indicates a moderate level of agreement or satisfaction across all statements, and the standard deviation of 0.442 suggests relatively low variability in responses.

Research Question 4: What are the impacts of Administrative and Policy Challenges on the process of implementing e-learning project?

Five items were designed in the questionnaire to respond to this section. From the table below, two of the five items designed to answer this question has a mean below the 2.5 cut-offs.

Table 16: Frequency and percentage of Administrative and policy challenges and e-learning project.

No	Item	SA		A		D		SD		M	SD
		f	%	f	%	f	%	f	%		
1	Adequate funding has been allocated for e-learning infrastructure and resources.	10	3.6	188	67.6	41	14.7	39	14.0	2.61	.770
2	School policies adequately address the unique challenges of e-learning.	11	4.0	121	43.5	107	38.5	39	14.0	2.37	.772
3	School guidelines adequately address the unique challenges of e-learning.	14	5.0	173	62.2	60	21.6	31	11.2	2.61	.751
4	Administrative processes have hindered the smooth	17	6.1	135	48.6	101	36.3	25	9.0	2.52	.744

	implementation of e-learning initiatives.										
5	Bureaucratic processes have hindered the smooth implementation of e-learning initiatives.	3	1.1	108	38.8	122	43.9	45	16.2	2.24	.731
	Grande mean						2.47				
	SD						.487				

The table above shows that 71.2% of respondents (Strongly Agree + Agree) believe that adequate funding has been allocated. 28.8% of respondents (Disagree + Strongly Disagree) have concerns about the adequacy of funding. The mean score is 2.61, indicating a relatively positive sentiment and strong agreement. The standard deviation (SD) of 0.770 suggests some variability in opinions, but overall, there is agreement that funding is adequate. 47.5% of respondents agree (Strongly Agree + Agree) that school policies adequately address e-learning challenges. 52.5% of respondents disagree with this statement. The mean score is 2.37, indicating some agreement but also a fair amount of disagreement. The standard deviation (SD) of 0.772 suggests moderate variability in opinions. 67.2% of respondents agree that school guidelines adequately address e-learning challenges. 32.8% of respondents disagree with this statement. The mean score is 2.61, indicating a relatively positive sentiment and strong agreement. The standard deviation (SD) of 0.751 suggests some variability in opinions. 54.7% of respondents agree that administrative processes have hindered implementation. 45.3% of respondents disagree with this statement. The mean score is 2.52, indicating some agreement but also a fair amount of disagreement.

The standard deviation (SD) of 0.744 suggests moderate variability in opinions. 40.0% of respondents agree that bureaucratic processes have hindered implementation. 60.0% of respondents disagree with this statement. The mean score is 2.24, indicating some agreement but also a fair amount of disagreement. The standard deviation (SD) of 0.731 suggests moderate variability in opinions. Overall, the investigation results suggest a mixed sentiment regarding e-learning funding, policies, and administrative challenges. There is generally positive sentiment and

agreement in some areas and more disagreement in others (e.g., school policies, administrative processes). The mean score of 2.47 for the "Grande mean" indicates a moderate level of agreement or satisfaction across all statements, and the standard deviation of 0.487 suggests relatively moderate variability in responses.

Implementation of e-learning project

Five items were designed in the questionnaire to respond to this section. From the table below, all five items designed to answer this question has a mean below the 2.5 cut-offs.

The table below shows that 79.5% of respondents (Strongly Agree + Agree) believe that e-learning initiatives have positively contributed to student's learning experiences. 20.5% of respondents (Disagree + Strongly Disagree) have concerns about the positive impact of e-learning initiatives. The mean score is 2.83, indicating a very positive sentiment and strong agreement. The standard deviation (SD) of 0.573 suggests relatively low variability in opinions, indicating strong consensus on this statement.

Table 17: Frequency and percentage of Implementation of e-learning project

No	Item	SA		A		D		SD		M	SD
		f	%	f	%	f	%	f	%		
1	Despite the challenges, e-learning initiatives have positively contributed to students' learning experiences.	18	6.5	203	73.0	49	17.6	8	2.9	2.83	.573
2	The benefits of e-learning outweigh the drawbacks encountered during implementation.	13	4.7	164	59.0	96	34.5	5	1.8	2.67	.595
3	Our school is committed to continuously improving and	25	9.0	164	59.0	79	28.4	10	3.6	2.73	.670

	refining its e-learning strategies.										
4	I possess an email address and I use it in the learning context.	18	6.5	171	61.5	89	32.0			2.75	.566
5	The e-learning process gives us flexibility to navigate in learning resources	43	15.5	148	53.2	78	28.1	9	3.2	2.81	.728
	Grande mean									2.76	
	SD									.317	

63.7% of respondents agree (Strongly Agree + Agree) that the benefits of e-learning outweigh the drawbacks. 36.3% of respondents disagree with this statement. The mean score is 2.67, indicating overall agreement but with some disagreement. The standard deviation (SD) of 0.595 suggests moderate variability in opinions. 68.4% of respondents agree that the school is committed to improving e-learning strategies. 31.6% of respondents disagree with this statement. The mean score is 2.73, indicating agreement and a commitment to improvement. The standard deviation (SD) of 0.670 suggests moderate variability in opinions. 68.0% of respondents agree that they possess and use an email address in the learning context. The mean score is 2.75, indicating agreement. The standard deviation (SD) of 0.566 suggests relatively low variability in responses.

68.7% of respondents agree that e-learning provides flexibility in navigating learning resources. The mean score is 2.81, indicating agreement. The standard deviation (SD) of 0.728 suggests moderate variability in opinions. Overall, the results suggest a generally positive sentiment toward e-learning and its impact on learning experiences. There is strong consensus on some statements (e.g., positive contribution of e-learning, email usage), while others show more moderate agreement with some level of disagreement (e.g., benefits vs. drawbacks of e-learning, commitment to improvement). The mean score of 2.76 for the "Grande mean" indicates a relatively high level of agreement or satisfaction across all statements, and the standard deviation of 0.317 suggests relatively low variability in responses, especially for the first statement.

Correlation analysis

To test the previously established hypotheses with the help of simple linear regression analyses, (Saunders et al. 2016) states that the collected data has to meet the precondition that is concerned with the linearity of the relationship between the separate IVs and the DV. Therefore, in the first instance, the researchers have produced scatterplots of the relationships between the different IVs, namely technological infrastructure, degrees of readiness, Content and Curriculum Adaptation and Administrative and Policy Challenges towards Effective eLearning Adoption as DV. Looking at the various scatterplots, it can be detected that the relationship between the different IVs and the DV in all cases is linear.

Table 18: Correlations among variables

	Technological Infrastructure	Teacher Readiness and Training	Content and Curriculum Adaptation	Administrative and Policy Challenges	Effective eLearning Adoption
Technological Infrastructure					
Teacher Readiness and Training	.583**				
Content and Curriculum Adaptation	.514**	.610**			
Administrative and Policy Challenges	.460**	.571**	.527**		
Effective eLearning Adoption	.147*	.160**	.272**	.131*	

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

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

The data given in this study demonstrates a significant and moderately strong correlation ($r = 0.583$) between Technological Infrastructure and Teacher Readiness and Training. This suggests that there exists a favourable association between the progress of technological infrastructure and the improvement of teacher readiness and training. There is a significant and positive correlation ($r = 0.514$) between Technological Infrastructure and Content and Curriculum Adaptation. The statement posits a correlation between the strengthening of technological infrastructure and the improvement in the adaptation of material and curriculum for e-learning. A positive and moderate correlation coefficient of 0.460 is observed between Technological Infrastructure and Administrative and Policy Challenges. This suggests that the use of technological breakthroughs

in infrastructure has the potential to mitigate administrative and policy challenges to some extent. A favourable and statistically significant correlation ($r = 0.610$) has been seen between teacher preparedness and training, and the ability to modify material and curriculum. This finding indicates that the level of readiness and training among instructors has a beneficial impact on their capacity to adapt and change educational content and curriculum for e-learning purposes. There is a notable and strong correlation ($r = 0.571$) between Teacher Readiness and Training and Administrative and Policy Challenges. This suggests that educators who get sufficient training and preparation are better equipped to navigate the administrative and policy challenges that arise in the context of e-learning.

A significant and positive correlation ($r = 0.527$) has been seen between the adaptation of content and curriculum and the challenges related to administration and policy. This implies that the challenges associated with modifying content and curriculum are somewhat influenced by administrative and policy-related elements. There is a slight positive correlation ($r = 0.147$) between Technological Infrastructure and Effective E-learning Adoption. This suggests that while there exists a relationship between improved technological infrastructure and higher adoption of e-learning, the magnitude of this connection is very low. A significant correlation of modest magnitude (0.160) is seen between Teacher Readiness and Training and the successful adoption of E-learning. This implies that there exists a positive relationship between the level of readiness shown by instructors and the degree to which the implementation of e-learning is successful. There is a positive and moderately strong correlation ($r = 0.272$) between Content and Curriculum Adaptation and the successful adoption of E-learning. This discovery implies that the effective adoption of e-learning is positively correlated with the successful adaption of content and curriculum.

A positive correlation coefficient of 0.131 is observed between the variables of Administrative and Policy Challenges and Effective E-learning Adoption. This suggests that while there may exist some administrative and policy-related challenges that might possibly hinder the integration of e-learning, the relationship between these factors and the actual execution of e-learning is very tenuous. Overall, the observed correlations suggest that there are relationships between the factors related to e-learning, with varied levels of intensity. The aforementioned links possess the capacity

to provide valuable insights into the many factors that impact the acceptability and subsequent effectiveness of e-learning courses.

Regression Analysis

The various assumptions underlying simple regression were examined. The correlations between the independent variables and the dependent variable were above 0.2 and thus were acceptable for the regression analysis (Tabachnick & Fidell, 2007). Moreover, there were not very high correlations ($r > 0.9$) (Field, 2009) between the independent variables. For further evaluation to check multicollinearity, which indicates a perfect linear relationship between two or more of the independent variables, the tolerance and variance inflation factor (VIF) values were examined. All the tolerance values were above 0.1 and the VIF values were less than 10, thus the data set did not indicate multicollinearity (Field, 2009; Tabachnick & Fidell, 2007).

The Mahalanobis distance was used to check for outliers. Mahalanobis distance "is the distance of a case from the centroid of the remaining cases where the centroid is the point created at the intersection of the means of all the variables" (Tabachnick & Fidell, 2007, p. 74). It reveals cases that lie at a distance from the other cases, and such cases are considered outliers. Mahalanobis distance is evaluated using chi-square distribution. "Mahalanobis distance is distributed as a chi-square (X^2) variable, with degrees of freedom equal to the number of independent variables" (Tabachnick & Fidell, 2007, p. 166). In order to detect which cases are multivariate outliers, the critical X^2 value of the number of degrees of freedom of the independent variables is compared with the Mahalanobis distance of the cases (Tabachnick & Fidell, 2007). Any case whose Mahalanobis distance value is greater than the critical X^2 is considered an outlier. (Tabachnick and Fidell 2007) have produced a table of critical X^2 values with which researchers can compare their Mahalanobis distance values. The data cases of the study were compared with this critical X^2 value. No case with critical values higher than what was prescribed by (Tabachnick and Fidell 2007) was detected.

Normality of the data set was checked with the Normal Probability Plot and the Scatterplot of the Standardised Residuals. The Normality Probability Plot produced a fairly straight diagonal plot, indicating that the points did not deviate from normality. Again, the scatterplot produced a

rectangular-shaped distribution of the residuals, with most points concentrated around zero (0). This indicated that the data was fairly normally distributed. SPSS produces unusual cases in a table called Case-wise Diagnostics for standard multiple regression. (Pallant 2005) alerted that the Casewise Diagnostics table has information on cases that have values above 3.0 or below -3.0 as their standardised residuals and that in normally distributed data, such cases should not be more than 1% of the total cases. In order to check if such cases have an effect on the results, one should have a look at the Cook's distance value. If the Cook's distance is more than 1, then there is call for concern (Field, 2009; Pallant, 2005; Tabachnick & Fidell, 2007). Though the Casewise Diagnostics produced a case with a standardised residual above 3 (in this case, it was 6.756), the Cook's distance produced a maximum value of 0.89. Thus, though the standardised residual is above 3, the maximum Cook's distance value was less than 1; therefore, this case can be included in the regression.

The standard regression with each of the four independent predictors (technological infrastructure, degrees of readiness, Content and Curriculum Adaptation and Administrative and Policy Challenges) to predict effective elearning adoption was used to verify each research hypothesis. The adjusted R^2 was reported because (Tabachnick and Fidell 2007) recommended that the R square tends to overestimate its true value in the population when the sample size is small and that the adjusted R square corrects the value of R square and thus produces a better predictor of the true population value.

Hypotheses Testing

H_{01} : Technological infrastructure in secondary schools has no statistically significant impact on the implementation e-learning project.

Regression

Regression was carried out to ascertain the extent to which Technological Infrastructure scores predict Effective eLearning Adoption.

Table 19: Model Summary of the effects of Technological Infrastructure on Effective eLearning Adoption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.147 ^a	.022	.018	.31350

a. Predictors: (Constant), Technological Infrastructure

b. Dependent Variable: Effective eLearning Adoption

The R-squared value of 0.022 suggests that Technological Infrastructure explains only a small fraction of the variability in Effective E-learning Adoption. This indicates that other factors not included in your model may have a stronger influence on Effective E-learning Adoption. The adjusted R-squared value is also very low, reinforcing the idea that the model does not capture much of the variation in the dependent variable. The correlation coefficient (R) of 0.147 indicates a weak positive relationship between Technological Infrastructure and Effective E-learning Adoption. While this relationship is statistically significant, its practical significance is limited due to its small magnitude.

Fig. 10: Scatterplot of the effects of Technological Infrastructure on Effective eLearning Adoption

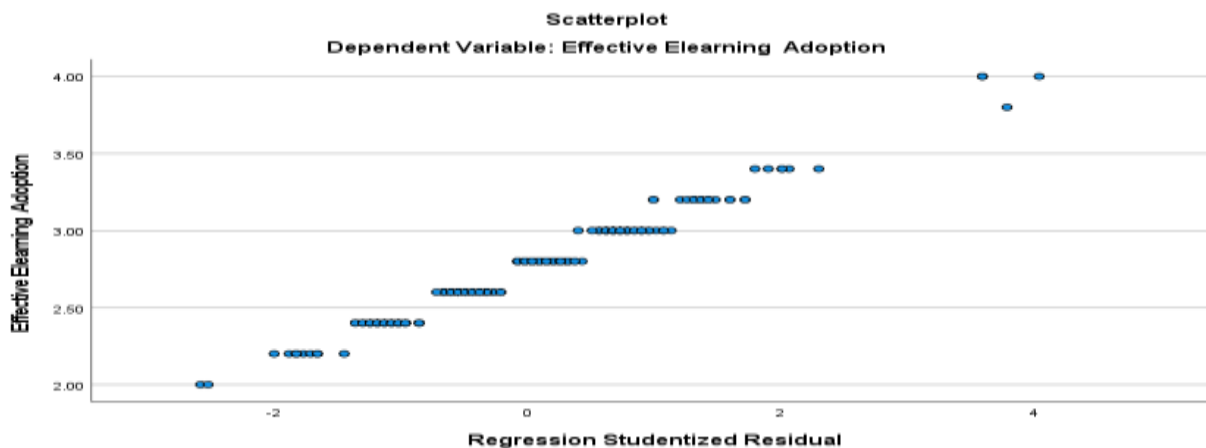


Table 20: ANOVA the effects of Technological Infrastructure on Effective eLearning Adoption

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.596	1	.596	6.065	.014 ^b
	Residual	27.126	276	.098		
	Total	27.722	277			

a. Dependent Variable: Effective Elearning Adoption

b. Predictors: (Constant), Technological Infrastructure

The ANOVA table indicates that the overall regression model (including the predictor Technological Infrastructure) is statistically significant ($p = 0.014$). This suggests that there is evidence to suggest that Technological Infrastructure has a significant effect on Effective E-learning Adoption. However, it's important to note that while the model is statistically significant, the R-squared value in your previous model summary indicated that Technological Infrastructure explains only a small portion of the variance in Effective E-learning Adoption. This means that other factors not included in the model may also be influencing Effective E-learning Adoption.

Table 21: Coefficients of the effects of Technological Infrastructure on Effective eLearning Adoption

Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	2.543	.089		28.660	.000
	Technological Infrastructure	.088	.036	.147	2.463	.014

a. Dependent Variable: Effective Elearning Adoption

The constant represents the estimated baseline value of Effective E-learning Adoption. The coefficient for Technological Infrastructure (0.088) is statistically significant ($p = 0.014$), suggesting that there is evidence to suggest that Technological Infrastructure has a positive effect on Effective E-learning Adoption. The standardized coefficient (Beta) indicates the strength of the relationship, and in this case, it suggests a modest positive impact of Technological Infrastructure on Effective E-learning Adoption. However, remember that the coefficient alone (0.088) suggests a relatively small effect size, and while it is statistically significant, other factors not included in the model may also play a role in explaining Effective E-learning Adoption.

H₀₂: Teachers readiness exhibited no statistically significant impact on the implementation e-learning project.

Regression was carried out to ascertain the extent to which Technological Infrastructure scores predict Effective eLearning Adoption.

Table 22: Model Summary of the effects of Teacher Readiness and Training on Effective eLearning Adoption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.160 ^a	.025	.022	.31286

a. Predictors: (Constant), Teacher Readiness and Training

b. Dependent Variable: Effective Elearning Adoption

The R-squared value of 0.025 suggests that Teacher Readiness and Training explains only a small fraction of the variance in Effective E-learning Adoption. This indicates that other factors not included in your model may have a stronger influence on Effective E-learning Adoption. The adjusted R-squared value is also very low, reinforcing the idea that the model does not capture much of the variation in the dependent variable. The correlation coefficient (R) of 0.160 indicates a weak positive relationship between Teacher Readiness and Training and Effective E-learning Adoption. While this relationship is statistically significant, its practical significance is limited due to its small magnitude.

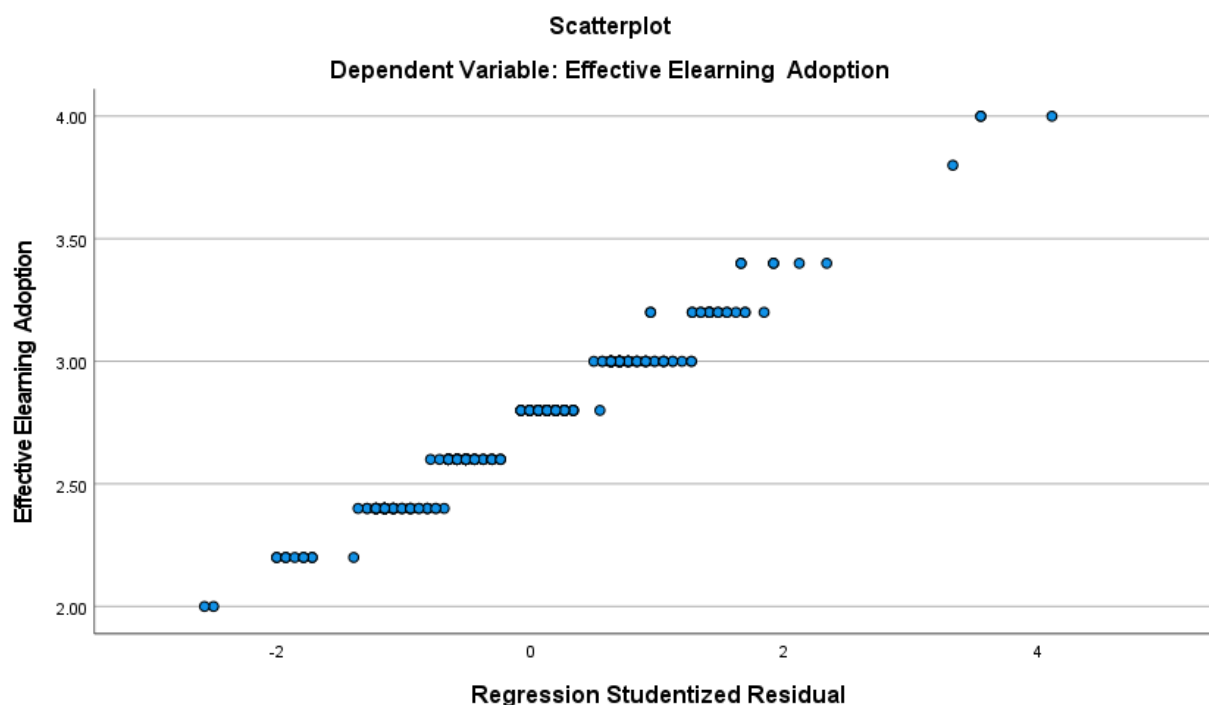
Table 23: ANOVA of the effects of Teacher Readiness and Training on Effective Elearning Adoption

Mod el		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.707	1	.707	7.220	.008 ^b
	Residual	27.015	276	.098		
	Total	27.722	277			

a. Dependent Variable: Effective Elearning Adoption

b. Predictors: (Constant), Teacher Readiness and Training

Fig. 11: Scatterplot of the effects of Teacher Readiness and Training on Effective Elearning Adoption



The table above shows that The ANOVA table indicates that the overall regression model (including the predictor Teacher Readiness and Training) is statistically significant ($p = 0.008$). This suggests that there is evidence to suggest that Teacher Readiness and Training has a significant effect on Effective E-learning Adoption. However, it's important to note that while the model is statistically significant, the R-squared value in your previous model summary indicated that Teacher Readiness and Training explains only a small portion of the variance in Effective E-learning Adoption. This means that other factors not included in the model may also be influencing Effective E-learning Adoption.

Table 24: Coefficients of the effects of Teacher Readiness and Training on Effective eLearning Adoption

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.482	.104		23.878	.000
	Teacher Readiness and Training	.107	.040	.160	2.687	.008

a. Dependent Variable: Effective eLearning Adoption

The constant represents the estimated baseline value of Effective E-learning Adoption. The coefficient for Teacher Readiness and Training (0.107) is statistically significant ($p = 0.008$), suggesting that there is evidence to suggest that Teacher Readiness and Training has a positive effect on Effective E-learning Adoption. The standardized coefficient (Beta) indicates the strength of the relationship, and in this case, it suggests a modest positive impact of Teacher Readiness and Training on Effective E-learning Adoption. However, remember that the coefficient alone (0.107) suggests a relatively small effect size, and while it is statistically significant, other factors not included in the model may also play a role in explaining Effective E-learning Adoption.

H₀₃: Content and Curriculum Adaptation has no statistically significant impact on the implementation e-learning project.

Regression was carried out to ascertain the extent to which Technological Infrastructure scores predict Effective eLearning Adoption.

Table 25: Model Summary of the effects of Content and Curriculum Adaptation on Effective eLearning Adoption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.272 ^a	.074	.071	.30498

a. Predictors: (Constant), Content and Curriculum Adaptation

b. Dependent Variable: Effective Elearning Adoption

The R-squared value of 0.074 suggests that Content and Curriculum Adaptation explains approximately 7.4% of the variance in Effective E-learning Adoption. This indicates that while there is a positive relationship, the predictor variable alone does not explain a large portion of the variability in Effective E-learning Adoption. The adjusted R-squared value, which accounts for the number of predictors, is still relatively low, indicating that there may be other factors not included in the model that also influence Effective E-learning Adoption. The positive correlation coefficient (R) of 0.272 indicates that there is a moderate positive relationship between Content and Curriculum Adaptation and Effective E-learning Adoption. However, the strength of this relationship is not very strong, as indicated by the relatively low R-squared value.

Fig. 12: Scatterplot of the effects of Content and Curriculum Adaptation on Effective eLearning Adoption

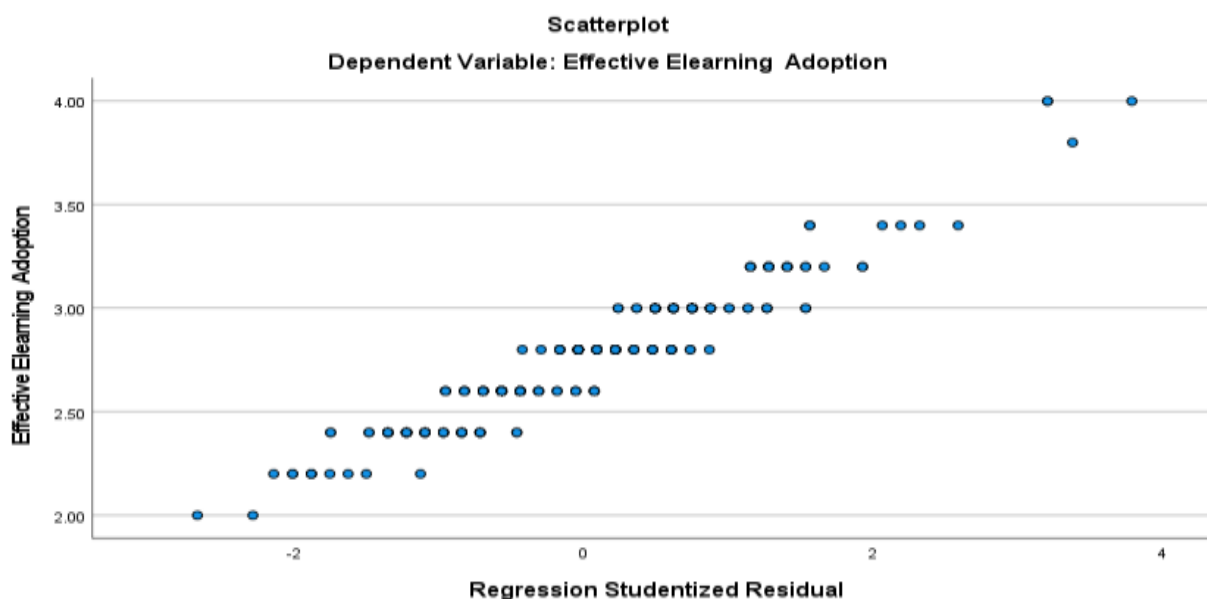


Table 26: Anova of the effects of Content and Curriculum Adaptation on Effective eLearning Adoption

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.050	1	2.050	22.036	.000 ^b
	Residual	25.672	276	.093		
	Total	27.722	277			

a. Dependent Variable: Effective Elearning Adoption

b. Predictors: (Constant), Content and Curriculum Adaptation

The table above shows that The ANOVA table indicates that the overall regression model (including the predictor Content and Curriculum Adaptation) is statistically significant ($p = 0.000$). This suggests that there is strong evidence to suggest that Content and Curriculum Adaptation has a significant effect on Effective E-learning Adoption. The majority of the variability in Effective E-learning Adoption is explained by the predictor variable Content and Curriculum Adaptation, as indicated by the large F-statistic and the very low p-value. This suggests that Content and Curriculum Adaptation plays a significant role in explaining the effectiveness of e-learning adoption, and the model as a whole is a good fit for the data. The remaining unexplained variability is accounted for by the residuals, which represent the random error or unexplained variance in the model.

Table 27: Coefficients of the effects of Content and Curriculum Adaptation on Effective eLearning Adoption

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.266	.106		21.327	.000
	Content and Curriculum Adaptation	.195	.041	.272	4.694	.000

a. Dependent Variable: Effective Elearning Adoption

The constant represents the estimated baseline value of Effective E-learning Adoption. The coefficient for Content and Curriculum Adaptation (0.195) is statistically significant ($p = 0.000$), suggesting that there is strong evidence to suggest that Content and Curriculum Adaptation has a significant positive effect on Effective E-learning Adoption. The standardized coefficient (Beta) indicates the strength of the relationship, and in this case, it suggests a moderate positive impact of Content and Curriculum Adaptation on Effective E-learning Adoption. In summary, based on this model, Content and Curriculum Adaptation has a statistically significant positive relationship with Effective E-learning Adoption. This suggests that improvements or changes in content and curriculum adaptation are associated with increased effectiveness in e-learning adoption.

H₀₄:Administrative and Policy Challenges has no statistically significant impact on the implementation e-learning project.

Regression was carried out to ascertain the extent to which Technological Infrastructure scores predict Effective eLearning Adoption.

Table 28: Model Summary of the effects of Administrative and Policy Challenges on Effective eLearning Adoption

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.131 ^a	.017	.014	.31420

a. Predictors: (Constant), Administrative and Policy Challenges

b. Dependent Variable: Effective Elearning Adoption

The R-squared value of 0.017 suggests that Administrative and Policy Challenges explain only a very small proportion (approximately 1.7%) of the variance in Effective E-learning Adoption. This indicates that there is a weak positive relationship between these challenges and e-learning. The

adjusted R-squared value, which accounts for the number of predictors, is still very low, indicating that there may be other factors not included in the model that also influence Effective E-learning Adoption. The positive correlation coefficient (R) of 0.131 suggests that there is a positive relationship between Administrative and Policy Challenges and Effective E-learning Adoption, but it's weak.

Fig. 13: Scatterplot of the effects of Administrative and Policy Challenges on Effective e-Learning Adoption

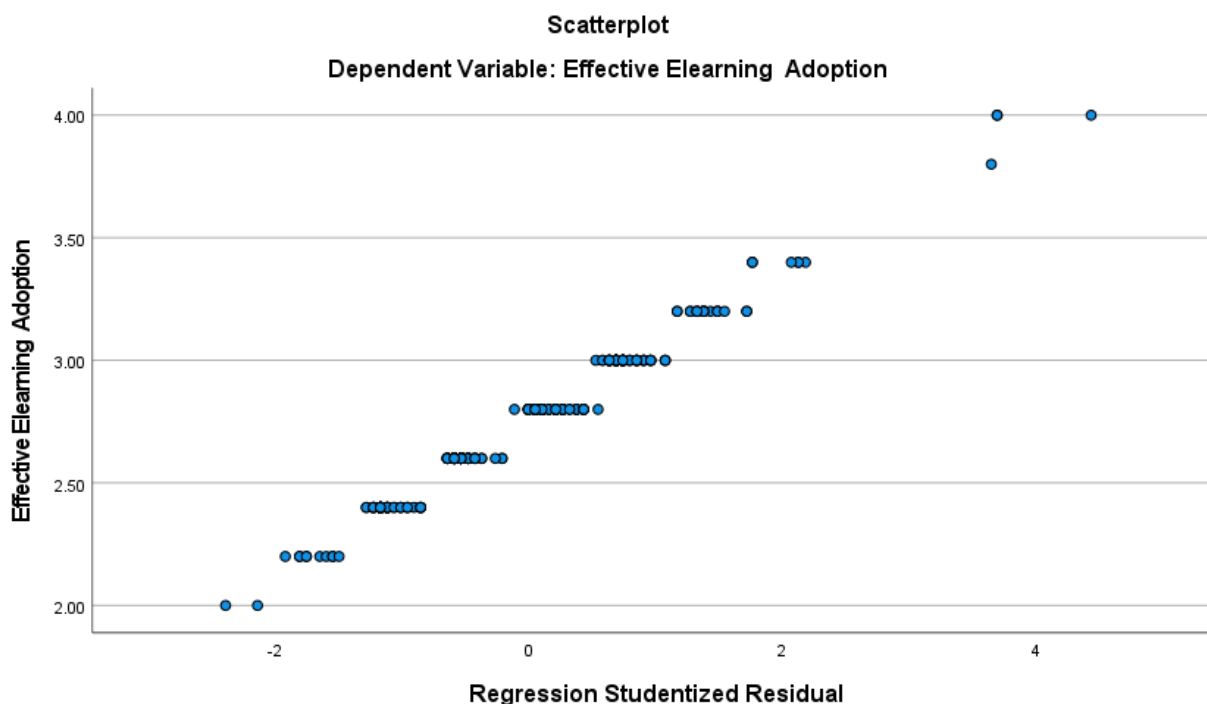


Table 29: ANOVA of the effects of Administrative and Policy Challenges on Effective eLearning Adoption

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.474	1	.474	4.802	.029 ^b
	Residual	27.248	276	.099		
	Total	27.722	277			

a. Dependent Variable: Effective Elearning Adoption

b. Predictors: (Constant), Administrative and Policy Challenges

The ANOVA table indicates that the overall regression model (including the predictor Administrative and Policy Challenges) is statistically significant ($p = 0.029$). This suggests that there is evidence to suggest that Administrative and Policy Challenges have a significant effect on

Effective E-learning Adoption. The variation in Effective E-learning Adoption is partially explained by the predictor variable Administrative and Policy Challenges, as indicated by the F-statistic and the p-value less than 0.05. This suggests that Administrative and Policy Challenges play a statistically significant role in explaining the effectiveness of e-learning adoption, though the effect may still be relatively modest. The remaining unexplained variability is accounted for by the residuals, which represent the random error or unexplained variance in the model.

Table 30: Coefficients of the effects of Administrative and Policy Challenges on Effective eLearning Adoption Top of Form

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.547	.098		26.092	.000
	Administrative and Policy Challenges	.085	.039	.131	2.191	.029

a. Dependent Variable: Effective eLearning Adoption

The constant represents the estimated baseline value of Effective E-learning Adoption. The coefficient for Administrative and Policy Challenges (0.085) is statistically significant ($p = 0.029$), suggesting that there is evidence to suggest that Administrative and Policy Challenges have a significant positive effect on Effective E-learning Adoption. The standardized coefficient (Beta) indicates the strength of the relationship, and in this case, it suggests a weak positive impact of Administrative and Policy Challenges on Effective E-learning Adoption. In summary, based on this model, Administrative and Policy Challenges have a statistically significant but weak positive relationship with Effective E-learning Adoption. However, they explain only a small portion of the variance in e-learning adoption effectiveness, and other factors not included in the model may have a more significant impact.

Table 31: Summary of Findings

Research Objectives	Research Questions	Research Hypotheses	Decision
To examine the impact of technological infrastructure in secondary schools on the process of implementing e-learning projects.	What are the impacts of technological infrastructure in secondary schools on the implementation of e-learning projects?	Technological infrastructure in secondary schools has a statistically significant impact on the implementation of e-learning projects.	Accepted

To assess the degree of readiness exhibited by secondary schools teachers in implementing e-learning project.	What are the degrees of readiness exhibited by secondary schools teachers in implementing e-learning project?.	Teachers' readiness exhibited a statistically significant impact on the implementation of e-learning project.	Accepted
To examine the impact of Content and Curriculum Adaptation on the process of implementing e-learning project.	What are the impacts of Content and Curriculum Adaptation on the process of implementing e-learning project?	Ha3:Content and Curriculum Adaptation has a statistically significant impact on the implementation e-learning project.	Accepted
To examine the impact of Administrative and Policy Challenges on the process of implementing e-learning project.	To What are the impacts of Administrative and Policy Challenges on the process of implementing e-learning project?	Administrative and Policy Challenges has a statistically significant impact on the implementation e-learning project.	Accepted

CHAPTER FIVE

DEVELOP THE DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS BASED ON THE FOLLOWING

The main objective of this study was to evaluate the challenges and prospects of the e-learning project adoption in selected public schools in Mfoundi Division. The research instrument used for study was the questionnaire. The study posed a set of questions while placing the hypotheses and their relationships within the study variables. It also arrived at several results that confirmed the problem and hypotheses posed in chapter one. Data collected was analyzed using SPSS statistical package. In this chapter, discussion, conclusion and recommendation presented based on the findings. Limitations, and suggestions for further study were equally proposed.

Discussion

The discussion is presented based on four themes generated from the dependant and independent variables used to formulate the research objectives, questions and hypotheses. The findings suggest that several key factors have been examined in relation to Effective E-learning Adoption: Technological Infrastructure, Teacher Readiness and Training, Content and Curriculum Adaptation, and Administrative and Policy Challenges. While all these factors show statistically significant positive associations with Effective E-learning Adoption, it is crucial to note that these associations are weak and explain only a small portion of the variance in e-learning adoption effectiveness.

Technological Infrastructure and Effective E-learning Adoption

The finding that technological infrastructure has a statistically significant, but weak, positive association with Effective E-learning Adoption is in line with the general understanding that access to and availability of technology is a prerequisite for effective e-learning. This result suggests that institutions or organizations with better technological infrastructure are more likely to see higher levels of e-learning adoption. However, it's important to note that the weak positive association indicates that while technological infrastructure plays a role, it is not the sole determining factor in the success of e-learning initiatives. This finding is consistent with existing literature that recognizes the multifaceted nature of e-learning adoption. Effective e-learning adoption involves

a complex interplay of various factors, including pedagogical strategies, learner motivation, organizational support, and the quality of content.

Teacher Readiness and Training and Effective E-learning Adoption

The finding that Teacher Readiness and Training have a statistically significant, albeit weak, positive association with Effective E-learning Adoption is a noteworthy result. This suggests that when teachers are adequately prepared and trained, there tends to be a slight improvement in the adoption of effective e-learning practices. This finding aligns with the understanding that teacher competence and comfort with technology are important drivers in the successful integration of e-learning into educational contexts (Al-rahmi et al., 2019; Liu et al., 2019). However, the critical point to highlight is that this association is weak and that Teacher Readiness and Training explain only a very small portion of the variance in Effective E-learning Adoption.

In other words, while teacher preparation and training are factors in the equation, they alone are not sufficient to ensure high levels of effective e-learning adoption. This finding underscores the complex and multifaceted nature of the e-learning landscape. **Multiple Influencing Factors:** Effective e-learning adoption is influenced by a multitude of factors beyond teacher readiness and training. These may include factors like the quality of e-learning content, the availability of technological resources, student engagement, administrative support, and the broader educational context (Hodges et al., 2020). Neglecting any of these factors can limit the impact of teacher readiness and training. It's important to note that teacher readiness and training are not static; they are ongoing processes. A one-time training program may not suffice in addressing the evolving needs of e-learning. Continuous professional development that supports teachers in keeping up with technological advancements and pedagogical strategies is crucial (Inan & Lowther, 2010).

Content and Curriculum Adaptation and Effective E-learning Adoption

The finding that Content and Curriculum Adaptation has a statistically significant positive relationship with Effective E-learning Adoption suggests that tailoring educational content to suit the needs and preferences of learners is indeed an important factor in enhancing the effectiveness of e-learning. This is in line with existing literature, which highlights the importance of personalized and adaptable learning materials in engaging and motivating learners (Ally, 2008;

Anderson, 2008). However, the fact that Content and Curriculum Adaptation explains only a small portion of the variance in Effective E-learning Adoption raises several important points for discussion.

Administrative and Policy Challenges and Effective E-learning Adoption

The finding that administrative and policy challenges have a statistically significant but weak positive relationship with effective e-learning adoption highlights a complex interplay between institutional governance and the successful implementation of e-learning initiatives. This result suggests that while administrative and policy challenges may play a role in shaping e-learning adoption outcomes, their influence is relatively limited. One possible explanation for this weak relationship is that administrative and policy challenges represent only a subset of the numerous factors that impact e-learning adoption. E-learning effectiveness depends on a multitude of variables, including technological infrastructure, pedagogical approaches, faculty readiness, student engagement, and more. These factors may interact in complex ways that diminish the relative importance of administrative and policy challenges. Additionally, the nature of the relationship being weak suggests that while administrative and policy challenges may pose some hindrances to e-learning adoption, they are not insurmountable obstacles. It is possible that institutions with effective strategies and mechanisms for addressing administrative and policy challenges can mitigate their negative impact on e-learning adoption.

Conclusions

The study's results emphasize that having a strong technological infrastructure is necessary but not sufficient for achieving effective e-learning adoption. Institutions or organizations should not solely rely on technology upgrades to drive e-learning success. Multifactorial Nature of E-learning Adoption: The weak association between technological infrastructure and effective e-learning adoption highlights the need to consider a broader spectrum of factors. These may include teacher training, curriculum design, learner engagement strategies, and institutional policies. To maximize the effectiveness of e-learning initiatives, institutions and organizations should take a holistic approach that considers both technological and non-technological elements. It's crucial to balance investments in technology with investments in pedagogical development and learner support. Given that technological infrastructure explains only a small portion of the variance in effective e-

learning adoption, further research is needed to identify and understand the specific factors that have a more substantial impact. This can help educators and policymakers make informed decisions about resource allocation and strategy development. Based on the findings and the supporting literature, it can be concluded that while Teacher Readiness and Training do play a role in Effective E-learning Adoption, they are only a part of the larger equation. They serve as a foundation but are not a panacea for ensuring the successful adoption of e-learning in educational settings.

Content and Curriculum Adaptation Matters: Content and curriculum adaptation is an important factor in enhancing the effectiveness of e-learning. Educational institutions and e-learning platforms should prioritize the development of adaptive and personalized learning materials.

Complexity of E-learning Effectiveness: E-learning effectiveness is a complex phenomenon influenced by multiple factors. Content and curriculum adaptation, while significant, is just one piece of the puzzle. Institutions should adopt a holistic approach to e-learning, addressing other critical factors such as technology infrastructure and instructional design.

Need for Comprehensive Research: Future research should expand the scope of inquiry to include a broader range of variables. Investigating the roles of institutional support, instructor training, and learner motivation, among others, will provide a more nuanced understanding of effective e-learning adoption. Based on the findings, it can be concluded that administrative and policy challenges are not the sole determinants of effective e-learning adoption. While they do have a statistically significant influence, this influence is weak, and these challenges explain only a small portion of the variance in e-learning adoption effectiveness. This implies that e-learning adoption is a multifaceted process influenced by a wide range of factors, and a singular focus on administrative and policy aspects is insufficient to ensure success. The weak positive relationship suggests that institutions should not disregard administrative and policy challenges but should view them in the broader context of e-learning implementation. Institutions must adopt a holistic approach that considers technological, pedagogical, and socio-cultural factors to maximize the effectiveness of e-learning initiatives.

E-learning effectiveness is a multifaceted construct: The findings indicate that effective e-learning adoption cannot be attributed solely to administrative and policy changes. E-learning effectiveness is influenced by a myriad of factors, including pedagogical strategies, technology infrastructure,

learner engagement, and instructor competence. Therefore, it is essential to consider a holistic approach when aiming to enhance e-learning outcomes. The need for a nuanced policy approach: While administrative and policy challenges have a weak positive relationship with e-learning adoption effectiveness, this relationship should not be dismissed. Policymakers and educational administrators should still address these issues to create a conducive environment for e-learning. However, they should be aware that these changes alone are unlikely to lead to significant improvements in effectiveness. Exploring other influential factors: Given that administrative and policy challenges explain only a small portion of the variance in e-learning adoption effectiveness, further research is needed to identify and understand the other factors at play. Future studies should investigate the role of pedagogy, learner motivation, technological support, and curriculum design, among other variables, to gain a more comprehensive understanding of what drives effective e-learning adoption.

Recommendations

Comprehensive Needs Assessment: Institutions planning to enhance e-learning adoption should conduct a thorough needs assessment that takes into account not only technological readiness but also pedagogical and organizational aspects. This assessment should involve stakeholders from different levels within the institution.

Professional Development: Invest in continuous professional development for educators to ensure they are equipped with the skills and knowledge required for effective e-learning delivery. Training should focus not only on technology usage but also on instructional design and online pedagogy. Schools and universities should establish ongoing training programs for teachers. These programs should focus on both technological skills and pedagogical strategies that enhance effective e-learning. Ensure that instructors receive ongoing professional development in online teaching methods and technologies. This will equip them with the skills needed to effectively facilitate e-learning environments. Invest in faculty and staff professional development to enhance their e-learning readiness and pedagogical skills. This will help in overcoming some of the challenges associated with e-learning adoption.

Collaboration and Sharing Best Practices: Institutions should collaborate with other organizations and share best practices in e-learning adoption. Learning from the experiences of others can provide valuable insights and accelerate the adoption process. Encourage collaboration among teachers, administrators, and instructional designers to develop and implement effective e-learning practices. Creating a supportive network can help teachers overcome challenges and share best practices. Collaboration between educators, instructional designers, IT departments, and policymakers is crucial. Together, they can identify barriers to e-learning effectiveness and work towards comprehensive solutions that consider both administrative and instructional aspects. Foster collaboration and open communication among various stakeholders, including faculty, administrators, and students. Effective communication can help in addressing policy challenges and garnering support for e-learning initiatives.

Holistic Approach: Educational institutions should take a holistic approach to e-learning adoption. This includes addressing not only teacher readiness and training but also investing in e-learning resources, support systems, and infrastructure. Institutions and policymakers should adopt a holistic approach to enhance e-learning effectiveness. This includes not only addressing administrative and policy challenges but also investing in faculty development, upgrading technological infrastructure, and designing engaging and learner-centered e-learning experiences.

Research and Evaluation: Regularly assess the effectiveness of e-learning initiatives. Conduct research to identify which specific factors, beyond teacher readiness and training, are inhibiting or facilitating effective e-learning adoption in your specific context. Continue to monitor and evaluate e-learning initiatives, collecting data on various factors that may impact adoption and effectiveness. This ongoing assessment will help institutions adapt and refine their strategies. Researchers should continue to explore and uncover the multifaceted nature of e-learning effectiveness. This includes investigating the interplay of various factors and their relative importance in different contexts. Researchers should continue to explore the various factors that influence e-learning adoption and effectiveness. This includes conducting in-depth studies on pedagogical approaches, technology integration. Encourage research and innovation in e-learning practices. Keeping up with emerging trends and best practices can help institutions navigate the evolving landscape of e-learning.

Invest in Content and Curriculum Adaptation: Educational institutions and e-learning providers should invest in technologies and strategies that enable content and curriculum adaptation. This may involve the use of learning analytics, intelligent tutoring systems, and responsive design to cater for individual learner needs.

Assess and Address Multiple Factors: When implementing e-learning initiatives, institutions should conduct comprehensive assessments that consider a wide range of factors. These assessments should encompass technology readiness, instructor training, learner support mechanisms, and the quality of the LMS.

Continuous assessment and adaptation: Institutions should regularly assess the effectiveness of their e-learning programs and make adjustments based on feedback and emerging best practices. Flexibility and adaptability are key to staying relevant in the rapidly evolving e-learning landscape.

Comprehensive E-Learning Strategy: Institutions should develop comprehensive e-learning strategies that encompass administrative and policy considerations while also addressing other critical factors. Such strategies should be flexible and adaptable to accommodate changes and evolving challenges.

Technological Infrastructure: Ensure that the technological infrastructure is robust and reliable. Technical issues can significantly impact e-learning effectiveness, and addressing these concerns should be a priority.

Data-Driven Decision Making: Implement data-driven decision-making processes to continually assess and improve e-learning initiatives. Regular evaluation can help identify and rectify issues related to administrative and policy challenges.

Policy Review and Adaptation: Periodically review institutional policies related to e-learning and make necessary adaptations. Policies should align with the institution's evolving goals and the changing landscape of e-learning.

Limitation of Study

The study has the following limitations:

Firstly, it underscores the complexity of e-learning adoption and effectiveness. While content and curriculum adaptation is a crucial component, it is not the sole determinant of success. E-learning encompasses a wide range of factors, including technology infrastructure, learner readiness, instructional design, and teaching methods (Picciano, 2009; Rovai, 2002). Neglecting these other factors may limit our understanding of what drives effective e-learning adoption.

Secondly, the finding suggests that there are likely other unaccounted variables or factors that significantly influence the adoption and effectiveness of e-learning. These may include institutional support, instructor skills, learner motivation, and the quality of the learning management system (LMS). It is essential to consider these variables in future research to gain a more comprehensive understanding of the determinants of effective e-learning adoption.

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APPENDIX

RÉPUBLIQUE DU CAMEROUN

Paix-Travail-Patrie

UNIVERSITÉ DE YAOUNDÉ I

**FACULTÉ DES SCIENCES
DE L'ÉDUCATION**

**DÉPARTEMENT DE
CURRICULUM
ET ÉVALUATION**



REPUBLIC OF CAMEROON

Peace-work-Fatherland

UNIVERSITY OF YAOUNDE I

FACULTY OF EDUCATION

**DEPARTMENT OF
CURRICULUM
AND EVALUATION**

QUESTIONNAIRE

Dear respondent.

I am Beriynyuy Emma Alcoline, a student at the University of Yaounde 1, Faculty of Education, and Department of Curriculum and Evaluation with a speciality in Conception and Management of Educational Projects. I am currently studying "An Evaluation of the Challenges and Prospects in the Adoption of E-Learning Project in Selected Public Secondary Schools in Mfoundi Division". This work aims to evaluate the challenges and prospects of the e-learning project adoption in selected public schools in Mfoundi Division. I will be very grateful if you take a few minutes to respond to this document's questions. I assure you that the answers provided shall be treated with the utmost confidentiality and used only for academic purposes. Thanks for your cooperation.

SECTION A: DEMOGRAPHIC DATA

Demographic Information: Please provide the following information for statistical purposes. Your responses will remain confidential.

Please tick (√) in the box corresponding to your most preferred response

School Name: [Optional]

Gender : a) Male (b) Female

Age : a) 20 - 30 (b) 31-40 (c) 40+

Years of Experience in Education: [0-5, 6-10, 11-15, 16+]

Qualification : a) DIPES I (b) DIPES II

SECTION B:

Instructions: Please rate your level of agreement with the following statements regarding the obstacles encountered by secondary schools in the process of implementing e-learning initiatives. Use the following scale: SA=strongly Agree, D= disagree A=agree SD= strongly disagree. Please tick in the box corresponding to your most preferred response

Section 1: Technological Infrastructure

S /N	Statements	Responses			
		SA	D	A	SD
1.	Our school has the necessary technological infrastructure to support effective e-learning.				
2.	Internet connectivity have hindered the successful implementation of e-learning.				
3.	Inadequate availability of computers for teachers has been a challenge.				
4.	The school provides reliable access to necessary e-learning tools and resources				
5.	Technical support is readily available to address e-learning-related issues.				

Section 2: Teacher Readiness and Training

S /N	Statements	Responses			
		SA	D	A	SD
6.	Teachers have received sufficient training to effectively use e-learning tools and platforms.				
7.	Lack of confidence among teachers in using e-learning tools has been a hurdle.				
8.	Lack of familiarity among teachers in using e-learning tools has been a hurdle.				
9.	Teachers are adequately supported in integrating e-learning into their teaching methods.				
10.	There have been continuous professional development opportunities related to e-learning provided to teachers.				

Section 3: Content and Curriculum Adaptation

S /N	Statements	Responses			
		SA	D	A	SD
11.	The school has successfully adapted the curriculum for effective e-learning delivery.				
12.	The school has developed appropriate e-learning content.				
13.	The school has curated appropriate e-learning content.				
14.	The school has aligned e-learning content with in-person teaching methods is a struggle.				
15.	Lack of interaction between students and teaching staff				

Section 4: Administrative and Policy Challenges

S /N	Statements	Responses			
		SA	D	A	SD
16.	Adequate funding has been allocated for e-learning infrastructure and resources.				
17.	School policies adequately address the unique challenges of e-learning.				
18.	School guidelines adequately address the unique challenges of e-learning.				
19.	Administrative processes have hindered the smooth implementation of e-learning initiatives.				
20.	Bureaucratic processes have hindered the smooth implementation of e-learning initiatives.				

Section 5: Overall Impact and Effectiveness

S /N	Statements	SD	SA	D	A
21.	Despite the challenges, e-learning initiatives have positively contributed to students' learning experiences.				
22.	The benefits of e-learning outweigh the drawbacks encountered during implementation.				
23.	Our school is committed to continuously improving and refining its e-learning strategies.				
24.	I possess an email address and I use it in the learning context.				
25.	The e-learning process gives us flexibility to navigate in learning resources				

Thank you for your participation! Your feedback is valuable in understanding the obstacles secondary schools face in implementing e-learning initiatives.