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Optimizing the delivery of digital skills in public schools: an analysis of cost factors and stakeholder engagement perspective in Nairobi City County.

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OPTIMIZING THE DELIVERY OF DIGITAL SKILLS IN PUBLIC SCHOOLS: AN ANALYSIS OF COST FACTORS AND STAKEHOLDER ENGAGEMENT PERSPECTIVE IN NAIROBI CITY COUNTY

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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ABSTRACT

Considering the government of Kenya's efforts to integrate ICT into education, this study explored the cost factors affecting the delivering digital skills in Nairobi County's public schools. Identified costs factors include resource acquisition, technical skills, and digital curriculum development. The effect of stakeholder relationships on program sustainability was also investigated. The study focuses on technical related cost factors, resource related cost factors, and curriculum-related costs factors alongside stakeholder involvement. It adopts a quantitative descriptive design grounded in technology acceptance model and stakeholder theory. The study employed a deductive descriptive approach due to the mixed nature of the collected data. It surveyed 187 principals and four critical informants from 353 public primary and secondary schools. Data was collected using a structured questionnaire, and descriptive and inferential analyses were conducted to analyse the collected survey data. Correlation tests found a moderate positive correlation between technical-related factors and digital skill delivery and a strong positive correlation between curriculum-related factors and skill delivery in Nairobi County's public schools. Additionally, a weak positive correlation existed between resource-related factors and skill delivery. Regression analysis indicated a positive and statistically significant relationship between related cost factors and skill delivery. Technical-related cost factors were positively correlated with skill delivery. However, resource-related cost factors showed an insignificant relationship. Curriculum-related cost factors positively influenced skill delivery, while stakeholder involvement had no significant effect. Findings further showed a weak positive moderating effect of stakeholder involvement on the relationship between selected optimization cost factors and the delivery of digital skills within public primary and secondary schools in Nairobi County. The study recommends continuous investment in improving infrastructure to ensure adequate support for the utilization of digital learning content. The study also recommends that the schools and the necessary government agencies address the current staffing shortages by recruiting and training skilled personnel. The study further recommends that public schools in Nairobi should continue fostering the inclusion of digital learning in the curriculum, ensuring alignment with national standards and guidelines for digital education.

Keywords*: Digital skills, digital literacy, cost, IT Infrastructure, technical-related cost, resource-related cost, curriculum-related cost, stakeholder*

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LIST OF ABBREVIATIONS

CBC	Competency Based Curriculum
CoE	Center of Excellence
DL	Digital Learning
DS	Digital Skills
ECD	Early Childhood Development
EU	European Union
GoK	Government of Kenya
ICT	Information Communication Technologies
IT	Information Technologies
OECD	Organization for Economic Co-operation and Development
RBV	Resource Based View
SEM	Structural Equation Model
TAM	Technology Acceptance Model
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEF	World Economic Forum

DEFINITION OF TERMS

Cost	The monetary and non-monetary value of all sacrifices made to achieve an objective (Srivastava, 2007)s. Concerning this study, cost will refer to the expense incurred when delivering digital learning in an educational setting.
Curriculum-related cost factors	The cost related to developing, promoting, and implementing a digital curriculum. These costs include digital curriculum development, digital content development, and curriculum implementation costs (Subrahmanyam, 2022).
Digital learning	The use of information technology and web-based systems to impart knowledge to students (Walia, Rajak, Chourasiya, & Kaiwartya, 2023)
Digital Skills	Digital skills refer to finding, evaluating, using, sharing, and creating content using digital devices, including smartphones, computers, and IT-enabled platforms and services (Van Laar et al., 2020).
IT Infrastructure	It refers to the various software, networks, internet connections, databases and hardware needed to deliver digital literacy skills (Chepkonga, 2015)
Resource-related cost factors	These are the costs associated with acquiring and maintaining digital learning resources, including digital learning materials, creating a digital environment and acquiring ICTs used by students and teachers in education delivery (Cherotich & Waweru Kamaku, 2020).
Stakeholder	In education, a stakeholder is defined as any individual who is invested in the wellbeing of a school and its students, which includes school administrators, teachers, parents, students,

	members of the community, elected officials, and members of the school board and government officials (Razak et al., 2019).
Technical-related cost factors	The costs associated with acquiring and maintaining technical infrastructure as well as upskilling teachers' and staff's digital skills (Subrahmanyam, 2022).

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The world is becoming more and more computerized; almost everything is mechanized, from manual to electronic commerce and banking. Technology is having an impact on even the educational system (Karadas et al, 2023). In the present day, technology has been integrated into the school curriculum, as a result, students get used to computers to come up with exhibitions. Additionally, they make use of the internet to conduct an investigation on a category of problems intended for their compositions and critiques. Information and communication technologies (ICTs) have shown to be extremely important to humanity, and as a result, there is now a global consensus on the necessity for their growth (Mohammed & Abdulghani, 2017). These technologies are now essential to modern cultures. ICT use includes a wide range of activities such as sending emails, reading e-books, conversing on the phone, viewing television news, and making online travel reservations. ICT is shorthand for the software, computers, networks, satellite linkages, and associated systems that enable people to generate, access, analyze, share, and use information, data, and knowledge in a variety of ways (Ghavifekr et al, 2019).

Information communication technologies (ICTs) are transforming how people, businesses, and governments interact and use information technologies, and governments worldwide have increased efforts to prepare their citizens for an IT-based future (Mashile, 2017). The ubiquity of digital devices and their influence on how people conduct transactions in the modern world has increased efforts to equip citizens with digital skills for economic and societal improvement (Sutter & Kihara, 2019). The European Union, for instance, now identifies digital competency development as a core component of development strategy and has developed different frameworks for digital literacy improvement such as the EU Digital Competence Framework for Citizens that has inspired policy redirection in many countries towards ICT's integration (Ei & Soon, 2021).

Other international organizations also call for countries to introduce programs to improve digital competence in adults and children. However, many countries are finding it hard to implement digital skills programs. Makau (2021) reports that more than 3.6 billion people, especially in

developing countries remain cut off from the digital era. According to Spires, Paul and Kerkhoff (2018) digital skills is a multifaceted concept where people are able to utilize digital tools to consume, create and communicate digital products. It enables people consume pieces of information from online resources and acquire knowledge through online reading and inquiry (Amwayi, 2018).

Digital skills are considered essential in the modern workplace as well as in social life and have been defined as 21st century skills, considering technology continues to become more and more ingrained in daily life. The concept of digital skills emerged when the United States government sought to help citizens better identify war propaganda and discern between helpful and misleading advertisements (Delwiche & Herring, 2020). In the modern world, digital literacy skills are meant to prepare young children and teenagers for the skills they need to safely and responsibly engage in technologies. Developing digital skills at an early age improves student's technological skills, enabling them to use digital content better in learning, communicating and in official settings (Rahmah, Eryansyah, & Silvhiany, 2021).

According to Delwiche and Herring (2020), low literacy scores can expose citizens to misinformation, online harassment and security concerns. Bejaković and Mrnjavac (2020) add that developing digital skills in an education setting is key to preparing learners for future workplace competitiveness and adjusting to new developments. Digital literacy is considered one of the facilitators of the Sustainable Development Goals, earmarked SDG 4.4.1 which specifies the need to ensure a higher proportion of youth and adults are equipped with adequate ICT skills and competencies (Rambousek, Štípek, & Vanõková, 2016). The European Union considers digital literacy a foundational skill for learning. UNESCO's Global Framework of Reference on Digital Literacy Skills provides a framework to facilitate the implementation of digital literacy programs to equip citizens with digital skills for the 21st century (Law et al., 2018).

The CoE identifies the digital citizen as the end product of digital literacy efforts, defining a digital citizen as an individual who can interact productively with digital technologies and data, actively participate in socio-economic development and advance human rights (Ei & Soon, 2021). In positioning digital literacy skills, the UNESCO affirms that digital citizens can find, access and use digital information ethically to advance human development. According to Kumpulainen

(2019) Finland reformed the country's curriculum to embed digital literacy in all competence areas of education. France's Digital Plan for Education funded high schools to ensure every student can access digital devices while at school. In the Netherlands, the Media Masters initiative sought to foster soft digital skills to young students using a gamified approach.

Bravo, Chalezquer and Serrano-Puche (2021) opines that digital skills are key to advancing sustainable development goals and human rights, and in essence crucial to realizing the 2030 Agenda. Multinational programs such as the IBM Digital and Nation Africa project launched in 2017 and Google's Digital Skills for Africa program are recent efforts to increase the digital skills of some 35 million youth across 20 countries by 2025 (Mbise et al., 2018). However, UNESCO reports that the application of efforts vary widely.

1.1.1 Costs of Delivery

In an analysis, UNESCO (2017) reveals that despite the abundance of initiatives and programs, out of 49 developed and developing countries, only 11 had developed their own frameworks, while 36 relied on frameworks provided by commercial actors. In the report, it was ascertained that many countries are facing significant challenges in implementing digital literacy programs, especially using nationwide approaches. Ephantus (2017) points to structural and cultural challenges affecting digital literacy implementation. In Germany, Ercikan, Asil and Grover (2018) unearthed the impact of social disparities on digital competence levels, affirming that students from less privileged social backgrounds have lower computer and information literacy scores than students from wealthy regions. In the UK, Polizzi and Taylor (2019) report that the national curriculum lacks effective provisions to address misinformation, a threat identified in the EU Digital Competence Framework for Citizens. According to Hassan and Mirza (2021), although the Indian government expressed support for digital programs through a new ICT-centric curriculum, teachers' limited ICT exposure was a major impediment to their effectiveness in supporting alternative modes of teaching and learning when the COVID-19 pandemic emerged.

Regionally, Nigeria's Okeji, Tralagba, and Obi (2019) affirm that librarians lack software security, firewall application, systems security and digital content supervision competencies. Ghana's Adarkwah (2021) researched digital learning challenges in online learning and provided evidence that the process is too costly, involving new machines, learning materials, and continuous support.

The research also revealed that schools in sub-Saharan Africa have limited access to internet services, among the main causes of the digital divide. Wairumbi (2021) opines that the teacher's IT competence, the instituted program architecture's effectiveness, and the technical assistance offered should be enhanced to implement digital learning programs in Kenyan public schools successfully. Accordingly, Mashile (2017) opines that understanding the effect of technical, human and curriculum-based costs on delivering digital skills is essential. These factors formed the basis of this study.

1.1.1.1 Technical Related Factors

Information communication technologies (ICTs) are expensive to acquire, operate, and maintain, especially when provided to schools for learning (Agustini, Lian, & Sari, 2020). Technical costs related to digital education delivery refer to those that schools encounter when developing ICT systems and acquiring, implementing, deploying, and maintaining technological assets (Kembo et al., 2019). These strategic assets include computers, software programs, digital tools, and interactive teaching material that schools use to communicate, create, disseminate, store, and manage information. These technologies require technical knowledge to operate and technical staff to maintain. Schools must acquire staff with the skills and competencies that enable individuals to perform specific tasks more effectively Bravo, Chalezquer and Serrano-Puche (2021). Pedagogical integration of ICT in education settings depends on schools' ability to acquire and retain competent staff with digital skills as they are required to research, assess, evaluate, prepare and transform digital material into educational content (Kembo et al., 2019).

Technical costs are significant determinants of schools' ability to integrate digital elements in learning. Bejaković and Mrnjavac (2020) affirm that all teachers should have pedagogical knowledge, skill and creativity on digital content to be effective at online instructional delivery and asserts that training is the key to improving the teachers' IT competency. India's Perdana, Yani, Jumadi and Rosana (2019) provide evidence that teachers' digital proficiency significantly impacts their ability to use digital resources in an educational setting and that it depends on their exposure to digital content and skills training. However, acquiring digitally capable teachers is costly and demanding. Further, setting up, installing and running digital literacy programs require competent technical support staff, who are costly (Nedungadi et al., 2018). This study studied how these cost factors influence the delivery of digital skills.

1.1.1.2 Resource Related Factors

These are the costs of acquiring the resources necessary to deliver digital skills (Subrahmanyam, 2022). This includes costs associated with acquiring digital content and learning materials, projectors, mobile phones, and other communication tools students and teachers use in education delivery (Cherotich & Waweru Kamaku, 2020). Subrahmanyam (2022) identifies digital textbooks, online grade books and classrooms, educational software, and interactive learning platforms and apps as key resources for digital learning. While digital resources are essential to the acquisition of digital skills, however, Hassan and Mirza (2021) affirm that schools need different types of resources to integrate digitization into the learning curriculum effectively and that acquiring these resources is expensive. Sulianta (2021) affirms that the availability of digital technology has a significant impact on the successful transfer of digital skills from teacher to student and that inadequacy of digital material can have negative impacts on teachers and students' ability to benefit from an ICT-based curriculum.

These assertations are made in the study by Bravo et al., (2021) who observed that limited access to video, audio and digital learning content has remained a significant challenge to effective transfer of digital skills to teachers as well as students. Paudel (2021) notes that many schools in developing economies need stocked ICT laboratories and outdated ICT learning material, giving them a basic view of technologies and lacking modern nuance and technology applications. Razak et al. (2018) argue that organizational culture is a critical resource for effective digital integration, arguing that the failure to create a culture receptive to new technologies and learning methods has left many institutions lagging in the push for ICT integration. Accordingly, access to quality financial resources, technology resources and digital learning materials are key to successful integration of an ICT based curriculum (Paudel, 2021), and this study studied how the cost factors associated with accessing these resources influence the delivery of digital skills among students in public schools.

1.1.1.3 Curriculum Related Factors

UNESCO (2015) defines a curriculum as a planned sequence of knowledge and skills which pupils are expected to learn in a school or in a specific course and considers it to be the backbone of any education system as it defines the goals and objectives as well as pathways to meeting the desired

objectives. A curriculum defines and describes the academic content acceptable in a school, course or program, and how knowledge and skills should be provided in schools (Regmi & Jones, 2020). Curriculums set the standards and learning objectives for all schools and teachers, and provides instruction on subjects, units and programs that should be offered in schools, the learning materials to be used in schools, assignments and projects, tests and assessments, among other rules governing schools (Isaboke, Mweru, & Wambiri, 2021). The researchers note that a curriculum as a critical determinant of program quality and learner outcomes, recommending that digital literacy be incorporated as part of the social, health and economic curriculum to encourage development of digital skills. Curriculum-related costs refer to those associated with developing, promoting, and implementing a digital curriculum. These costs include digital curriculum development, digital content development, and curriculum implementation costs (Subrahmanyam, 2022).

Singhavi and Basargekar (2019) confirm that coherent and cohesive curriculums are considered strategic sources of competitive advantage in education systems. Saputra et al. (2021) opines that an effective curriculum helps teachers in the identification of the type of skills, resources and knowledge that would improve students' ability to evaluate online content while Sadaf and Johnson (2017) aver that a curriculum standardizes learning goals, methods and processes to ensure all minimum standards are maintained at all times. Further, according to Mertala (2020), a curriculum should reflect culture and identity of the local environment. Governments worldwide are implementing policies to encourage schools to adopt digital technologies and integrate them into the school curriculum (Singhavi & Basargekar, 2019). Given localized curricula is key to the identification and addressing of students' needs, the cost associated with the development (Singhavi & Basargekar, 2019), the costs associated with the promotion and implementation of an IT-based curriculum can have significant effects on teachers' delivery of digital skills

1.1.1.4 Stakeholder involvement

As highlighted, the successful integration of ICTs in education depends on a host of interrelated factors and actors, including the government, teachers and students (Subrahmanyam, 2022). The government provides general directions and expectations for schools and school management and teachers carry out internal analysis and decide how to implement national policies. Some schools have the financial, technical, and resource capability to fully adapt digital technologies while others lack these capabilities and will implement ICT only partially (Razak et al., 2019). The

decision on implementing ICT curriculums in schools' rests on stakeholders within and around school settings (Yamamoto & Yamaguchi, 2019). In education, a stakeholder is any individual invested in the wellbeing of a school and its students, including school administrators, teachers, parents, students, members of the community, elected officials and members of the school board and government officials (Razak et al., 2019). Stakeholders also comprise collective entities invested in promoting education delivery such as grassroots organizations, advocacy groups, teachers' unions, and parent-teacher organizations. De Torres (2021) concurs that all these actors have a stake and perception of how they want the school to perform and operate.

Razak et al. (2019) note that stakeholders have a vested interest in education and generally seek to ensure the education delivered is of acceptable standards. Stakeholder involvement refers to the practices organizations undertake to promote stakeholder participation in decision-making (Rangel-Pérez et al., 2021). These include opportunities for stakeholders to occupy leadership roles and decision-making opportunities for teachers, students, parents, and the larger community. Razak, et al. (2019) adds that it also involves giving voice to the beliefs, values, perspectives and opinions of people from different cultural backgrounds within the community. The researchers point out that stakeholder involvement in the education sector promotes a sense of shared responsibility and ownership and is considered central to successful school improvement as it incorporates many different opinions prior to decision making.

Stakeholder involvement is especially important when it comes to ICT implementation in schools (Razak, et al., 2019). Empirical evidence shows how stakeholders can promote ICT integration through donating to schools and offering their experience with regards to ICT integration into school curriculums. In developing economies, stakeholder donations and financial support have been key to the distribution and acquisition of digital learning material which is essential to acquisition of digital skills. Looking into internal stakeholders, Ayllón, Alsina and Colomer (2019) aver that the involvement of teachers in ICT curriculum development is paramount to reducing internal resistance and implementing ICT at the ground level. Accordingly, Singhavi and Basargekar (2019) note that limited stakeholder involvement is one of the main hurdles to effective ICT integration in schools which negatively impacts students' acquisition of digital skills. This study studied whether the participation of stakeholders has any moderating effect on the

relationship between the factors related to the cost of delivery of digital skills and students' digital skills.

1.1.2 Digital Skills

Digital skills refer to the ability to find, evaluate, use, share, and create content using digital devices, including smartphones, computers and IT enabled platforms and services (Van Laar et al., 2020). Digital skills vary depending on the individual, context and range from basic understanding of digital technologies and their associated concepts to technical skills and abilities specific to certain sectors, such as software development skills (Ziomek, 2021). Digital skills are an acquired skills that are acquired through exposure and learning. Caputo et al. (2019) associate digital skills with improved employee efficiency and innovation in the workplace and considers them a source of competitive advantage in the marketplace where businesses and industries are increasingly integrating a variety of digital tools to run operations such as sales, service delivery, customer care and even tax compliance. Digital skills can be applied in various contexts, including trade, financial exchange, manufacturing, and agriculture. According to Van Laar et al. (2020), a digitally literate workforce is the core of competitiveness in the 21st-century digital economy.

Digital skills are acquired skills that can best be delivered in a school setting (Cherotich & Waweru, 2020). Kenya is committed to uplifting her citizens' digital skills and recently implemented the Basic Education Curriculum Framework, which refers to the need to redesign the curriculum to focus on citizenship, digital literacy, creativity, critical thinking, self-efficacy, collaboration, and communication as the core competencies (KICD, 2019). This is a form of learner-centered thinking in instructional delivery, whereby one of the primary goals is to consider the impact of teaching on the learner. This curriculum is centered on socio-cultural principles whereby learners don't just consume but also create and participate in its development (Mahinda, 2019). According to a DigiSchool (2018) report, the Kenyan government requires schools to teach computer skills and digital literacy in its strategy to accelerate economic development and create an innovative pedagogy. The Basic Education Curriculum Framework, a predecessor of the 2013's Digital Literacy Program calls for every Kenyan to be a digital citizen.

According to the World Bank (2019), Kenya is well positioned to digitalize its education sector, having intensified efforts to increase e-learning resources development and sharing, attract public–

private partnerships to mobilize resources that can support nationwide e-learning integration and to develop and implement an integrated e-learning curriculum that anchors digital skills delivery. However, according to Cherotich and Waweru Kamaku (2020), access to education through e-learning is still far from possible considering the country still struggles to provide necessary resources to schools in terms of e-learning materials, technologies and IT-competent teachers and support staff. To address some of the challenges associated with rapid technology developments, the ICT Ministry, through the Digital Literacy Program, sought to train instructors in modern ways to deliver new e-learning content. However, only 81,000 teachers received this training, given the Teachers Service Commission estimates that the country has a 96,000-teacher shortage (Kerkhoff & Makubuya, 2022).

Full implementation of the Digital Literacy Program requires that the government identifies, acquires and sets up quality technologies, infrastructure and instructors, and technicians (Murithi & Yoo, 2021). According to Pratolo and Solikhati (2021), teachers in schools that implemented the program reported increased attentiveness and interest in learning among students. However, these resources are costly. Battery failure, unstable power supply, high power bills, poor supply of technical staff, especially in rural areas, low internet connectivity due to high data costs, and theft of the digital technologies are some of the challenges to effective implementation of the program (Cherotich & Waweru, 2020). Further, the curriculum has not incorporated emerging threats such as cyber security skills. This study sought to examine the extent to which these cost factors impact Kenya's ability to guarantee quality digital skills delivery in public education setting.

1.1.3 Public Schools in Nairobi County

Nairobi County is the capital city of Kenya. It houses the largest number of schools in the country and is the leader in developing and adopting a digital curriculum (Hussein, Abayo, & Mugambi, 2019). The country is at the forefront of spearheading Kenya's ICT policy, which was introduced in 2006 to create a prosperous ICT-based society. The policy promotes the use of digital technologies and the development of e-learning at all levels of education to provide learners with digital skills and competencies (Muriithi, Horner, & Pemberton, 2016). Public schools in Nairobi County have all attempted to integrate ICT resources and facilities. Still, according to Oyugi (2020), 80% of the residents in Nairobi do not have adequate ICT understanding and knowledge. Hussein, Abayo, and Mugambi (2019) confirm that 70% of public primary schools have a

computer that students can use as part of the curriculum, and even fewer have access to quality, up-to-date digital learning materials. Research into the determinants of digital learning in Kenya highlights a variety of factors, including the lack of teachers with digital skills (Oyugi, 2020), limited funding to support infrastructure purchases, the costs associated with the development and adoption of a new curriculum (Competency Based Curriculum) (Ong'udi, 2021), and insufficient internal and external support (Msomi & Hoque, 2018). These were the target of the current research.

According to the Nairobi County Government Department of Education (2022), there are 225 primary and ECD and 128 secondary schools within the county (Nairobi County Department of Education, 2022). As per the national directive, these schools are expected to have implemented digital learning into their curriculum.

1.2 Statement of Problem

Kenya has prioritized the integration of ICT across all economic sectors in line with its Vision 2030 master plan. The government hoped to address issues like packed classrooms, a lack of teachers and textbooks, inclusion education, disruptions to children's education in Arid and Semi-Arid Lands (ASAL), and the transition from content-based to competency-based curricula through the integration of ICT in teaching and learning. Nonetheless, Kenya's educational system's ICT penetration rate is still much below the global average of 50% (Sutter & Kihara, 2019). Specifically, it is still unclear to what extent ICT is integrated into teaching and learning in the majority of public elementary schools.

In the 4th industrial revolution, digital skills have emerged as core elements of competitiveness and economic growth (Cherotich and Kamaku, 2020). According to Bejaković and Mrnjavac (2020), digital skills are a useful competency in the modern workforce, which is constantly digitizing. Acknowledging the influence of a digitally skilled population, governments worldwide are increasing investment into incorporating ICTs in education delivery (Chetty et al., 2018). Kerkhoff and Makubuya (2022) report that the Kenyan government, through the Digital Literacy Program, aims to equip students with digital skills from an early age and has invested in digital laptops for students and teachers, of which more than 75,000 teachers have received training to equip them with didactic and practical digital skills. Digital skills and coding have been embedded into the

school curriculum for learners (DigiSchool, 2018). However, despite these efforts, the Ibrahim Forum (2021) reports that while 58% of Kenyans have access to the internet, only 29% possess basic digital literacy skills. Maina and Waga (2018) aver that the implementation of digital learning is a costly endeavor that requires strategic investment for effective delivery of digital skills (Kibuku, Ochieng, & Wausi, 2020). This study sought to develop a clear understanding of the costs affecting the delivery of digital skills.

Researchers such as Brata et al. (2022) researched the factors impacting digital skills among Indonesian schools and observed that internet costs and interest in digital technology were the main factors influencing digital literacy. Rajasthan et al. (2022) researched on the factors influencing students' willingness to participate in a digital literacy program and asserts that the cost-effectiveness of the technologies and internet services is a key factor. The study evaluated students, while the current study sought data from school heads. In seeking to develop an integrative digital literacy framework for Indian students, Nedungadi et al. (2018) identified a lack of ICT-enabled facilities, intermittent electricity failures, and a shortage in technical support as the main challenges to e-learning implementation. On the other hand, the researchers Regmi and Jones (2020) hold that e-learning faces costs related to the collaboration and integration of e-learning into current curricula. The study was based on e-learning implementation in health sciences education

Regionally, Nigeria's Michael and Igenewari (2018) report that ICT implementation in the country was costly due to high IT incompetence and resistance, lack of technical support, and poor funding, resulting in resource insufficiency. In Kenya, Amwayi (2018) opines that schools cannot afford e-learning resources, and many stakeholders are not involved in implementing digital learning. Tarus, Gichoya, and Muumbo (2015) add that financial constraints affect the school's ability to access ICT infrastructure, design ICT-enabled courses, support teachers' upskilling, and implement an ICT-based curriculum. Indeed, the above studies prove that multiple factors affect the delivery of digital skills and that stakeholder support can significantly impact schools' ability to manage these costs. In some studies, the lack of supportive infrastructure is the biggest impediment, while other studies show outdated material as the main challenge (Nedungadi et al., 2018; Brata et al., 2022). Furthermore, Amwayi (2018) and Michael and Igenewari (2018) provide evidence that instructors can also have limited capacity to use available resources to improve their

digital skills delivery. This study sought to asecrtain the most pertinent cost factor determining the cost of delivery on digital skills among public school students in Nairobi County, Kenya.

1.3 General Objectives

This study focused on studying the optimization of the delivery of digital skills in public schools through a cost analysis and stakeholder engagement perspective in Nairobi City County.

1.3.1 Specific Objectives

i. To determine the effect of technical-related cost factors on the delivery of digital skills within public schools in Nairobi County, Kenya.
ii. To establish the effect of resource-related cost factors on the delivery of digital skills within public schools in Nairobi County, Kenya.
iii. To analyze the effect of curriculum-related cost factors on the delivery of digital skills within public schools in Nairobi County, Kenya.
iv. To establish the moderating effect of stakeholder involvement on the relationship between costs and delivery of digital skills within public schools in Nairobi County, Kenya.

1.3.2 Research Questions

i. Do technical-related cost factors affect the delivery of digital skills within public schools in Nairobi County, Kenya?
ii. Do resource-related cost factor affect the delivery of digital skills within public schools in Nairobi County, Kenya?
iii. Do curriculum-related costs factors on delivery of digital skills within public schools in Nairobi County, Kenya?
iv. Does stakeholder involvement affect the relationship between costs and the delivery of digital skills within public schools in Nairobi County, Kenya?

1.4 Scope of the study

This study sought to examine the optimization of the delivery of digital skills in public schools in Nairobi County and used a descriptive design. Geographically, the study was restricted to public schools in Nairobi County. The stakeholder theory and the technology acceptance model guided

the study. The methodological scope for the research was based on mixed research design focusing on principals and head-teachers drawn from all public schools within Nairobi County and qualitative research focusing on policy stakeholders such as the Ministry of Education, Ministry of ICT, KICD and Nairobi County officials within Nairobi County. The research applied the following theories; Technology acceptance model and the Stakeholder theory. The research was conducted between October 2023 to March 2024.

1.5 Significance of the study

1.5.1 To the Government

Globally, teachers play a significant role in curriculum delivery and are also charged with developing students' digital competency skills. This study focuses on the effect of cost factors on the delivery of digital skills among public schools. Its main beneficiary, thus is the education sector in Kenya. This study will propose solutions that the government can adopt in improving the delivery of digital skills in education institutions as it will identify the costliest factors that can influence the delivery of digital skills in public schools. This will help it direct its policies towards more effective measures. The findings will immensely contribute to the management of schools in making practical solutions in their day-to-day execution of digital learning in the schools. The results will help in decision-making on the key cost factors to consider in order to strengthen the delivery of digital skills within schools.

1.5.2 To Literature

The research will also contribute to the literature on digital literacy enhancement within educational settings. This study will contribute to research on the ways through which governments and education institutions can go about enhancing the quality of digital skills delivery. Further, the findings of the study can be utilized by donor agencies and philanthropists who can identify the gaps in the delivery of digital skills and how to help public schools minimize the factors associated with costs derailing the implementation of digital learning.

1.5.3 To Scholars

This study will also be relevant to future scholars as it explores an important factor in economic growth literature in relation to education delivery. It will serve as a citation source and suggest

what needs to be enhanced to improve the quality of digital skills delivery. This study will further identify gaps in the literature and make suggestions for topics that require further exploration.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presented the theoretical and empirical review sections. The chapter began with the theoretical perspective and concluded by presenting the factors associated with digital skills within Kenyan schools. These are presented in line with the research objectives and questions. The chapter then provided a conceptual framework depicting the relationship between the study variables.

2.2 Theoretical review

2.2.1 Technology Acceptance Model

The Technology Acceptance Model (TAM) is an information systems theory developed by Davis (1989) to elaborate on the use of emerging technologies and their acceptance by users. Badri, Alnuaimi, et al. (2017) affirm that the TAM is tailored to predict the factors that make technologies acceptable and popular. The model grew out of the logic that when it comes to the use and acceptance of technologies, it is not a factor of the users' generic attitude toward behavioral intention but specific beliefs about technology use. Developing on the Theories of Reasoned Action and Planned Behavior, Davis (1989) hypothesized that an information system's use is dependent on a trade-off between the users' perceived difficulty when using it and the system's perceived usefulness through an evaluation done by the users. Therefore, TAM predicts that the use of technology and its acceptance is determined by the perceived usefulness and ease of the technologies, according to Davis (1989).

Perceived usefulness refers to an individual's perception of their expectations regarding the ability of a new system to perform. The variable that emerged from Bandura's (1982) concept of outcome judgment is the user's expectation that they are engaging in a behavior that triggers a positive outcome. The variable perceived usefulness emerged from the evidence that system performance expectancy encourages system usage (Robey, 1979). Perceived ease of use on the other hand, refers to the level of belief a user has on the technology system usage that it was free of effort and has the ability to complete a task using a new technology (Davis, 1989).

Hill, Smith and Mann (1987) had earlier predicted that self-efficacy plays a key role in predicting user's decision-making about technology use. The two constructs have been tested in an organizational context and validated and Davis (1989) confirmed relationships between perceived ease of use, perceived usefulness, intention and behavior usage. According to Davis's (1989) TAM, external factors such as the design of the system trigger responses (perceived usefulness and perceived ease of use), which eventually predict the user's attitude and intention toward using the technology. The higher the affective response, the higher the repeated technology use behavior, confirming the popularity of easy-to-use and useful technologies.

The TAM has received international recognition and has been expanded to evaluations of different types of technology uptake beyond computer systems, including use of telemedicine services (Dash, Shadangi, Kar, & Prusty, 2019) and mobile banking applications (Tam, Santos, & Oliveira, 2020). In the education sector, the TAM has proved key to predicting digital technologies use by teachers (Ibieta, Hinostroza, Labbé, & Claro, 2017) and e-learning platforms among students (Mailizar, Burg, & Maulina, 2021). In the educational context, the TAM proposes that schools use technologies that are expected to be easy for both teachers and students and offer advantages over the reliance on traditional models. Technologically ready schools and technologies that are task-useful are likely to be adopted. Therefore, this study, which focuses on digital skills, this theory predicts the factors that make these technologies useful and easy to use in the education sector.

2.2.2 Stakeholder Theory

The Stakeholder Theory, according to Freeman (1983), opines that an organizational management and business ethics model explains organizations in relation to their stakeholders (Freeman et al., 2010). The theory incorporates the accounts different constituencies that are likely to be affected by business entities and seeks to address business ethics, morals, and values, and affirms that businesses have to think of and manage all stakeholders affected by the organization (Ayllón, Alsina, & Colomer, 2019). The theory takes a step from capitalistic goals and proposes that all stakeholders, and not just shareholders, are important to an organization and that the relationship between stakeholders and the organization is of particular significance to the organization's performance outcomes. Freeman (2010) identifies and highlights the importance of different types of stakeholders that the management has to consider in decision-making, including the employees, customers, financiers, suppliers, and the government, among others. In essence, the theory

describes and proposes how to treat those who can be affected by firm operations or affect firm operations (Ayllón et al., 2019).

The theory hypothesizes that stakeholders can either back or reject an organization and this backing can determine the organization's performance outcomes and proposes how the management should view, manage and treat them in order to have maximum social and economic impact and achieve profitability in an ethical, socially acceptable manner. According to Freeman et al. (2010), the theory provides an explanation of how businesses can consider stakeholder interests and incorporate them in decision-making. The theory proposes that stakeholder relations are very important to an organization's performance and that stakeholders will only support an organization when they receive value in return. Thus, coordination between the organization and stakeholders is a factor of the value that each party generates for each other. As a customer-centric approach, the theory supports the notion that establishing clear, uniform objectives between an organization and stakeholders is key to the realization of the objective and goals (Freeman, 2023). Therefore, Freeman (2023) proposes that stakeholders' incorporation in decision-making frameworks will engender greater acceptance and goal realization.

The theory has received criticism for failing to identify and isolate key stakeholders for different organizations (Brunetti et al., 2020). However, despite this, the theory has been used extensively in the analysis into different organizational initiatives such as corporate social responsibility and ethical practices on firm competitiveness (Waheed & Zhang, 2022), stakeholder engagement on company sustainability (Torelli, Balluchi, & Furlotti, 2020). In the study by Waheed and Zhang (2022), community responsibility, customers' responsibility, suppliers' responsibility, and employee responsibility are among the ways companies foster unity in goal realization and internal well-being. Penuel et al. (2020) highlighted the importance of stakeholders in the education sector, confirming that collaborative systems significantly affect the development of education infrastructure.

With regard to digital learning, Razak et al. (2019) note that stakeholders have a vested interest in education and generally seek to ensure the education delivered is of acceptable standards. (Brunetti et al., 2020) used the theory to assess how schools can address challenges facing digital learning implementation. In Kenya, Karimi, Mulwa, and Kyalo (2020) highlighted the role of stakeholders

in planning, financing, and identifying gaps that may affect the adoption of the country's new CBC curriculum. This study plans to use this theory to anchor the stakeholder variable and explore their role in delivering digital education to public school-going children.

2.2.3 Theoretical Implications

This study uses a multi-theoretical approach in its attempt to decode the cost factors determining the delivery of digital skills in public schools in Kenya. Davis's (1989) TAM proposes that digital tools that are easy to use and offer value to learners as well as teachers was likely to be adopted. The researcher Ibrahim et al. (2017) identified perceived usefulness and ease of use, instructor characteristics, computer self-efficacy and course design as the factors that influence the effectiveness of implementation of digital literacy programs. The theory complements the TCT in that it proposes that schools with access to easy-to-use learning material and tools achieve a higher rate of digital literacy and informed the study of these constructs in the context of schools. On the other hand, the stakeholder theory recognizes the importance of stakeholder involvement in the design, planning and implementation of digital programs. The theory supports the notion that establishing clear, uniform objectives between schools and stakeholders, who include students, teachers, education sponsors, and subject matter experts, is key to the realization of the specified goals and objectives (Freeman, 2023). Therefore, Freeman (2023) proposes that the incorporation of stakeholders in decision-making structures engender greater acceptance and goal realization and according to Msomi and Hoque (2018), successful digital skills delivery is dependent on the extent to which the needs and concerns of stakeholders are addressed. Together, these three theories inform us of the importance of strategic resources, easy-to-use and valuable IT material, and the importance of involving stakeholders in implementing digital learning programs.

2.3 Empirical review

This section reviews previous literature on the expense factors that influence digital skills among school-going children in public schools. The section was arranged according to the study's objectives, starting with technical costs, resource costs, curriculum costs and stakeholder engagement and their influence on digital skills.

2.3.1 Technical-Related Cost factors and Delivery of Digital Skills

Ibieta et al. (2017) investigated the factors that determine teachers' usage of ICTs in teaching with a specific focus on the impact of personal factors. The study focused on Chilean teachers and relied on multiple regressions to analyze the extent of the relationships between the variables. The results were that teachers are more likely to use digital services outside the classroom for preparation purposes and that their ICT self-efficacy is an important determinant of their intention to use ICTs in teaching. Teacher's ICT self-efficacy was determined by their previous ICT experience, access to ICT resources such as an LCD projector, and training, reflecting the importance of funding these initiatives.

Similar findings were made by Volkan, Sefa, and Sadık (2022), whose analysis was on the factors that determine instructor's readiness on digital literacy in Turkey. The study used correlation, regression and reliability analyses, which revealed that digital self-efficacy has significant influences on instructors' effective use of technologies in learning contexts. These studies highlighted the importance of upskilling teachers with ICT skills and pedagogies and the costs associated with ICT upskilling, acquiring teachers with digital skills and teaching material. Affirming the need to introduce technologies to classrooms, Hutagalung and Purbani (2021) researched on the effect of teacher's digital literacy skills on digital instructional delivery. The study used a quantitative research method and applied statistical analysis, revealing that the lack of effective digital skills among elementary teachers has a negative impact on their ability to utilize new technologies to design, create, and inspire students to think critically. The study links digital skills' upskilling cost with teachers' ability to generate and prepare digital instructional content, thus facilitating blended learning.

In this relation, Belaya (2018) identified the costs related to the time spent acquiring digital skills and the costs of developing locally-inspired digital learning material as challenges to e-learning implementation in their study. The research employed a literature review methodology and deduced that e-learning implementation carries additional costs for setting up workplaces, data transmission, and maintenance of computers, software, and learning media. The findings are in the context of vocational education and training institutions, while the current explored e-learning in junior and intermediate levels.

Chihobo, Tambula, and Musademba (2022) evaluated the determinants of effective implementation of e-learning in engineering education at an institution of higher learning in Zimbabwe and used a cross-sectional survey and correlation analysis. Findings were that while the institution has an e-learning strategy embedded in the ICT policy, the high cost of quality maintenance staff was impacting the quality of teaching material, and many of the tools, such as webcams, were ineffective. This study is highly context-specific since it is based on one institution. The study further reported that power failure was a systematic challenge impacting e-learning. Funmilayo, Adewale, and Jane (2023) also highlighted the impact of high maintenance costs on e-learning in Nigeria. The study carried out a literature review, which revealed that costs associated with the maintenance of computer laboratories and school repositories, high internet subscription costs, and low infrastructural development were the main factors affecting the utilization of e-learning platform exposure. The researchers specified the utilization of e-learning platforms, while the current studied all means through which digital skills can be delivered.

Using insights from the technology diffusion theory, Kamau (2020) carried out descriptive research on the drivers of digital literacy implementation among Kenyan universities. Specific objectives were on the effect of staff skills and competencies, ICT infrastructure, and strategic planning, and descriptive and inferential methods were applied in the analysis. The study revealed that the variables have significant explanatory power on the success of digital literacy implementation programs. Conclusions were that universities have to increase investment in internet connectivity, ICT infrastructure, strategic alliances, and the development of staff skills and competencies through online courses, workshops, and other professional development initiatives.

These studies show the impact of different cost factors on the extent of use of digital tools, on teachers' willingness and ability to deliver digital skills, and on students’ ability to access digital learning materials. This study studied these costs (upskilling costs, costs of setting up digital workspaces and maintenance costs) in relation to the delivery of digital skills to Kenyan school-going children in junior and intermediate classes.

2.3.2 Resource-Related Cost factors and Delivery of Digital Skills

Gil-Flores, Rodríguez-Santero, and Torres-Gordillo (2017) carried out a qualitative analysis of the role of ICT infrastructure in the ICT education delivery in Spain. Data was sourced from teachers and school IT technicians, and multilevel logistic regression was used. Findings were that computers and basic IT infrastructure were available (mobile network coverage, computer laboratories, computers, and uninterruptible energy supply), schools lacked adequate learning material, internet connection, and ICT-competent teachers, and this impacted their ability to deliver digital skills. The study thus concluded that schools should invest in IT software to improve the quality of instruction delivery. In India, Hassan and Mirza (2021) sought after the drivers of digital literacy with a focus on the perspective of teachers. Descriptive and empirical analysis revealed that despite being aware of digital tools and their potential in instruction delivery, the ICT infrastructure is inadequate, the curriculum obsolete and doesn't directly support new forms of digital literacy delivery, and instructors had minimal IT training and exposure to digital content. The cost of digital resources and bandwidth costs were the reasons for the use of outdated content.

Confirming that educational problems can be solved through the use of new technologies and teacher training, Iyer (2019) examined the factors influencing the improvement of education in rural India. The specific focus of the study was on access to mobile devices, a hybrid learning and assessment mechanism, and availability of high-quality educational content. The analysis revealed that rural schools were facing significant difficulties delivering minimum proficiency skills due to the high cost of multilanguage quality educational content and courses, inaccessibility of assessment tools, and poor cell networks. Moreover, the high cost of AI tools and virtual reality labs also meant that the rural schools were only able to deliver minimum skills.

Cherotich and Waweru (2020) reviewed the infrastructure in ICT linked with digital literacy using a descriptive design and literature review focusing on primary schools. The study used random sampling and inferential analysis, which revealed that there is a significant association between digital resources, computers, and internet connectivity and digital literacy delivery in Kenyan primary schools. More findings were that there is a significant difference in access to digital resources and infrastructure within schools as many schools lack the finances to access ICT

resources and hence use outdated teaching materials, content, and instruments, and this has had significant negative impacts on teachers' ability to deliver quality digital literacy skills.

Kyalo (2021) affirmed the slow implementation of digital literacy programs in Makueni County despite the existence of policies, frameworks, and guidelines for effective digital literacy implementation. The research applied regressions in analysis and ascertained that poor power supply, inadequacy of learning devices and resourcing challenges were the main factors impacting digital learning implementation. Conclusions were that the availability of IT resources and facilities is a minimum requirement, while the standards and quality of the resources are precursors to effective learning. The analysis also affirms that proper financing and digital continuity plans are factors that guarantee teacher training, regular supply of updated learning materials, and resourcing issues. Accordingly, the study confirms that instituting a competency-based ICT curriculum would fast-track the implementation process.

Njoroge, Ngugi, and Kinzi (2017) carried out research into selected factors determining ICT implementation in public secondary schools in the Naivasha sub-county, Kenya, in research that adopted an ex post facto research design. Findings were that while the cost of ICT infrastructure and the development of teachers' ICT skills had significant impacts on ICT implementation, the vision of the school with regard to ICT policy and the strategic implementation plan had more significant impacts. The study contributes to our understanding of the impact of head teachers' policies and vision but it does not inform of the impact of ICT implementation on teachers' digital skills delivery.

2.3.3 Curriculum-Related Cost factors and Delivery of Digital Skills

Brata et al. (2022) carried out a case study in Indonesia to determine the factors influencing effective digital literacy integration for Biology students. The case study conducted interview guides to collect data on students' digital literacy interests, internet costs, gender, and learning outcomes. Applying regressions in analysis, it was ascertained that with adequate resources and educational material, the student's digital literacy scores are subject to the costs of the internet and interest by the teachers and students in digital technology. The analysis further revealed that while learning outcomes depend on the web-based biology learning environment, creating this

environment is costly as it must be integrated with STEM subjects and increases the economic burden in education.

Post et al. (2023) examined the cost of simulation-based mastery learning programs for abdominal ultrasound skills acquisition in research that used an exploratory approach, which revealed that simulated and virtual learning environments provide cost-efficient means for equipping trainees with ultrasound skills. Costs associated with curriculum development costs and equipment depreciation costs, as well as the number of participants, were identified as the factors that influenced the type of simulator used and the time taken to master abdominal ultrasound examinations. This study was specific to simulated learning in clinical situations, which provides a perspective unique to the development of clinical training.

The researcher Lyons et al. (2019) examined the costs associated with bridging the gap between digital skills and employability for vulnerable populations. The study explored global strategies employed to deliver digital skills and ascertained that developing a multilevel educational approach encounters costs associated with reforming existing education systems to directly link education to skills training and the labor market, promoting internship and apprenticeship programs, and creating alternative and non-formal digital training educational models. This study was on how to bridge employees' skills, while the current study focused on skills delivery in schools.

The research by Schirmer et al. (2023) provides a similar gap in their literature review, which examined the concepts and educational requirements for digital competence development among older adults. The review highlighted the importance of strategic investment in the design and development process to ensure learning content is based on learners' needs, addresses local problems, and considers social processes. Costs related to considering individual needs and designing flexible educational formats in the curricula were identified as barriers to the adoption of digital educational programs and the eventual acquisition of digital skills. The study reviewed secondary data, while the current studied primary and secondary data.

Salam et al. (2017) sought after the strategic barriers to effective ICT integration in Pakistani public schools. The study used a survey-style research design that relied on regressions, which revealed that the country was facing a financing crisis as the education sector was facing challenges

designing ICT curricula, deciding on the models and learning material, and developing teachers' ICT skills in line with the business environment. A strategic approach to financing, curricular development, resource acquisition, and skills development were indicated as means of ensuring effective ICT integration. This study's findings were from Pakistani Muslim public schools, while the current study specifies a multicultural perspective.

Salam et al. (2018) also used literature analysis to the impediments to the integration of ICT in public schools, confirming that successful integration of ICT depends on overcoming the barriers. The main impediments to ICT integration that influenced curricula were a dearth of funds for developing localized content (including language software), lack of policy and planning, inability to relate curricula with ICT and basic ICT training skills, and a difference in curricula and medium of instruction in public and private schools. The research showed the importance of periodically revising education policy and curricula but offered methodological differences, having carried out secondary literature analysis.

2.3.4 Stakeholder Involvement and Delivery of Digital Skills

Petko and Prasse (2018) used a structural equation model in the analysis of the stakeholder engagement influence on educational technology influence in elementary schools on students' digital skills. The study specified the involvement of elementary school teachers in Switzerland. The study confirmed that while factors such as the quality of infrastructure, teacher beliefs, and teacher skills have direct influences on the program's integration, the teacher's beliefs and perceptions regarding IT were a factor of the principal's engagement, while the teacher's skills were influenced by the degree of teacher leader engagement. The involvement of parents proved important to the teachers' beliefs as well as skills, while access to digital devices was the result of engagement by the school board, teacher leaders, and parent leaders.

Findings from Marti et al. (2018) also revealed a significant positive effect of parental involvement on students' readiness and skills. The study specified the role of parents in the Getting Ready for School (GRS) intervention program but evaluated early literacy, math, and self-regulatory skills among children from disadvantaged families. The study revealed that children were more effective thinkers when parents attended GRS events, spent time doing GRS activities at home, and use digital learning materials. Agustini, Lian, and Sari (2020) used a descriptive study that used a

qualitative methodology on the factors influencing digital literacy program implementation in Indonesia. The study used interviews, observation, and documentation to collect data from primary school teachers implementing digital literacy programs. The findings revealed a significant connection between digital literacy technologies, programs, and technicians as an investment and the school principals' commitment to digital literacy. The study asserted that principals who support the above document and enforce targets that can support digital literacy, organizing seminars, and establishing relationships with stakeholders for technical assistance.

Gruchel et al. (2022) confirm that the home is an informal learning environment that can have significant impacts on students' digital skills in research that sought after the impact of parents' role construction, digital skills, self-efficacy, and parental instruction on IT use. Structural Equation Modeling (SEM) analysis was conducted on data sourced from German children and parents, and it was ascertained that parents' ability to motivate their children plays a significant part in children's practical and school-or-learning-related internet use. From a resource-based perspective, Badri et al. (2017) demonstrated the support role played by parents. The research focused on 6th-grade children in Abu Dhabi and examined their ability to use personal computers, mobile phones, and social media applications in schools' social networking groups. Findings were that children from homes with the internet and with ICT-knowledgeable parents demonstrated greater ICT proficiency but were likely to spend more time online and perform poorly in specific subjects.

Ajuoga and Keta (2021) expounded on the role of stakeholders in the oversight and identification of gaps in digital skills development in research that evaluated the effect of stakeholder involvement on the implementation of the Competence Based Curriculum. In the study, parents were involved in preparing timetables and instructional material for the students and identifying the new system's weaknesses with regard to student wellbeing. Local and regional stakeholders were also involved heavily in donating learning and teaching material for the new curriculum.

Similar roles were identified by Kegoro (2019), which evaluated CBC implementation. The study, which involved parents in a national conference, revealed how parents' opinions on homework and resources needed for the new curriculum exposed the new curriculum as an expensive, energy and time-consuming system that may exacerbate education inequality and impact skills acquisition

and retention. These studies show stakeholders as financiers, oversight role, and motivating agents whose involvement in education can either encourage or discourage children's acquisition of digital skills in educational and non-educational settings.

Muriuki (2017) researched on ICT implementation among primary schools in Kenya with a focus on ICT training and financing in Kajiado North sub-county. Thus, the research focused on schools' infrastructural facilities, administrative support and ICT policy directives and their effect on ICT integration in primary schools. The descriptive research used regressions in analysis, revealing a significant association between ICT policies, infrastructure, and administrative support. The study called on school heads to provide support to facilitate IT training and enforce digital knowledge to instructors through financial and technical resupply. School heads were also recommended to develop relationships with IT agencies that would provide technical support and assist in the localization of digital learning material.

2.4 Summary of Research Gaps

The empirical literature reviewed reveals the existence of a host of factors that may have an impact on children's digital skills. However, while informative, many of the studies evaluated are foreign-based and present the opinion of societies that are already highly technologically integrated (Ibieta et al., 2017; Tejedor et al., 2020). Furthermore, the study by Ibieta et al. (2017) provided a conceptual gap, having specified the teachers' competencies as a determinant of children's digital skills. Rafi et al. (2019) present a gap in their study, which specified digital skills for university students, while the current one specifies public school-going children. The gap is also present in the study by Oyedokun et al. (2018), which evaluated the effect of library technicians' IT skills on students' utilization of digital skills. This study expounded on these findings by evaluating resource, stakeholder, and curriculum costs on students' IT skills among primary school students in a developing economy where parents, as well as teachers and multiple stakeholders, have limited IT skills, and schools are heavily underfunded. Table 2.1 presents a summary of the gaps.

Table 2.1 Summary of Research Gaps

Author	Title	Findings	Research Gap	Type of gap	How the gap was addressed
Brata et al. (2022)	Student's digital literacy is based on students' interest in digital technology, internet costs, gender, and learning outcomes.	With adequate resources and education material, the student's digital literacy scores are subject to internet costs and teacher's and student's interest in digital technology.	This study was specific to digital skills acquisition among biology students and internet costs.	Contextual gap	This gap was addressed through a focus on digital delivery in multiple subjects and examine more than technical costs (internet)
Agustini, Lian and Sari (2020)	School's Strategy for Teacher's Professionalism through Digital Literacy in the Industrial Revolution 4.0	School principals' commitment to digital literacy and investment in digital literacy programs, technologies, and technicians, as well as supportive principals, promote digital literacy skills	This study specified the teacher's role in digital literacy programs and did not examine costs associated with curriculum and resource access.	Contextual and Conceptual gaps	This gap was addressed by evaluating the role of multiple stakeholders.
Zahari et al., (2018)	A Conceptual Digital Transformation Design for International	Long-term planning is an integral factor of digital transformatio	This was a case study, limiting the extension of its	Methodological gap	This study studied multiple institutions to get findings

	Islamic University Malaysia to" University of the Future	n within universities.	findings to research on multiple institutions .		that can be generalized.
Rahmah, Eryansyah and Silvhiany (2021)	EFL Students' Digital Literacy: Barriers to Development and Effective Web Application Programs	Lack of finances to access the latest digital devices and learning material were impacting the digital literacy delivery in universities.	This was also a case study that focused on one state-owned university and used interview schedules and thematic analysis.	Methodological gap	This study evaluated digital skills among public primary and secondary schools.
Petko and Prasse (2018)	Exploring the impact of stakeholder engagement on the integration of educational technology in elementary schools: Expanding the will-skill-tool model with contextual variables.	The quality of infrastructure, teacher beliefs, and teacher skills have direct influences on the program's integration; students' beliefs and perceptions regarding IT were a factor in the principal's engagement,	This study only evaluated stakeholder roles	Conceptual gap	This study examines stakeholder roles as a moderating (facilitator) variable.

Gruchel et al. (2022)	Parental Involvement and Children's Internet use Relationship with Parental role construction, self-efficacy, Internet Skills, and parental instruction.	Parents' motivation ability plays a significant part in children's practical and school-or-learning-related internet use.	This study specified children's cost factors and digital literacy at home.	Conceptual gap	The role of parents was examined as a facilitator variable due to its impact on access to digital tools.
Salam et al. (2018)	Impediments to the Integration of ICT in Public Schools of Contemporary Societies: A Review of Literature.	Lack of finances for developing localized content, poor policy planning, and inability to relate curricula with ICT and basic ICT training skills	This study used a secondary literature review	Methodological gap	This study used primary and secondary data to get a more localized understanding of ICT cost factors (impediments)

2.5 Conceptual Framework

The below conceptualizations outline the relationship between the various study variables as guided by the survey's objectives. This study predicts that technical-related costs,

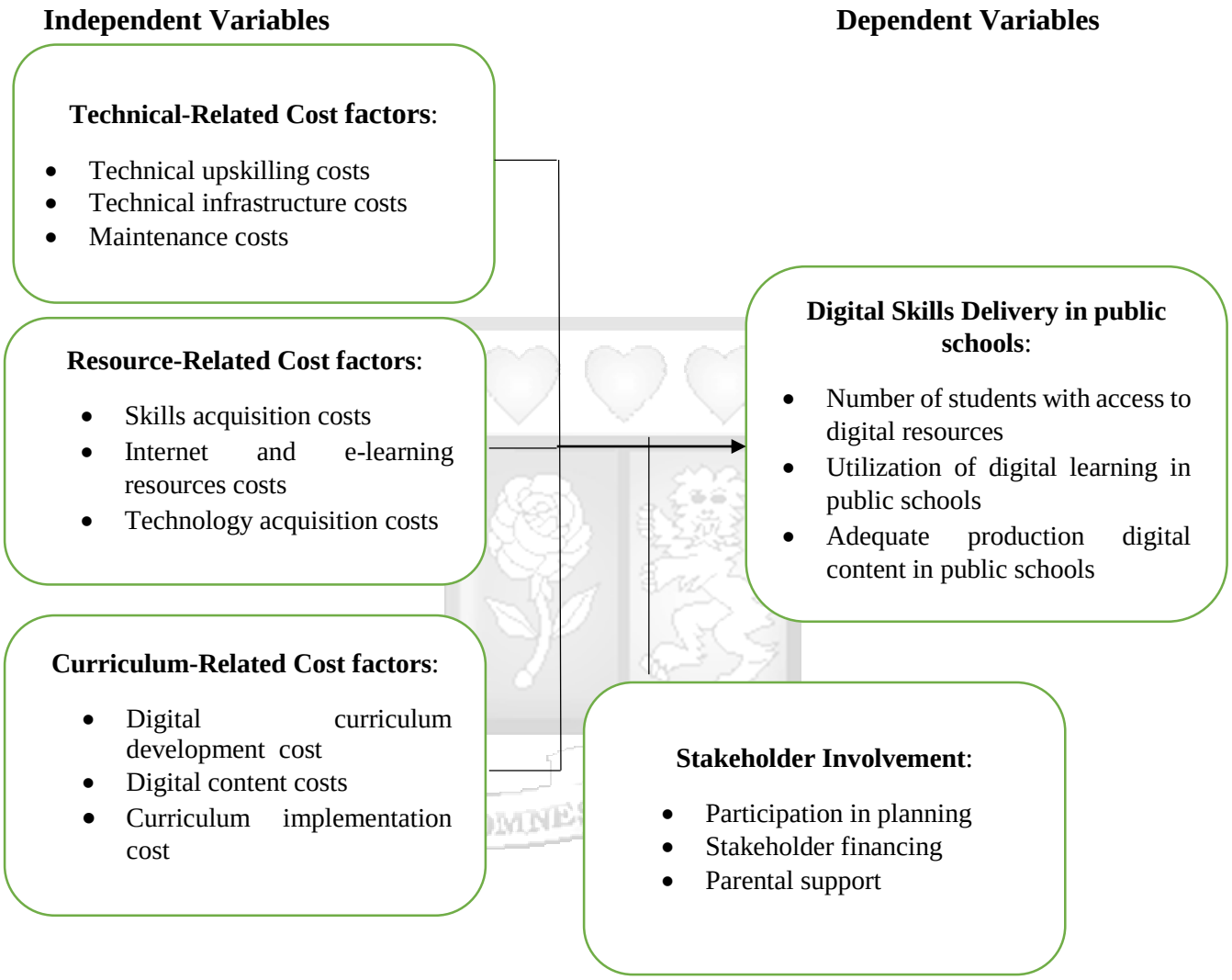

Figure 2.1 Conceptual Framework

The framework in Figure 2.1 has captured how the predictor variables; technical-related factors, resource-related factors, curriculum-related factors and stakeholder involvement factors was operationalized in the survey and their interaction with the dependent variable; acquisition of digital skills in public schools in Nairobi County.

Table 2.2 Operationalization of Research Variables

Variable	**Indicators**	**Data collection tool**	**Data analysis**	**Supporting literature**
Technical-Related factors:	• Technical upskilling costs • Technical infrastructure costs • Maintenance costs	Structured questionnaire; 5-point Likert scale	• Descriptive analysis • Factor analysis • Inferential analysis	Ibieta, et al. (2017), Isaboke (2021)
Resource Related factors:	• Skills acquisition costs • Internet and e-learning resources costs • Technology acquisition costs	Structured questionnaire; 5-point Likert scale	• Descriptive analysis • Factor analysis • Inferential analysis	Ayllón et al. (2019), Muriuki (2017)
Curriculum-Related factors:	• Digital curriculum development cost • Digital content costs • Curriculum implementation cost	Structured questionnaire; 5-point Likert scale	• Descriptive analysis • Factor analysis • Inferential analysis	Subrahmanyam (2022)
Stakeholder Involvement:	• Participation in planning • Stakeholder financing • Parental support	Structured questionnaire; 5-point Likert scale	• Descriptive analysis • Factor analysis • Inferential analysis	Kerkhoff et al. (2020)
Digital Skills Delivery in public schools	• Number of students with access to digital resources • Utilization of digital learning in public schools	Structured questionnaire	•	Brata et al. (2022); Subrahmanyam (2022)

- Adequate production of digital content in public schools

2.6 Chapter Summary

This study presents the study's basis of reasoning. Prior to reviewing researchers' previous findings on the effect of resource factors on rates on digital literacy, the theoretical underpinning of the study was done on Kenyan students. The chapter, therefore, concludes with a conceptual framework that visualizes the hypothetical interaction between the variables of the study. In the framework, the independent variables are the investigated factors, while delivery of digital skills serves as the dependent variable.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methods and procedures that was applied in conducting the research study in order to address objectives highlighted in the first chapter. The chapter provides information on the research design, population, and sampling design to be used in the study. The methods of data collection, research procedures and data analysis were included. Finally, the chapter concluded with a summary of the outline provided above.

3.2 Research Philosophy

Research paradigm has been termed as the important framework of position that is used to organize interpretations, opinions and perceptions (Bougie & Sekaran, 2019). The researcher used the pragmatism research philosophy (Ghauri, Grønhaug, & Strange, 2020). The role of the researcher was limited to the collection and interpretation of data using an objective approach, which created findings that are quantifiable through statistical analysis. Further, pragmatism philosophy allows for in-depth utilization of qualitative and quantitative data to be collected for analysis. This was also utilized in this survey with key informant being considered ideal to obtain more contextual information on the digital skills landscape in the Kenyan education sector.

3.3 Research Design

The study employed mixed methods research (MMR) design. Mixed methods research design incorporates both quantitative and qualitative research data in a study (Creswell, 2014). According to Creswell (2014), open ended sources without pre-designed answers are used in qualitative data, whereas close-ended data sources such as tests and questionnaires are used in quantitative data. MMR design was selected as the preferred research design in this study based on the criteria outlined by Mariani and Baggio (2020). The authors contend that the core dimensions factored in analysing the appropriateness of a methodological design include reporting and visualization tools, sources of data and the nature of the study (Mariani & Baggio, 2020). Data sources in this study was persons in the education sector who are conversant with the language of the study (English). The nature of this study could be described by both quantitative and qualitative attributes from different stakeholders from the education sector. The reporting and visualization tools used both

narratives and statistical aspects from the respondents. Considering all these dimensions, MMR was selected as appropriate design as it gives an opportunity to use all these different strengths together to better examine the cost on delivery of digital skills in public schools.

Mixed method research (MMR) in this study consisted of aspects of phenomenological design (qualitative) and descriptive cross-sectional design (quantitative). The researcher used a descriptive cross-sectional survey to collect quantitative data from principals and head teachers' on digital skills, costs related to technical, resource, curriculum and the involvement of stakeholders. Quantitative data was analysed using statistical methods. On the other hand, the phenomenological design was used to go deeper into policy stakeholders such as Ministry of Education, Ministry of ICT, KICD, and Nairobi County officials within Nairobi County. The above therefore guided the analysis of the cost delivery on digital skills within public schools in Nairobi County.

3.4 Target Population

The target population is defined as the group of individuals in which the researcher intends to conduct research and draw conclusions (Ghauri, Grønhaug, & Strange, 2020). The population of interest for the survey was both from public primary and public secondary schools within Nairobi County. According to the Nairobi County Government Department of Education (2022) there are 225 primary and ECD and 128 secondary schools within the county (Nairobi County Department of Education, 2022). The head teachers and principals from each institution was considered for this research. The population for the study was 358 participants; further, the survey targeted key informants drawn from the Ministry of ICT, Ministry of Education, Kenya Institute of Curriculum Development and Nairobi County Government as shown in the table below.

Table 3.1 Target Population

Sub-County	Category	Population
Dagoretti	Primary schools	26
	Secondary schools	12
Embakasi	Primary schools	45
	Secondary schools	7
Kamukunji	Primary schools	18
	Secondary schools	8
Kasarani	Primary schools	26
	Secondary schools	35
Langata	Primary schools	15
	Secondary schools	11
Makadara	Primary schools	32
	Secondary schools	14
Starehe	Primary schools	34
	Secondary schools	14
Westlands	Primary schools	29
	Secondary schools	27
Key Informant Interviews	Ministry of ICT (PS)	1

Ministry of Education (PS Basic Education)	1
Kenya Institute of Curriculum Development (Director)	1
Nairobi County Government (CEC Education)	1
Kenya National Parents Association (Chair)	1

Source: (Nairobi County Department of Education, 2022).

3.5 Sampling Design

Sample design determines the relevant method that can be embraced in selecting the units to be included in the inquiry (Sekaran & Bougie, 2016). Through sampling design, a researcher can make a determination of the most ideal sample since there are clear means of grouping the elements in a population. Sampling techniques include identifying methods that are critical in selecting representative items from the population (Bryman, 2016). Sampling is a process of reducing the larger targeted population into smaller units that can easily be utilized to obtain information (Patten, 2017). Stratified random sampling was used to identify subgroups within the study population since they were expected to have different parameters. The focus of the study was on the public schools within Nairobi County and will exclude all private institutions as indicated in the population of the research. The study used the Yamane formula in calculating the sample that was selected from the public schools within the county.

$$\boldsymbol{n = N/(1 + N(e)2)}$$

Where: n = sample size required

N = size of the population = 358

e = margin of error = 0.05

n = 358/ 1 + 358 (0.05)2

n = 187 principals

Table 3.2 Sample Distribution

Sub-County	Category	Population	Sample Respondents
Dagoretti	Primary schools	26	38/353 * 187 = 20
	Secondary schools	12	
Embakasi	Primary schools	45	52/353 * 187 = 27
	Secondary schools	7	
Kamukunji	Primary schools	18	26/353 * 187 = 14
	Secondary schools	8	
Kasarani	Primary schools	26	61/353 * 187 = 32
	Secondary schools	35	
Langata	Primary schools	15	26/353 * 187 = 14
	Secondary schools	11	
Makadara	Primary schools	32	46/353 * 187 = 24
	Secondary schools	14	
Starehe	Primary schools	34	48/353 * 187 = 25
	Secondary schools	14	
Westlands	Primary schools	29	56/353 * 187 = 30
	Secondary schools	27	

Key informant interviews	Ministry of ICT	5	5
	Ministry of Education		
	Kenya Institute of Curriculum Development		
	Nairobi County Government		
	Kenya National Parents Association (Chair)		

Source: (Nairobi County Department of Education, 2022).

3.6 Data Collection Instruments

Primary data was collected using a questionnaire as the tool for collecting data. Bryman (2016) the reason for seeking primary data is because of their closeness to the truth as well as not having errors. Therefore, primary data was used in obtaining objective information. The research employed questions which was in closed ended form so as to save time and also facilitating simpler analysis because they happen to be in an instant usable form. The questionnaire entails information of the organization which consists of statement with regard to the questions of research. The researcher employed the Likert 5- Point Scale; whereby 1 represent 'strongly disagree, 2 represent 'disagree', 3 'neutral', 4 represent 'agree' and 5 'strongly agree'. The questionnaires was categorized into two parts. The first part entails demographic information while the second section had questions related to the three specific objectives of the study. Further, key informant interviews guides were developed to complement the collected structured data. The interviews questions was aligned to the objectives of the research.

3.7 Research Procedure

The researcher prepared debrief and consent forms which accompanied the research questionnaires that was distributed to the target respondents. The Institutional Review Board approval of the research proposal to go to the field and gather data was sought from the University. The research sought authorization from the NACOSTI for approval to collect data. The study data was collected using Google forms to save on time and cost in the data collection process. The researcher pretested the research instrument among 10% (18) of the sample respondents to support the reliability and validity tests of the questionnaire. The participants included in the pilot testing were not involved in the main survey.

A research instrument should have validity and reliability as its core components. Validity refers to the ability of an instrument to measure its intended variables (Orodho, 2003). Content validity is a measure of a degree to which data collected by a research instrument represents specific indicators of a concept (Mugenda & Mugenda, 2003). In this study, the questionnaire was given to supervisors to judge its validity. The reliability of the research instrument was checked using the Cronbach Alpha score. The test ranges between 0-1 with values above 0.7 being considered reliable thus ensuring the internal consistency of the questionnaire.

Table 3.3 Reliability Results

Variable	Cronbach's Alpha	N Items	of Decision
Digital skills	.771	8	Accepted for adoption in the research
Technical-related	.730	5	Accepted for adoption in the research
Resource-related	.704	4	Accepted for adoption in the research
Curriculum-related	.859	4	Accepted for adoption in the research

Stakeholder involvement	.820	4	Accepted for adoption in the research

3.8 Data Analysis and Presentation

Data analysis is the processing of the raw statistical evidence sought from the field into meaningful insights (Sekaran & Bougie, 2016). The processing of the gathered data from the field was conducted and quantitatively supported using means and standard deviations as well as correlation and regression analysis. The study adopted f-tests (ANOVA) to determine the statistical significance of the model and T-tests to establish the significance of the individual variable coefficients. The regression model fitness was checked by conducting diagnostic checks such as normality, autocorrelation, heteroscedasticity and collinearity checks to determine the fitness of the model adopted. The collected qualitative data was analyzed using content analysis along the themes of the study. The research findings were presented using tables and charts and the below regression model was applied in the study;

$$\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$$

Where;

Y = Dependent variable (adoption of digital literacy)

α = the model intercept

$\beta_{1\text{-}3}$ = Coefficient of independent variables

$\mathbf{X_1}$ – technical-related costs

$\mathbf{X_2}$ – resource-related costs

$\mathbf{X_3}$ – curriculum-related costs

$\mathbf{X_4}$ – stakeholder involvement

$\boldsymbol{\varepsilon}$ = Error Term

3.9 Ethical Consideration

Bryman (2016) define ethics as the norms used in conducting research that a researcher should observe. The procedure involves the approval of the proposal by Strathmore Ethics Review Board in order to collect data. The proposal was sent to the National Commission for Science, Technology and Innovation (NACOSTI) in order to get a permit for data collection. Informed consent of the participants was sought in advance and the management of schools was notified in writing prior to actual field work. Consent forms and debrief forms was presented to the participants who was required to append their signatures before taking part in the study. All materials used in the study was appropriately cited and later referenced as a means of countering possible plagiarism.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This chapter presented the various results that were obtained from the analysis of the primary research data collected. The study applied both quantitative and content analysis and the findings are presented in line with the research objectives.

4.2 Background Information

The section highlights the response rate and the demographic information of the institutions that participated in the research.

4.2.1 Response Rate

The study sought to obtain research data from 187 participants drawn from principals and 5 government officials. A response of 153 was obtained from the main research tool (questionnaire) representing 82% response rate which was considered reliable for conducting quantitative analysis.

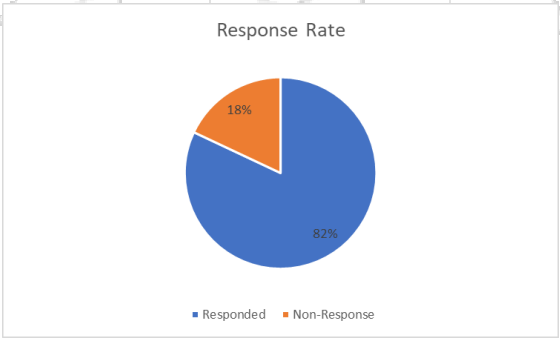

Figure 4.1 Research Response Rate

4.2.2 Gender of Respondents

The study focused on the gender representation among the school heads and findings showed that 54% (n = 83) were male principals while 46% were female; which was an indicator of improved gender equality in school leadership within the public institutions.

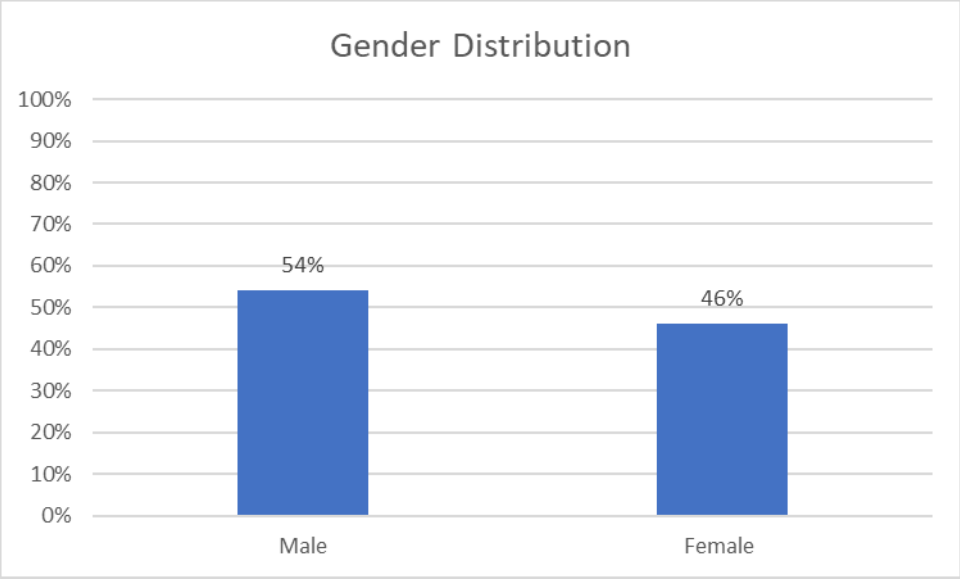

Figure 4.2 Gender Distribution

4.2.3 Highest Education Level

The research examined the education attainment among the school principals and the results are presented in Table 4.1

Table 4.1 Education Attainment

	Frequency	Percent
Degree	36	23.5
Master's Degree	110	71.9
Doctorate	7	4.6
Total	153	100.0

Analysis revealed that 72% (n = 110) of the school principals had a masters degree with 5% only having a doctorate degree. The findings demonstrated there was increased higher professional qualification among the respondents which is key to improving their management of the institutions.

4.2.4 Length of Period as School Head

The results showed that 70% of the participants had held the position for atleast 6-10 years with 14% having worked within the schools for 11-15 years as the school heads. The findings

implied that participants being considered in this research have a wide experience in management of the institutions thus can provide information necessary to answering the research problem.

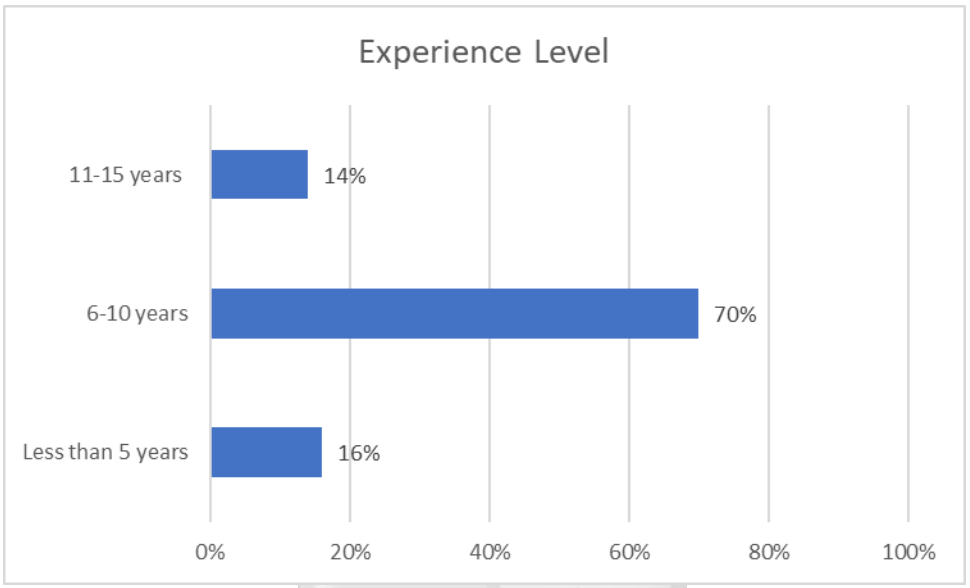

Figure 4.3 Length of Period as School Head

4.3 Descriptive Analysis

The research applied a structured questionnaire in collecting research data from the school principals that was summarized using means and standard deviation. Further, qualitative data was obtained from key informants and was presented using content analysis in line with the variables of the research.

4.3.1 Digital Skills in Public Schools

The dependent variable focused on the digital skills uptake within public schools in the county and findings are shown in Table 4.2

Table 4.2 Digital Skills in Public Schools

	N	Mean	Std. Deviation
Our students have adequate access to digital literacy programs	153	3.5229	1.08873
Our students have been widely utilizing digital learning resources	153	3.5490	.97967
Our students are able to utilize and produce digital learning content	153	3.6078	.87536

Our students are aware of the risks associated with utilization of digital learning resources	153	3.5621	.95855
Our students are able to collaborate with other learners through digital learning	153	3.5229	.93952
Our students do leverage on digital learning to improve their critical thinking and computational skills	153	3.5294	.88153
Our students are able to create new learning methods as a result of improved digital skills	153	3.7974	3.47616
Our students are able to share knowledge and resources seamlessly using digital learning tools	153	3.5817	.94322

The respondents agreed that students are able to utilize and produce digital learning content (mean = 3.6078, dev = .875). Results indicated agreement that students do leverage on digital learning to improve their critical thinking and computational skills (mean = 3.5294, dev = .8815). The participants were in agreement the students are able to share knowledge and resources seamlessly using digital learning tools (mean = 3.5817, dev = .9432). Analysis revealed that students have adequate access to digital literacy programs as shown by a mean of 3.5229.

4.3.2 Technical-Related Cost Factors in Public Schools

The first variable focused on technical-related cost factors within the sample institutions and the findings are presented in Table 4.3

Table 4.3 Technical-Related Cost Factors in Public Schools

	N	Mean	Std. Deviation
The school supports our teachers to improve their technical competency on various digital learning resources	153	3.4052	.95585
The school has provided adequate infrastructure to support utilization of digital learning content	153	3.1634	1.00954
The school has allocated adequate financial and human resources to support the maintenance of digital learning	153	3.2026	1.01540
The school has invested on necessary hardware to support the maintenance of our digital resources	153	3.2418	.98693

The school maintains a collaborative environment with software developers to ensure we utilize emerging technologies in digital learning	153	3.4314	.81729

Findings showed moderate agreement (mean = 3.4052) the school supports our teachers to improve their technical competency on various digital learning resources. Respondents moderately agreed the school maintains a collaborative environment with software developers to ensure we utilize emerging technologies in digital learning (mean = 3.4314). The results indicated moderate agreement the school has provided adequate infrastructure to support utilization of digital learning content (mean = 3.1634).

4.3.3 Resource-Related Cost Factors in Public Schools

The second variable examined resource-related cost factors within the institutions and the analysis is shown in Table 4.4

Table 4.4 Resource-Related Cost Factors in Public Schools

	N	Mean	Std. Deviation
The school has adequate number of skilled personnel to lead in implementing digital literacy	153	2.8170	1.07261
The school has access to internet and e-resources necessary for adoption of digital literacy	153	2.9869	1.10612
The school engages with various partners to improve financing for access new technologies needed for digital literacy	153	3.2157	1.02560
The school has invested in physical infrastructure required for the smooth utilization of digital learning resources	153	3.2026	1.04730

The results indicated moderate agreement the school engages with various partners to improve financing for access new technologies needed for digital literacy (mean = 3.2157, dev = 1.025). Respondents moderately agreed the school has invested in physical infrastructure required for the smooth utilization of digital learning resources (mean = 3.2026, dev = 1.047). The analysis

showed moderate agreement the school has adequate number of skilled personnel to lead in implementing digital literacy as demonstrated by a mean of 2.817.

4.3.4 Curriculum-Related Cost Factors in Public Schools

The survey further analyzed the curriculum-related cost factors in the public schools and summary of responses is shown in Table 4.5.

Table 4.5 Curriculum-Related Cost Factors in Public Schools

	N	Mean	Std. Deviation
The school has fostered the inclusion of digital learning in the curriculum provided to our pupils	153	3.1634	1.03528
The school regularly participates in training and seminars to improve the skills of our instructors on digital learning content	153	3.2092	1.13354
The school participates in ministry led digital curriculum development within the country	153	3.1765	1.13043
The school routinely reviews available digital resources to enhance the quality of learning	153	3.2484	1.08386

The study participants moderately agreed the school routinely reviews available digital resources to enhance the quality of learning (mean = 3.2484, dev = 1.083). The principals further moderately agreed the school regularly participates in training and seminars to improve the skills of our instructors on digital learning content (mean = 3.2092, dev = 1.133). Findings revealed moderate agreement the school has fostered the inclusion of digital learning in the curriculum provided to our pupils (mean = 3.1634).

4.3.5 Stakeholder Involvement in Public Schools

The study further analyzed the role played by stakeholders within the public schools and findings are shown in Table 4.6

Table 4.6 Stakeholder Involvement in Public Schools

	N	Mean	Std. Deviation
The school engages online instructors to facilitate digital learning implementation	153	2.9281	1.14193
The school collaborates with donor agencies to enhance the funding available for digital learning	153	3.2092	1.15652
The school relies on stakeholder involvement to develop new policies and strategies to improve digital learning experience	153	3.3725	1.13487
The school routinely involves guardians/parents in provision of resources needed in adoption of digital learning	153	3.4183	1.04890

Participants moderately agreed (mean = 3.4183) the school routinely involves guardians/parents in provision of resources needed in adoption of digital learning. Results showed moderate agreement the school relies on stakeholder involvement to develop new policies and strategies to improve digital learning experience (mean = 3.3725, dev = 1.134). The study revealed moderate agreement the school engages online instructors to facilitate digital learning implementation (mean = 2.9281, dev = 1.141).

4.4 Qualitative Analysis

4.4.1 Digital Skills in Public Schools

The key informant (1, 4) was in agreement that *'public schools have seen increased uptake of digital learning is quite on the right path especially with the introduction of Competency Based Curriculum (CBC) that focuses on the nurturing the learner's potential and is skill based rather than classroom oriented. Further, there was need for more sensitization to be carried out in public schools*. This was contrary to KII (3) who reported that the '*uptake of digital learning has been slow and quite inequitable in the different schools through the years, contrary to how it was expected when the digital literacy program was started in 2013*'. Similarly (KII, 2); reported that '*the process is quite slow. Considering the intensive investment in ICT by the government, I think more needs to be done to incorporate digital learning, especially to public schools. For instance, in my children's public school, teachers still use chalkboards and tattered books for teaching as compared to most private schools in Nairobi County where most learning is done on smart boards and tablets'*.

4.4.2 Technical-Related Cost Factors

Key Informants showed consensus that *the limited number of devices is a big factor. This is contributed by the high equipment cost that would mean the schools would need to invest more money on the equipment, which is most often diverted to more important items that the schools need. Further, the cost of assets such as computers and tablets, software programs e.g e-pubs are quite costly. Most learners have to share these assets which are not adequate therefore impeding the process.*

4.4.3 Resource-Related Cost Factors

The key informant indicated *that books are a key resource as well as ICT resources like computers and tablets since the content including curriculum designs and books are converted into Accessible digital content that is easily consumed by the learners, the process is quite lengthy. Moreso, in some of the public schools they do not have dedicated computer rooms where the students can be able to access and learn about these digital skills. In addition to these, human resource is another limiting factor, where you will find that some of these schools do not have the instructors that are dedicated to teaching the students these digital skills.*

4.4.4 Curriculum-Related Cost Factors

Further the key informants (2) revealed that '*curriculum that is already approved is converted into digital content for access by the learners. However, the schools lack enough trained staff and ICT equipment to handle this. The government has put effort to ensure curriculum content approved by KICD is delivered in schools across the country'.* The KII (3) noted that '*most of the learning platforms require subscriptions of some form, including the Microsoft suites which are basic for students to learn how to use computers. This greatly hinders learning using computers and tablet*'. Moreso, KII (4) noted ICT is *an ever- evolving field. Most curriculums do not keep up with current ICT trends and changing curriculum frequently is quite expensive.*

4.4.5 Stakeholder Involvement

The key informant (3) revealed that *there was need for the government should pass laws on enablement of digital skills in public schools to ensure a future digital economy, school administrators and teachers should take the initiative to learn digital skills in order to deliver them*

to students effectively, parents should support their children and the teachers in the digital skills enhancement journey through eg contributions for training and buying equipment. KII (4) also noted *parental engagement and empowerment with digital skills is very key in ensuring digital skills transfer to the children/learners at home*. In general, the key informants indicated the '*government should seek to bridge the implementation gap, community members should offer security for digital gadgets, political leaders should support implementation and school admins to offer support for capacity building, giving resources'*.

4.4.6 Ways of Enhancing Digital Learning

The Key Informant (3) indicated that '*peer-to-peer training could be a great way to enhance delivery of digital skills, as it will assist find some of the students already possessing these skills and they could pass them on to their friends. Also, we could have volunteers from the community who could offer to train these children in school on the different digital skills and get recognition for their hard work. We could also have the schools use free online material that would greatly reduce the costs of teaching the digital skills and ensure there is access to the same'*. KII (2) noted that '*the government can provide grants to public schools on digital skills enhancement and purchase of digital equipment which will improve delivery'*.

KII (1) contends that '*content production can be done online and distributed in a cheaper way through existing platforms and partnerships. Example books are printed and sold for each user, the cost of digital books distribution is less and content update can be seamless*. This was corroborated by KII (4) who revealed that '*KICD already has in place the Kenya Education Cloud that hosts the accessible digital content that is free for all learners. Further, this can be done cost effectively by developing offline digital content that can be shared regionally. The other way is also through having teachers using resources like a projector and a computer to teach a group of learners say from three schools in one area or by using social platforms like YouTube and Zoom'*.

4.4.7 Key Factors Impending Delivery of Digital Skills

KII (3) reported the main factors affecting '*delivery of digital skills as in the public schools is infrastructure. The limited number of devices and computer classrooms in the schools greatly reduce the number of students in the schools who would be able to join these classes. In addition, lack of enough instructors/teachers who are able to train the students on these skills is another*

contributing factor, as has been seen in most of the schools in the rural areas'. KII (1) listed the following as the main barriers; '*expensive digital equipment that most public-school parents cannot afford (i); lack of digital know-how by teachers and principals (ii); outdated beliefs from parents that digital technology does more harm than good (iii) and lack of proper sensitization of benefits of digital skills to public schools (iv)*. KII (4,1) noted that; *'inadequate resources like internet connectivity in schools, computers and tablets, relevant software, computer labs, lack of technical knowhow from the teachers, inadequate teaching staff in schools to handle the digital skills*' were some of the main impeding factors.

4.4 Diagnostic Analysis

The linear regression assumptions were adopted in the study prior to conducting the regression analysis and the findings are shown in this section.

4.4.1 Collinearity Test

Multicollinearity problem occurs when there is a high degree of relation between the independent variables. The research applied the variance inflation factor and the tolerance values in the analysis.

Table 4.7 Collinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Technical Related	.645	1.551
	Resource Related	.525	1.904
	Curriculum Related	.629	1.591
2	(Constant)		
	Stakeholder Involvement	.404	2.474

a. Dependent Variable: Digital Skills

The above findings confirm that the predictor variables adopted in the research did not have a collinearity problem. This signified by the variance inflation factors that were less than 10 with corresponding tolerance values above 0.1

4.4.2 Heteroscedasticity Test

The study further conducted heteroscedasticity check to determine whether the disturbances or the error terms in regression function have the same variance. The analysis utilized the Breusch Pagan test and results are shown below.

Table 4.8 Heteroscedasticity Test

Breusch-Pagan Test for Heteroskedasticity [a,b,c]		
Chi-Square	df	Sig.
.027	1	.870

a. Dependent variable: Digital Skills

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

Findings above revealed P-value observed was greater than the standard P-value 0.05 ($p<0.05$) with a chi-square of .027. This indicates that heteroscedasticity was not observed among the variables selected for this study.

4.4.3 Normality Test

The research adopted normality test to check if the data set is well-modelled by a normal distribution or whether data has been drawn from a normally distributed population. The study relied on the normality p-p plot and the findings showed the observations were within the normality line thus indicating the data was from a normally distributed sample.

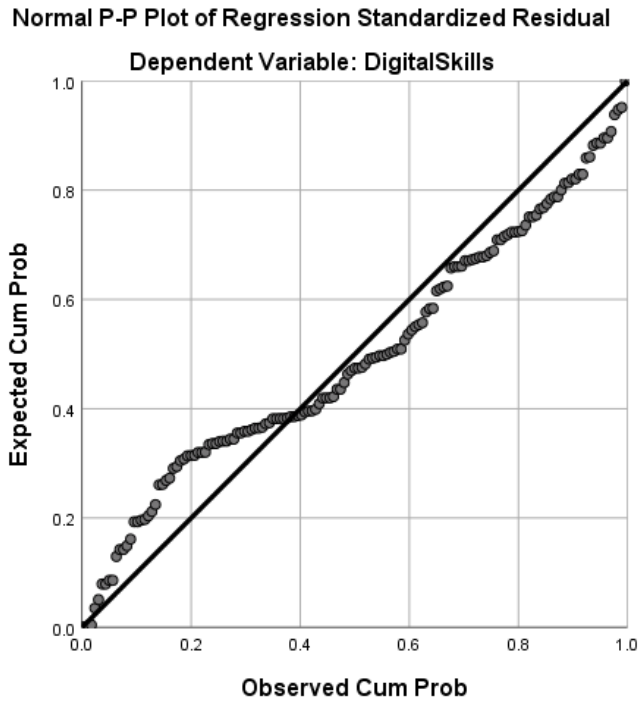

Figure 4.4 Normality Test

4.5 Correlation Analysis

The study adopted Spearman rank correlation to establish the direction of relation between the variables and the results are presented in Table 4.9

Table 4.9 Correlation Test

			Digital Skills	Technical-Related	Resource-Related	Curriculum-Related	Stakeholder Involvement
Spearman's rho	Digital Skills	Correlation Coefficient	1.000				
		Sig. (2-tailed)	.				
		N	153				
	Technical-Related	Correlation Coefficient	.542**	1.000			
		Sig. (2-tailed)	.000	.			
		N	153	153			
	Resource-Related	Correlation Coefficient	.435**	.554**	1.000		
		Sig. (2-tailed)	.000	.000	.		
		N	153	153	153		
	Curriculum-Related	Correlation Coefficient	.614**	.426**	.556**	1.000	
		Sig. (2-tailed)	.000	.000	.000	.	
		N	153	153	153	153	
	Stakeholder Involvement	Correlation Coefficient	.538**	.395**	.563**	.754**	1.000
		Sig. (2-tailed)	.000	.000	.000	.000	.
		N	153	153	153	153	153

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

The analysis showed there was moderate positive and significant relation between technical-related factors and delivery of digital skills within public schools in Nairobi County (r .614**, sig = .000). The tests showed a strong positive relation between curriculum-related factors and delivery of digital skills within public schools in Nairobi County (r .542**, sig = .000). Findings indicated there was a weak positive and significant relation between resource-related factors and delivery of digital skills within public schools in Nairobi County (r .435**, sig = .000).

4.6 Regression Analysis

The research adopted both simple and multiple regression analysis to estimate the magnitude of influence of the cost of delivery and digital skills within public schools in Nairobi County.

4.6.1 Technical-Related Factors and Delivery Digital Skills Within Public Schools

The first objective sought to establish the effect of technical-related factors on delivery of digital skills and findings are showed in Table 4.10

Table 4.10 Regression Technical-Related Factors and Delivery Digital Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.521[a]	.271	.266	.71579

a. Predictors: (Constant), Technical Related

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.785	1	28.785	56.181	.000[b]
	Residual	77.366	151	.512		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Technical Related

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.434	.293		4.900	.000
	Technical Related	.654	.087	.521	7.495	.000

a. Dependent Variable: Digital Skills

The regression revealed a coefficient of determination (R^2=*.271* which implied that technical-related factors predicted 21.7% of the changes in the delivery of digital skills within public schools in Nairobi County. The statistical significance tests of the relationship was conducted at a 5% significance level, and the findings indicated an F-value of 56.181 and Sig =.000<.05. This showed there is a positive and significant relationship between technical-related factors and delivery of digital skills within public schools in Nairobi County. The results also showed a coefficient of technical-related (β = .654, sig = .000), which was statistically significant implying that a change in the technical-related costs will improve delivery of digital skills by .654 (65.4%).

4.6.2 Resource-Related Factors and Delivery Digital Skills Within Public Schools

The second variable sought to establish the effect of resource-related factors on delivery of digital skills and findings are showed in Table 4.11

Table 4.11 Regression Resource-Related Factors and Delivery Digital Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.458[a]	.209	.204	.74555

a. Predictors: (Constant), Resource Related

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.219	1	22.219	39.973	.000[b]
	Residual	83.932	151	.556		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Resource Related

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.075	.246		8.424	.000
	Resource Related	.494	.078	.458	6.322	.000

a. Dependent Variable: Digital Skills

The analysis revealed a coefficient of determination (R^2=*.209)* which implied that resource-related factors predicted 20.9% of the changes in the delivery of digital skills within public schools in Nairobi County. The statistical significance tests of the relationship was conducted at a 5% significance level, and the findings indicated an F-value of 39.973 and Sig =.000<.05. This showed there is a positive and significant relationship between resource-related factors and delivery of digital skills within public schools in Nairobi County. The results also showed a coefficient of resource-related (β = .494, sig = .000), which was statistically significant implying that a change in the resource-related costs will improve delivery of digital skills by .494 (49.4%).

4.6.3 Curriculum-Related Factors and Delivery Digital Skills Within Public Schools

The third objective focused on establishing the effect of curriculum-related factors on delivery of digital skills and findings are showed in Table 4.12

Table 4.12 Regression Curriculum-Related Factors and Delivery Digital Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.547[a]	.299	.294	.70201

a. Predictors: (Constant), Curriculum Related

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.736	1	31.736	64.397	.000[b]
	Residual	74.415	151	.493		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Curriculum Related

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.994	.206		9.679	.000
	Curriculum Related	.497	.062	.547	8.025	.000

a. Dependent Variable: Digital Skills

The regression showed a coefficient of determination (R^2=.299) which implied that curriculum-related factors predicted 29.9% of the changes in the delivery of digital skills within public schools in Nairobi County. The statistical significance tests of the relationship was conducted at a 5% significance level, and the findings indicated an F-value of 64.397 and Sig =.000<.05. This showed there is a positive and significant relationship between curriculum-related factors and delivery of digital skills within public schools in Nairobi County. The results also showed a coefficient of curriculum-related (β = .497, sig = .000), which was statistically significant implying that a change in the curriculum-related costs will improve delivery of digital skills by .497 (49.7%).

4.6.4 Stakeholder Involvement and Delivery Digital Skills Within Public Schools

The fourth objective sought to establish the effect of stakeholder involvement on delivery of digital skills and findings are showed in Table 4.13

Table 4.13 Regression Stakeholder Involvement and Delivery Digital Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.428[a]	.183	.178	.75766

a. Predictors: (Constant), Stakeholder Involvement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.470	1	19.470	33.917	.000[b]
	Residual	86.681	151	.574		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Stakeholder Involvement

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.304	.228		10.091	.000
	Stakeholder Involvement	.396	.068	.428	5.824	.000

a. Dependent Variable: Digital Skills

The regression tests revealed a coefficient of determination (R^2*=.183),* which implied that stakeholder involvement predicted 18.3% of the changes in the delivery of digital skills within public schools in Nairobi County. The statistical significance tests of the relationship was conducted at a 5% significance level, and the findings indicated an F-value of 33.917 and Sig =.000<.05. This showed there is a positive and significant relationship between stakeholder involvement and delivery of digital skills within public schools in Nairobi County. The results also showed a coefficient of stakeholder involvement (β = .396, sig = .000), which was statistically significant implying that a change in the stakeholder involvement will improve delivery of digital skills by .396 (39.6%).

4.7 Cost Factors and Delivery of Digital Skills

The overall regression model focused on establishing the composite effect of the related-costs on the delivery of digital skills in public schools. The results are presented below.

Table 4.14 Regression Summary on Related-Costs and Delivery of Digital Skills

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.627[a]	.394	.381	.65724

a. Predictors: (Constant), Curriculum Related, Technical Related, Resource Related

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.788	3	13.929	32.246	.000[b]
	Residual	64.363	149	.432		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Curriculum Related, Technical Related, Resource Related

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.008	.282		3.577	.000
	Technical Related	.406	.100	.324	4.075	.000
	Resource Related	.053	.095	.050	.563	.574
	Curriculum Related	.336	.073	.370	4.601	.000

a. Dependent Variable: Digital Skills

The overall regression summary showed a r-squared value of .394; which showed that the related costs predicted 39.4% in delivery of digital skills. This indicated that stakeholder involvement, technical-related, resource-related, curriculum-related costs do positively improve the delivery of digital skills within public schools in Nairobi County. Other factors not considered in the model accounted for 60.6% of changes. The ANOVA test yielded a f-value 32.246, sig = .000<.05, signifying a positive and statistically significant relationship between related costs and delivery of digital skills within public schools in Nairobi County.

The results on technical-related costs showed a coefficient (β_1 = .406, sig = .000), which was statistically significant, implying that a change in the technical-related costs positively improve delivery of digital skills in public schools. The analysis indicated that curriculum-related

costs had a coefficient (β_3 = .336, sig = .000), which was statistically significant implying that a change in the curriculum-related costs positively improve delivery of digital skills in public schools. The findings on resource-related costs revealed an insignificant effect (sig .574 > .05) thus showing they did not directly influence teachers' delivery of digital skills.

4.7.1 Moderated Regression Analysis

The fourth objective of the research sought to determine the moderating effect of stakeholder involvement on the relationship between costs and delivery of digital skills within public schools in Nairobi County, Kenya. A hierarchical regression was applied and the results are shown in Table 4.15

Table 4.15 Moderated Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.628[a]	.394	.378	.65933

a. Predictors: (Constant), Curriculum Related*Stakeholder Involvement, Technical Related*Stakeholder Involvement, Resource Related*Stakeholder Involvement, Stakeholder Involvement

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41.813	4	10.453	24.046	.000[b]
	Residual	64.338	148	.435		
	Total	106.151	152			

a. Dependent Variable: Digital Skills

b. Predictors: (Constant), Curriculum Related*Stakeholder Involvement, Technical Related*Stakeholder Involvement, Resource Related*Stakeholder Involvement, Stakeholder Involvement

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.020	.287		3.552	.001
	Stakeholder Involvement	-.838	.193	-.905	-4.347	.000
	Technical Related*Stakeholder	.813	.200	.641	4.060	.000
	Resource Related*Stakeholder	.117	.195	.104	.600	.550
	Curriculum Related*Stakeholder	.701	.188	.716	3.728	.000

a. Dependent Variable: Digital Skills

The second model had a coefficient of determination R2 = .394, F-value = 24.046, sig = .000, which showed a significant but weak moderating effect of stakeholder involvement on the interaction between related costs and the delivery of digital skills in schools within Nairobi City County. Further, analyzed as predictor variable the results indicated that resource related costs and stakeholder involvement had a negative impact on the delivery of digital skills (β_4 =.-.838, sig = .001). The survey findings found out that jointly technical-related costs and stakeholder involvement will positively improve the delivery of digital skills (β^* = .813, sig = .000), curriculum-related costs and stakeholder involvement would also positively and significantly improve the delivery of digital skills (β^* = .701, sig = .000).

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

The chapter presents the summary of findings then discusses the findings based on the previous studies. The chapter then presents the conclusion and recommendations. Lastly, the chapter highlights the areas for further research that can be conducted in the future.

5.2 Summary

This study sought to investigate the effect of cost on delivering digital skills within public schools in Nairobi County. Specifically, the study focused on technical-related costs, resource-related costs, curriculum-related costs, and stakeholder involvement and their effect on delivering digital skills within public schools in Nairobi County. The research was grounded on the resource-based view theory, technology acceptance model, and stakeholder theory. The study obtained research data from 153 participants drawn from principals of public schools in Nairobi County and five government officials.

The data collected was analyzed by conducting both correlation and regression tests. Correlation tests revealed that there was a moderate positive and significant relation between technical-related cost factors and delivery of digital skills within public schools in Nairobi County. The tests also showed a strong positive relation between curriculum-related cost factors and delivery of digital skills within public schools in Nairobi County. Findings further indicated there was a weak positive and significant relation between resource-related cost factors and the delivery of digital skills within public schools in Nairobi County. Results from the regression analysis revealed that related costs had a positive and statistically significant relationship on the delivery of digital skills within public schools in Nairobi County. The study further showed a positive and significant relationship between technical-related cost factors and the delivery of digital skills within public schools in Nairobi County. This study showed that there is an insignificant relationship between resource-related cost factors and the delivery of digital skills within public schools in Nairobi County. The study also reveals that curriculum-related cost factors have a positive and significant relationship with the delivery of digital skills within public schools in

Nairobi County. The study also notes a negative and significant effect of stakeholder involvement on the delivery of digital skills within public schools in Nairobi County.

5.3 Discussion of Findings

This section discusses the findings from the study based on the objectives presented. The discussion compared the current study's findings to those of the previous literature.

5.3.1 Technical-Related Cost Factors and Delivery of Digital Skills

The current study found a positive and significant relationship between technical-related costs and the delivery of digital skills within public schools in Nairobi County and this finding aligns with the technology acceptance model, which posits that perceived usefulness and perceived ease of use influence the adoption and acceptance of technology. In this case, technical-related costs relating to access to digital resources, infrastructure, and collaborative environments with software developers were shown to contribute to the perceived usefulness and ease of use of digital skills delivery methods, thereby promoting their adoption within schools.

The finding of the current study that technical-related costs have positive and significant effects on the delivery of digital skills is broadly in line with the reviewed literature on the importance of developing educator's technical factors such as their ICT self-efficacy, access to ICT resources, and ICT training when they adopt digital learning programs. A similar study by Ibieta et al. (2017) highlighted the importance of ICT self-efficacy and emphasized the need to finance training programs and purchase digital tools to ensure teachers feel confident and competent when using digital technologies, which can be achieved through training and access to ICT resources.

The current study also found that the schools support teachers to improve their technical competency on various digital learning resources and similarly, Volkan, Sefa, and Sadık (2022) emphasized the significance of developing instructor's skills and intention to use digital learning materials. The study revealed that teachers have to be upskilled but conceded that upskilling costs may impact schools' ability to regularly upskill all teachers. Hutagalung and Purbani (2021) also highlighted the importance of teacher's digital literacy skills in digital instructional delivery, echoing the current study's findings regarding the positive relationship between digital skills

development and digital skills delivery. The two studies emphasize the importance of adequate financing to ensure effective and continuous digital skill training for all teachers.

This study found that the school has provided adequate infrastructure to support the utilization of digital learning content and in a similar examination, Kamau (2020) highlighted the significance of ICT infrastructure and strategic planning in driving the adoption of digital literacy programs. The current study's findings further suggest that investments in ICT infrastructure and strategic planning are crucial for enhancing digital skills delivery within public schools. This finding is in line with observations by Belaya (2018) which revealed that schools need regular investments in laptops and other digital learning materials to sustain digital learning. While the findings from the current study are largely in line with previous literature, there are some differences in context and focus. For example, Funmilayo, Adewale, and Jane (2023) focused on e-learning implementation in vocational education and training institutions and Nigeria, respectively, while the current study focused on digital skills delivery in public schools in Nairobi County. Despite these differences, the findings regarding the impact of costs and access to resources on digital skills delivery are consistent across studies and confirm that technical-related costs can indeed influence a school's success in delivering digital skills.

5.3.2 Resource-Related Cost Factors and Delivery of Digital Skills

The study sought to establish the effect of resource-related cost factors on the delivery of digital skills within public schools in Nairobi County, Kenya. The current study found out that there is an insignificant relationship between resource-related cost factors and delivery of digital skills within public schools in Nairobi County and these findings suggests that the cost factors associated with acquiring and utilizing resources, such as financial and human resources, may not always directly influence the delivery of digital skills. From these findings, it is clear that while resources are essential for digital skills delivery, their impact may be mediated by other factors.

The finding of the current study that there is an insignificant relationship between resource-related factors and delivery of digital skills is in contrast to evidence from Gil-Flores et al. (2017) which highlighted the importance of access to ICT resources in ICT education delivery in Spain, emphasizing the importance of computers, IT infrastructure, internet connection, and ICT-competent teachers being available. This discrepancy may be attributed to differences in contexts,

where the availability of resources in Spanish schools may have a more pronounced impact on digital skills delivery compared to schools in Nairobi County.

While the current study revealed that the schools lack adequate number of skilled personnel to lead in implementing digital literacy, similar research by Hassan and Mirza (2021) found that inadequate ICT personnel and resources, including outdated content are a major hindrance to digital literacy delivery in India. Cherotich and Waweru (2020) emphasized the importance of digital resources and infrastructure in digital literacy delivery in Kenyan primary schools and revealed a significant association between teachers' access to digital resources, computers, and internet connectivity and the delivery of digital skills. The difference in findings could be attributed to variations in the level of resource availability and distribution across different regions in Kenya.

The study findings that resource-related cost factors have an insignificant effect on the delivery of digital skills is in line with several studies in Kenya such as Kyalo (2021) and Njoroge, Ngugi, and Kinzi (2017) studies which highlighted the resource-related challenges that were shown to influence teachers' digital skills delivery. These studies emphasize the importance of proper financing to ensure adequate infrastructure and resource allocation to support digital skills delivery in Nairobi County.

5.3.3 Curriculum-Related Cost Factors and Delivery of Digital Skills

The third objective sought to determine the effect of curriculum-related cost factors on the delivery of digital skills within public schools in Nairobi County and the findings revealed that curriculum-related cost factors have a positive and significant effect on the delivery of digital skills within public schools in Nairobi County. These findings are consistent with the technology acceptance model. According to TAM, the design and relevance of the curriculum can influence perceived usefulness and ease of use, thereby affecting the adoption of digital skills delivery methods.

The current study finding that curriculum-related cost factors have a positive and significant effect on the delivery of digital skills was similar to the findings from the study by Post et al. (2023) which examined the cost factors associated with simulation-based mastery learning programs. The researchers emphasized that curriculum development costs can impact the delivery of digital skills

and confirmed that covering costs for developing the curriculum, including the design and development process are critical to skills acquisition in educational settings.

The current study found that the school routinely reviews available digital resources to ensure they are up to date and meet the required standards and similar study by Brata et al. (2022) highlighted the importance of ensuring educational materials are regularly reviewed and renewed to influence students' digital literacy scores. These two studies both confirm that curriculum content has direct impacts on shaping students' digital skills acquisition. Similarly, Lyons et al. (2019) explored global strategies for bridging the gap between digital skills and employability and highlighted the costs associated with reforming education systems and creating alternative training models.

The current study found that schools participate in ministry-led digital curriculum development and similar findings were made in the study by Lyons et al. (2019) which revealed that strategic investment in curriculum development has significant impacts on teachers' ability to deliver digital skills. Similarly, Schirmer et al. (2023) discussed the educational requirements for digital competence development and emphasized the importance of strategic investment in curriculum design to address individual needs and flexible educational formats. Their findings regarding the barriers to adoption of digital educational programs due to cost considerations align with the current study's findings that including digital learning in the curriculum is a costly endeavor. Salam et al. (2018) emphasized the importance of policy planning, and curriculum development in overcoming barriers to digital skills delivery in public schools. Their findings bring out the broader principle that curriculum-related factors play a crucial role in shaping educational outcomes which aligns with the current study's findings that curriculum-related cost factors have a positive effect on digital skills delivery.

5.3.4 Stakeholder Involvement and Delivery of Digital Skills

The study's last objective sought to establish the moderating effect of stakeholder involvement on the relationship between cost factors and delivery of digital skills within public schools in Nairobi County, Kenya and the study found out that stakeholder involvement had a negative and significant effect on the delivery of digital skills within public schools in Nairobi County. This finding is somewhat in dispute with Stakeholder Theory which emphasizes the importance of engaging various stakeholders, including teachers, parents, administrators, and community

members, in decision-making processes related to educational initiatives. The findings suggest that in the context of Nairobi County, stakeholder involvement is not adequate enough to support the delivery of digital skills within schools.

The current study found out that stakeholder involvement has a negative and significant effect on the delivery of digital skills within public schools in Nairobi County contrasts much of the available literature which establishes a positive link between stakeholder involvement and the delivery of digital skills. Similar research by researchers Petko and Prasse (2018) and Agustini et al. (2020) found a significant positive effect of stakeholder involvement, particularly parents and school principals on educational technology integration and digital literacy program implementation respectively. Their findings showed the importance of teachers, principals, and parents, in supporting and facilitating the integration of digital skills into educational settings. This contrasts with the current study's findings, which found a negative relationship between stakeholder involvement and digital skills delivery in Nairobi County.

The study findings revealed that the school routinely involves guardians/parents in provision of resources needed in the adoption of digital learning and in similar research, Marti et al. (2018) noted the positive effect of parental involvement on students' readiness and skills, particularly in programs aimed at promoting early literacy and math skills. Marti et al. (2018) added that parental involvement has significant impacts on children's educational outcomes. Another study by Gruchel et al. (2022) highlighted the significant impact of parental involvement on motivating children to use digital technologies for practical and learning-related purposes. The study showed the influential role that parents play in shaping children's interests in digital technology and skills acquisition, which may not have been fully captured in the current study's analysis of stakeholder involvement within public schools in Nairobi County.

The study found out that schools engage collaborates with donor agencies to enhance the funding for digital learning and in similar study by Ajuoga and Keta (2021) and Kegoro (2019), it was deduced that stakeholders play a key role in supporting schools through providing finances, skills and resources necessary to identify gaps in digital skills development. The studies highlight the role of parents and local/regional actors in supporting and enhancing digital skills acquisition among students. While their focus was on curriculum implementation rather than digital skills

delivery per se, their findings confirm that stakeholder involvement could shape educational outcomes. Similar study by Muriuki (2017) confirmed that schools engage stakeholders when developing ICT policies, seeking infrastructure and financial resources to facilitate ICT integration in primary schools in Kenya. Muriuki's (2017) findings confirmed that stakeholders support is essential to the delivery of digital skills within educational settings.

5.4 Conclusion

Results from the first objective revealed that there is a positive and significant relationship between technical-related cost factors and delivery of digital skills within public schools in Nairobi County. Based on the results, the study concludes that schools are able to afford the costs associated with supporting the improvement of their teacher's technical competency on the various digital teaching resources and methods. The study further concludes that schools can support costs associated with providing IT infrastructure to schools and have allocated financial, hardware and technical resources to support the maintenance of digital learning material and technology. The study further concludes that many schools are able to afford the costs associated with actively engaging with external stakeholders to ensure the utilization of emerging technologies in digital learning.

Findings from the second objective led to the conclusion that there is an insignificant relationship between resource-related cost factors and the delivery of digital skills within public schools in Nairobi County. From the analysis, it was determined that the schools are unable to meet the demand for adequately trained staff which shows an inadequate availability of teachers with the necessary expertise to effectively integrate digital technologies in the teaching and learning process. Moreover, the study concluded that while schools have some level of access to the internet and e-resources, these are not sufficient to support digital skills delivery. Additionally, the study concludes that the schools' efforts to access external support to enhance their technological resources are inadequate and the resources and infrastructure provided in schools are inadequate to facilitate smooth delivery of digital skills.

The findings from the third objective revealed that curriculum-related cost factors have a positive and significant relationship on the delivery of digital skills within public schools in Nairobi County. This led to the conclusion that Kenyan schools are able to meet the costs associated with curriculum development and integration. The study concludes that schools are able

to meet costs associated with integrating digital learning into educational programs. The study further concludes that schools participate in digital curriculum development projects in the county and are able to fund teachers' participation in training and seminar programs aimed at improving their digital teaching skills. With high curriculum integration costs having an impact on the delivery of digital skills, the study concludes that schools are able to meet the costs associated with routinely reviewing available digital resources to enhance the quality of learning, indicating a commitment to continuous improvement and the introduction of latest educational technologies and resources into classrooms.

Lastly, the study also found out that stakeholder involvement had a negative and significant effect on the delivery of digital skills, showing that the contribution of the various players in the education sector was not adequate to support the delivery of digital skills within schools in Nairobi City County. Findings imply that although stakeholders are involved in policy development, this involvement does not necessarily translate into improved delivery of digital skills within public schools. The study concluded that while some schools may utilize online instructors to facilitate digital learning implementation, their involvement is inadequate to improve the delivery of digital skills within public schools in Nairobi County. The study also concluded that while schools have some level of engagement with external partners to enhance funding for digital learning, the degree of collaboration does not necessarily enhance schools' ability to deliver digital skills. Moreover, the findings lead to the conclusion that the schools are not doing enough to ensure stakeholders such as parents are adequately involved in the digital learning process.

5.5 Recommendation

The findings from the first objective led to the conclusion that technical-related cost factors had a positive and significant effect on delivery of digital skills. Based on this conclusion, the study recommends that schools should provide ongoing technical training and support for teachers to enhance their competency in utilizing digital learning resources effectively. The study further suggests continuous investment in improving infrastructure to ensure adequate support for the utilization of digital learning content. Additionally, the study recommends that schools should strengthen their resource allocation strategies to ensure sufficient financial and human resources are available for the maintenance and upkeep of digital learning infrastructure.

Based on the conclusion that there is an insignificant relationship between resource-related cost factors and delivery of digital skills, the study still recommends factors that can enhance digital literacy in schools and are based on broader considerations of improving the overall infrastructure and support for digital education. The study recommends the schools and the necessary government agencies address the current staffing shortages by recruiting and training skilled personnel specifically dedicated to leading digital literacy initiatives within schools. The study further recommends an improvement in access to internet and e-resources by investing in reliable connectivity solutions and expanding the digital resource library available to students and teachers. Furthermore, the public schools should foster stronger collaborations with donor agencies and other external partners to enhance funding opportunities for acquiring new technologies and resources needed for digital literacy programs.

The conclusion from the third objective that curriculum- cost factors has a positive and significant relationship on the delivery of digital skills led to the following recommendations. The study recommends that public schools in Nairobi should continue fostering the inclusion of digital learning in the curriculum, ensuring alignment with national standards and guidelines for digital education. The management of these schools in collaboration with the government, should also provide regular training and professional development opportunities for instructors to enhance their skills in utilizing digital learning content effectively. The study also suggests that schools should actively participate in ministry-led digital curriculum development initiatives to ensure curriculum relevance and responsiveness to emerging educational trends.

Research on the final objective concluded that stakeholder involvement had a negative and significant effect on the delivery of digital skills. Based on this finding, the study recommends that parents and other stakeholders play an active role in the design and implementation of digital curricula. Parents can show their support by helping students at home and by purchasing digital learning content for their children. The study further suggests that public schools ensure they maintain regular communication and engagement with online instructors to facilitate digital learning implementation and provide support and training needed by teachers. The study also recommends that schools improve their collaboration with donor agencies to leverage additional funding and resources for digital learning initiatives.

For parents who lack knowledge of the various technologies used in digital learning or lack finances needed to purchase digital learning material, this study calls on schools to increase their efforts to engage other stakeholders such as the church, telecommunication firms, tech firms and NGOs as this would increase schools' access to technical and curriculum related support. Finally, the study suggests that public schools in Nairobi County continue to involve stakeholders, including guardians/parents and the government, in policy development and decision-making processes related to digital learning, ensuring their voices are heard and their perspectives are considered when developing the curricula. This is key as it would increase the student's active involvement in digital learning both at home and in school.

Based on the interviews of key informants, the study recommends that the government facilitate schools in coming up with a digital hub. The future is heavily digital and there is need to equip every child with such capabilities that can help them use, understand or contribute to digitization. One key item to improve this learning would be to invest more in the infrastructure. By providing more well-equipped classrooms, then the students will be able to access more of these digital skills. Improve accessibility of the digital learning materials to the students in all the schools, where they can be able to learn on their own. Here, it would also be important to factor in the students with disabilities, where they would also be able to access these materials.

The Government through ministries should also support the implementation of favourable policies to help public schools migrate from analog to digital learning, eg, provide data bundles to public school students to enable hybrid learning. Teacher training would also be a great way to improve skills uptake, as the institutions would have more well-trained instructors to take students through digital learning. Lastly, there should be collaborative participation with the community, development partners and other agencies to facilitate the implementation of digital policies and foster a positive digital learning culture.

5.6 Limitations of the study

This study focuses on the optimization of the delivery of digital skills in primary and secondary schools in Kenya. Just as the delivery of digital skills has faced stumbling blocks, this study expects to encounter several limitations. First, the study was limited to an analysis of primary and secondary schools in Nairobi County, and as such, its findings was unique to the current state of

digital adoption in the county. Being the capital city, this may not represent other regions in Kenya. Moreover, the study used data provided by head teachers and principals. These authority figures are responsible for supporting the digital learning program and may embellish their achievements. This limitation was delimited by informing them of the study's anonymous principle and by highlighting the study's importance in providing data that may be used to address the cost challenges associated with digital skills delivery in learning institutions. Another limitation that this study expects to encounter is the school heads' unwillingness to participate in the study, and this limitation was addressed by including options for IT teachers to participate in the study.

5.7 Area for Further Research

The main focus of the study was in public schools with teachers as the target population. Further research can be conducted to investigate the role of parental involvement in supporting students' digital skills development and explore strategies to enhance collaboration between schools and parents in this regard. The study was contextualized in Nairobi County. More research could be conducted in other parts of the country, especially in rural areas where access to technology is not as high, and comparisons could be made with the current study findings. The study adopted qualitative research. Quantitative research can be conducted, which will take into account the students digital skills assessment scores as well as the exact costs applied in the delivery of these digital skills.

REFERENCES

Adarkwah, M. A. (2021). "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, 26(2), 1665-1685.

Agustini, D., Lian, B., & Sari, A. P. (2020). School's Strategy for Teacher's Professionalism through Digital Literacy in the Industrial Revolution 4.0. *International Journal of Educational Review*, 2(2), 160–173.

Ajuoga, M. A., & Keta, E. (2021). Competence Based Curriculum for Kenyan Primary Schools: Implementation Challenges Among Stakeholders in Kenya. *International Journal of Innovation Research and Advanced Studies (I JIRAS)*, 8(3).

Amwayi, A. I. (2018). Mobile Based Application for Curriculum Content Delivery in Kenyan Primary Schools. *United States International University-Africa*.

Ayllón, S., Alsina, Á., & Colomer, J. (2019). Teachers' involvement and students' self-efficacy: Keys to achievement in higher education. *PloS one*, 14(5), e0216865.

Badri, M., Alnuaimi, A., Al Rashedi, A., Yang, G., & Temsah, K. (2017). School children's use of digital devices, social media and parental knowledge and involvement–the case of Abu Dhabi. *Education and Information Technologies*, 22, 2645-2664.

Bejaković, P., & Mrnjavac, Ž. (2020). The importance of digital literacy on the labour market. *Employee Relations: The International Journal*, 42 (4) 921-932.

Belaya, V. (2018). The Use of e-Learning in Vocational Education and Training (VET): Systematization of Existing Theoretical Approaches. *Journal of Education and Learning*, 7(5), 92-101.

Bougie, R., & Sekaran, U. (2019). *Research methods for business: A skill building approach.* . John Wiley & Sons.

Brata, W., Padang, R., Suriani, C., Prasetya, E., & Pratiwi, N. (2022). Student's digital literacy based on students' interest in digital technology, internet costs, gender, and learning outcomes. *International Journal of Emerging Technologies in Learning*, 17 (3), 138-151.

Bravo, M. C., Chalezquer, C. S., & Serrano-Puche, J. (2021). Meta-framework of digital literacy: a comparative analysis of 21st-century skills frameworks. *Revista Latina de Comunicación Social*, 79, 76-109.

Brunetti, F., Matt, D. T., Bonfanti, A., De Longhi, A., Pedrini, G., & Orzes, G. (2020). Digital transformation challenges: strategies emerging from a multi-stakeholder approach. *The TQM Journal*, 32(4), 697-724.

Bryman, A. (2016). *Social research methods.* . Oxford university press.

Caputo, F., Cillo, V., Candelo, E., & Liu, Y. (2019). Innovating through digital revolution: The role of soft skills and Big Data in increasing firm performance. *Management Decision*, 57(8), 2032-2051.

Cherotich, S. L., & Waweru, K. P. (2020). ICT Infrastructure and Digital Literacy Adoption in Public Primary Schools in Nakuru County. *Mba, Jomo Kenyatta University of Agriculture and Technology*.

Chetty, K., Qigui, L., Gcora, N., Josie, J., Wenwei, L., & Fang, C. (2018). Bridging the digital divide: Measuring digital literacy. 12(23), 1-20.

Chihobo, C. H., Tambula, S., & Musademba, D. (2022). Evaluation of E-Learning in Engineering Education in Higher and Tertiary Education Institutions in Zimbabwe. *022 IEEE IFEES World Engineering Education Forum-Global Engineering Deans Council (WEEF-GEDC)* (pp. 1-5). IEEE.

Dash, M., Shadangi, P. Y., Kar, S., & Prusty, R. (2019). A conceptual model for telemedicine adoption: An examination of technology acceptance model. *Int J Recent Technol Eng*, 8(2), 1286-1288.

De Torres, P. (2021). Stakeholder's involvement to school-Initiated activities of district I secondary schools: Basis for enhanced community partnership program of activities. *International Journal of Innovative Science and Research Technology*, 6(2), 481-490.

Delwiche, A., & Herring, M. M. (2020). *Propaganda Critic, Russian Disinformation, and Media Literacy: A Case Study.* Routledge: Media Literacy in a Disruptive Media Environment.

DigiSchool. (2018). *Milestones achieved. Nairobi, Kenya: Ministry of Information, Communication and Technology*. Retrieved from http://icta.go.ke/digischool/milestones/

Ei, C. H., & Soon, C. (2021). *Towards a Unified Framework for Digital Literacy in Singapore.* IPS Working Papers.

Ephantus, G. M. (2017). ICT Infrastructure Preparedness for E-Learning Implementation in Kenyan Universities. *Kisii University*.

Ercikan, K., Asil, M., & Grover, R. (2018). Digital divide: A critical context for digitally based assessments. *Education Policy Analysis Archives*, 26, 51-51.

Freeman, R. E. (2023). *The politics of stakeholder theory: Some future directions.* Springer International .

Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). *Stakeholder theory: The state of the art.*

Funmilayo, A. B., Adewale, O. A., & Jane, I. I. (2023). The current realities of utilization of e-learning platform due in dynamic Nigerian environment. . *REVIEW OF AFRICAN EDUCATIONAL STUDIES (RAES)*, 2(1)21-30.

Ghauri, P., Grønhaug, K., & Strange, R. (2020). *Research methods in business studies.* . Cambridge University Press.

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J.-J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behaviour*, 68, 441–449.

Gitonga, P. W. (2021). the influence of technological factors on e-procurement adoption in small and medium-size enterprises in Nyeri County Kenya. *Africa J. Tech. Vocat. Educ. Train*, 6 (1), 96–109.

Gruchel, N., Kurock, R., Bonanati, S., & Buhl, H. M. (2022). Parental involvement and Children's internet uses-Relationship with parental role construction, self-efficacy, internet skills, and parental instruction. *Computers & Education*, 182, 104481.

Hassan, M. M., & Mirza, T. (2021). The digital literacy in teachers of the schools of Rajouri (J&K)-India: Teachers perspective. *International Journal of Education and Management Engineering*, 11(1), 28-40.

Haukijärvi, I. (2015). Strategizing the Digitalization of Learning and Teaching–A Resource-based view on the digitalization of learning and teaching in a Finnish Higher Education Institution. *Master's thesis*.

Hussein, Q., Abayo, R., & Mugambi, H. (2019). Determinants of digital learning implementation in public primary schools: A case of Nairobi county schools. *International Academic Journal of Human Resource and Business Administration*, 3(6), 150.

Hutagalung, B., & Purbani, W. (2021). The Ability of Digital Literacy for Elementary School Teachers. *Jurnal Pendidikan Indonesia*, 10(4), 710-721.

Ibieta, A., Hinostroza, J. E., Labbé, C., & Claro, M. (2017). The role of the Internet in teachers' professional practice: Activities and factors associated with teacher use of ICT inside and outside the classroom. *Technology, Pedagogy and Education*, 26(4), 425-437.

Ibrahim, R., Leng, N. S., Yusoff, R. C., Samy, G. N., Masrom, S., & Rizman, Z. I. (2017). E-learning acceptance based on technology acceptance model (TAM). *Journal of Fundamental and Applied Sciences*, 9(4S), 871-889.

Isaboke, H., Mweru, M., & Wambiri, G. (2021). Teacher Preparedness and Implementation of the Competency-Based Curriculum in Public Pre-Primary Schools in Nairobi City County, Kenya. *International Journal of Current Aspects*, 5 (3), 32, 53.

Iyer, S. (2019). Futuristic Technology and Innovation to Solve the Problems of Indian Rural Education. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 7 (7).

Karadas, T., Dilci, T., & Sagbas, N. Ö. (2023). Life in the Digital World. In Handbook of Research on Perspectives on Society and Technology Addiction (pp. 192-216). IGI Global.

Kamau, E. (2020). An analysis of key drivers for the implementation of digital literacy programs in Kenyan universities. *Thesis, Strathmore University*.

Karimi, S. S., Mulwa, A. S., & Kyalo, D. N. (2020). Stakeholder engagement in monitoring and evaluation and performance of literacy and numeracy educational programme in public primary schools in Nairobi County, Kenya. *Journal of Educational and Developmental Psychology*, 10(2), 10-24.

Kegoro, G. (2019). *Competency Based Curriculum will Exacerbate Economic Inequality and Burden Parents.* Retrieved from standard.co.ke.

Kembo, J., Omito, O., Ayere, M., & Ali, A. A. (2019). Teachers' computer capacity in public primary schools in Homa Bay County, Kenya: The case of the digital literacy programme. *European Scientific Journal*, 15 (19), 301-325.

Kerkhoff, S. N., & Makubuya, T. (2022). Professional Development on Digital Literacy and Transformative Teaching in a Low-Income Country: A Case Study of Rural Kenya. *Reading Research Quarterly*, 57(1), 287-305.

Kerkhoff, S., Spires, H., & Wanyonyi, P. (2020). Teaching new literacies and inquiry: A grassroots effort to bring about educational change in Kenya. *Journal of Adolescent & Adult Literacy*, 64(2), 145– 156.

Kibuku, R. N., Ochieng, D. O., & Wausi, A. N. (2020). e-Learning Challenges Faced by Universities in Kenya: A Literature Review. *Electronic Journal of e-Learning*, 18(2), pp150-161.

KICD. (2019). *Basic education curriculum framework. Nairobi, Kenya: Author*. Retrieved from https://kicd.ac.ke/curriculum-reform/basic-education-curriculum-framework/

Kithinji, E. (2017). Effects of digital banking strategy on financial inclusion among commercial banks in Kenya. *Mba, University of Nairobi*.

Kücher, A., Mayr, S., Mitter, C., Duller, C., & Feldbauer-Durstmüller, B. (2020). Firm age dynamics and causes of corporate bankruptcy: age dependent explanations for business failure. *Review of Managerial Science*, 14(3), 633-661.

Kumpulainen, K. (2019). Promoting the joy of learning multiliteracies from early years onwards: An educational reform initiative in Finland. *Media education research journal*, 8(2), 83-94.

Kyalo, E. M. (2021). Implementation of Digital Literacy Program in Public Primary Schools: a Case Study of Makueni County, Kenya. *Mba, University of Nairobi*.

Law, N. W., Woo, D. J., de la Torre, J., & Wong, K. W. (2018). A global framework of reference on digital literacy skills for indicator. *University of Hong Kong*, 4.4. 2.

Lyons, A., Kass-Hanna, J., Zucchetti, A., & Cobo, C. (2019). Leaving no one behind: Measuring the multidimensionality of digital literacy in the age of AI and other transformative technologies. *The Future of Work and Education The Future of Work and Education* , 1-17.

Lyons, A., Zucchetti, A., Kass-Hanna, J., & Cobo, C. (2019). Bridging the gap between digital skills and employability for vulnerable populations. *The Future of Work and Educationfor the Digital Age*.

Mailizar, M., Burg, D., & Maulina, S. (2021). Examining university students' behavioural intention to use e-learning during the COVID-19 pandemic: An extended TAM model. *Education and Information Technologies*, 26(6), 7057-7077.

Makau, W. M. (2021). The impact of COVID-19 on the growing North-South divide. *E-international Relations*.

Makura, D. (2019). Digital Literacy Programme on course, says ICT CS. *Web log post*.

Marti, M., Merz, E. C., Repka, K. R., Landers, C., Noble, K. G., & Duch, H. (2018). Parent involvement in the getting ready for school intervention is associated with changes in school readiness skills. *Frontiers in psychology*, 9, 759.

Mashile, T. (2017). Technology integration and the digital divide: understanding factors that impact on educators' ability to integrate technology in South African classrooms. *Mba, University of Pretoria*.

Mbise, T., Taal, S., Roberts, M., & Lammersen, F. (2018). Digital connectivity & e-commerce: Overview of financing flows and examples of aid for trade support.

Mertala, P. (2020). Data (il) literacy education as a hidden curriculum of the datafication of education. *Journal of Media Literacy Education*, 12(3), 30-42.

Michael, C. P., & Igenewari, L. S. (2018). The Impact of Computer Literacy among Secondary School Teachers in Rivers State. *International Journal of Education and Evaluation*, 4 (1), 1-9.

Msomi, A. P., & Hoque, M. (2018). The role of stakeholders for E-learning success in higher education. *European Conference on e-Learning* (pp. 679-XVII). Academic Conferences International Limited.

Mugenda, O., & Mugenda, A. (2003). *Research methods, quantitative and qualitative techniques.* Nairobi: African Centre for Technology Studies.

Muriithi, P., Horner, D., & Pemberton, L. (2016). Factors contributing to adoption and use of information and communication technologies within research collaborations in Kenya. *Information Technology for Development*, 22(l), 84– 100.

Murithi, J., & Yoo, J. E. (2021). Teachers' use of ICT in implementing the competency-based curriculum in Kenyan public primary schools. *Innovation and Education*, 3(1), 1-11.

Muriuki, J. (2017). Factors Affecting Implementation of ICT Education in Public Primary Schools in Kajiado north sub-county, Kenya. *Mba, University of Nairobi*.

Mwasiaji, E., Kombo, K., Nawiri, M. P., & Iloka, K. M. (2022). Critical reflection on resource requirement, pedagogy and entrepreneurship skills training for competency based curriculum implementation in Kenyan universities. *International Academic Journal of Social Sciences and Education (IAJSSE)*, 2(3), 40-58.

Nairobi County Department of Education. (2022). *NAIROBI CITY COUNTY: EDUCATION DEPARTMENT DATA ON NAIROBI PUBLIC ECD CENTRES & PRIMARY SCHOOLS* . Retrieved from Nairobi County : https://nairobi.go.ke/wp-content/uploads/Public-Primary-Schools.pdf

Nascimbeni, F., & Vosloo, S. (2019). Digital literacy for children: Exploring definitions and frameworks. *Scoping Paper*.

Nedungadi, P. P., Menon, R., Gutjahr, G., Erickson, L., & Raman, R. (2018). Towards an inclusive digital literacy framework for digital India. *Education+ Training*, 60(6), 516-528.

Njoroge, F., Ngugi, M., & Kinzi, J. (2017). Influence of selected factors on the implementation of information and communication technology policy in public secondary schools in Naivasha Sub-county, Kenya. *International Journal of Education and Development using ICT*, 13(2).

Okeji, C. C., Tralagba, E. C., & Obi, I. C. (2019). An investigation of the digital literacy skills and knowledge-based competencies among librarians working in university libraries in Nigeria. *Global Knowledge, Memory and Communication*, 69 (4/5) 311-330.

Ong'udi, V. O. (2021). A Mobile-based parent portal for public primary schools in Nairobi County, Kenya. *Mba, Strathmore University*.

Orodho, A. (2003). *Essentials of educational and social sciences research method.* Nairobi: Masola Publishers.

Oyugi, G. A. (2020). Evaluation of the teacher factors on the integration of information communication technology into teaching and learning in public primary schools in Nairobi County, Kenya. *Mba, Maasai Mara University*.

Patten, M. L. (2017). *Understanding research methods: An overview of the essentials.* . Routledge.

Paudel, P. (2021). Online education: Benefits, challenges and strategies during and after COVID-19 in higher education. *International Journal on Studies in Education (IJonSE)*, 3(2).

Penuel, W. R., Riedy, R., Barber, M. S., Peurach, D. J., LeBouef, W. A., & Clark, T. (2020). Principles of collaborative education research with stakeholders: Toward requirements for a new research and development infrastructure. *Review of Educational Research*, 90(5), 627-674.

Perdana, R., Yani, R., Jumadi, J., & Rosana, D. (2019). (). Assessing students' digital literacy skill in senior high school Yogyakarta. *Jurnal Pendidikan Indonesia*, 8(2), 169-177.

Petko, D., & Prasse, D. (2018). Exploring the impact of stakeholder engagement on the integration of educational technology in elementary schools: Expanding the will-skill-tool model with contextual variables. *Society for Information Technology & Teacher Education International Conference* (pp. 1068-1074). Association for the Advancement of Computing in Education .

Pillai, N. M., Mohan, A., Devika, M., Gutjahr, G., & Nedungadi, P. (2022). Cost-Effectiveness of Using Tablets for Digital Literacy Training in Tribal Areas of Rajasthan. *Advances in Data and Information Sciences*, 363-370.

Polizzi, G., & Taylor, R. (2019). *Misinformation, digital literacy and the school curriculum.* London School of Economics and Political Science.

Post, J. H., Teslak, K. E., Tolsgaard, M. G., Rasmussen, S., & Friis, M. L. (2023). Cost of simulation-based mastery learning for abdominal ultrasound. *BMC Medical Education*, 23(1), 921.

Pradipta, R. F., Purnamawati, F., Yasin, M. H., Dewantoro, D. A., Irvan, M., & Susilawati, S. Y. (2020). Online Learning Resource Based on One ID Website for All Access (OIAA) as a Student Learning Assistance System. *2020 6th International Conference on Education and Technology (ICET)*, (pp. 77-83).

Prasad, C. V., Lalitha, P. P., & Srikar, P. V. (2015). Barriers to the use of Information and Communication Technology (ICT) in secondary schools: Teacher's Perspective. *Journal of Management Research*, 7(2), 190.

Pratolo, B. W., & Solikhati, H. A. (2021). Investigating Teachers' Attitude toward Digital Literacy in EFL Classroom. *Journal of Education and Learning (EduLearn)*, 15(1), 97-103.

Rambousek, V., Štípek, J., & Vanõková, P. (2016). Contents of digital literacy from the perspective of teachers and pupils. *Procedia-Social and Behavioral Sciences*, 217, 354-362.

Rangel-Pérez, C., Gato-Bermúdez, M. J., Musicco-Nombela, D., & Ruiz-Alberdi, C. (2021). The massive implementation of ICT in universities and its implications for ensuring SDG 4: Challenges and difficulties for professors. *Sustainability*, 13(22), 12871.

Rashid, S., & Mustafa, H. (2022). Corporate reputation antecedents and stakeholder loyalty in Malawi higher education institutions: employees' and students' perspectives. *Tertiary Education and Management*, 28(1), 101-117.

Razak, N. A., Jalil, H. A., Krauss, S. E., & Ahmad, N. A. (2018). Successful implementation of information and communication technology integration in Malaysian public schools: An activity systems analysis approach. *Studies in Educational Evaluation*, 58, 17-29.

Razak, N., Ab Jalil, H., & Ismail, I. (2019). Challenges in ICT integration among Malaysian public primary education teachers: The roles of leaders and stakeholders. *International Journal of Emerging Technologies in Learning (iJET)*, 14(24), 184-205.

Regmi, K., & Jones, L. (2020). A systematic review of the factors–enablers and barriers–affecting e-learning in health sciences education. *BMC medical education*, 20(1), 1-18.

Sadaf, A., & Johnson, B. L. (2017). Teachers' beliefs about integrating digital literacy into classroom practice: An investigation based on the theory of planned behavior. *Journal of Digital Learning in Teacher Education*, 33(4), 129-137.

Salam, S., Jianqiu, Z., Pathan, Z. H., & Lei, W. (2017). Strategic barriers in the effective integration of ICT in the public schools of Pakistan. *Proceedings of the 2017 International Conference on Computer Science and Artificial Intelligence*, (pp. 169-172).

Salam, S., Zeng, J., Pathan, Z. H., Latif, Z., & Shaheen, A. (2018). Impediments to the Integration of ICT in Public Schools of Contemporary Societies: A Review of Literature. *Journal of Information Processing Systems*, 14(1).

Saputra, N., Nugroho, R., Aisyah, H., & Karneli, O. (2021). Digital Skill During Covid-19: Effects of Digital Leadership and Digital Collaboration. *Jurnal Aplikasi Manajemen*, 19(2), 272-281.

Schirmer, M., Dalko, K., Stoevesandt, D., Paulicke, D., & Jahn, P. (2023). Educational Concepts of Digital Competence Development for Older Adults—A Scoping Review. *International Journal of Environmental Research and Public Health*, 20(13), 6269.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach.* . John Wiley & sons.

Singhavi, C., & Basargekar, P. (2019). Barriers Perceived by Teachers for Use of Information and Communication Technology (ICT) in the Classroom in Maharashtra, India. *International Journal of Education and Development using Information and Communication* , 15 (2), 62-78.

Spires, H., Paul, C., & Kerkhoff, S. (2018). Digital literacy for the 21st century. In M. Khosrow-Pour (Ed.), Encyclopedia of information science and technology. *Hershey, PA: IGI Global*, 4, 2235– 2242.

Srivastava, S. (2007). Theory of Cost. *Unpublished thesis*.

Subrahmanyam, G. (2022). *Digital Skills Development in TVET Teacher Training.* Unesco-Unevoc International Centre For Technical And Vocational Education And Training.

Sulianta, F. (2021). Tools Of Digital Learning Scheme In The Era Of Pandemic Covid 19. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(8), 327-332.

Tam, C., Santos, D., & Oliveira, T. (2020). Exploring the influential factors of continuance intention to use mobile Apps: Extending the expectation confirmation model. *Information Systems Frontiers*, 22, 243-257.

Tarus, J. K., Gichoya, D., & Muumbo, A. (2015). Challenges of implementing e-learning in Kenya: A case of Kenyan public universities. *The international review of research in open and distributed learning*, 16(1).

Tejedor, S., Cervi, L., Pérez-Escoda, A., & Jumbo, F. T. (2020). Digital literacy and higher education during COVID-19 lockdown: Spain, Italy, and Ecuador. *Publications*, 8(4), 48.

Torelli, R., Balluchi, F., & Furlotti, K. (2020). The materiality assessment and stakeholder engagement: A content analysis of sustainability reports. *Corporate Social Responsibility and Environmental Management*, 27(2), 470-484.

Van Laar, E., Van Deursen, A. J., Van Dijk, J. A., & De Haan, J. (2020). Measuring the levels of 21st-century digital skills among professionals working within the creative industries: A performance-based approach. *Poetics*, 81, 101434.

Vasudevan, H. (2021). Resource-based view theory application on the educational service quality. *International Journal of Engineering Applied Sciences and Technology*, 6(6), 174-186.

Volkan, Ö., Sefa, Y. M., & Sadık, T. H. (2022). Factors affecting digital literacy of human resources. *Управленец*, 13(1), 68-83.

Waheed, A., & Zhang, Q. (2022). Effect of CSR and ethical practices on sustainable competitive performance: A case of emerging markets from stakeholder theory perspective. *Journal of Business Ethics*, 175(4), 837-855.

Wairumbi, M. W. (2021). Critical Success Factors to the Implementation of Digital Literacy Programme in Public Schools in Kenya: a Case Study of Langata and Westlands Constituencies in Nairobi County. *Mba, University of Nairobi*.

Walia, S., Rajak, R., Chourasiya, S., & Kaiwartya, O. P. (2023). State Of Art Digital Learning: Proposed Framework, Methods, Benifits, Tools, And Challenges. *Journal of Theoretical and Applied Information Technology*, 101(7).

World Bank. (2019). *The Changing Nature of Work: World Development Report 2019.* Washington, DC: World Bank Group.

Yamamoto, Y., & Yamaguchi, S. (2019). Relationships between ICT Implementation at Schools and Factors Related to Transformational Leadership: A Case of Primary School in Mongolia. *International Journal of Education and Development using Information and Communication Technology*, 15(2), 45-61.

Ziomek, A. (2021). Developing digital skills in Economy 4.0. *UR Journal of Humanities and Social Sciences*, 3 (20)), 143-160.

APPENDICES

Appendix I: Research Questionnaire

Hello,

I'm a student at Strathmore University Business School, currently pursuing a Masters of Business Administration Degree. As part of my academic journey, I'm required to undertake research on an area of interest. I'm asking for your help in answering the attached questionnaire. The research data collected was only used for the above academic requirements and your anonymity is guaranteed in the course of the research. I really appreciate your assistance as you provide the study responses.

Regards,

Part A: Demographic Information

1. What is your gender?

Male ( )
Female ( )

2. What is your highest education attainment?

Degree ( )
Master's Degree ( )
Doctorate ( )

3. How long have you been a headteacher/principal within the institution?

Less than 5 years ( )
6-10 years ( )
11-15 years ( )
Over 16 years ( )

PART B: EFFECT OF COST ON DELIVERY OF DIGITAL SKILLS WITHIN PUBLIC SCHOOLS IN NAIROBI COUNTY

Kindly provide your response on the below statements using the scale below; 5 = strongly agree, 4 = agree, 3 = moderately agree, 2 = disagree, 1 = strongly disagree.

	Digital Skills	**1**	**2**	**3**	**4**	**5**

1.	Our students have adequate access to digital literacy programmes					
2.	Our students have been widely utilizing digital learning resources					
3.	Our students are able to utilize and produce digital learning content					
4.	Our students are aware of the risks associated with utilization of digital learning resources					
5.	Our students are able to collaborate with other learners through digital learning					
6.	Our students do leverage on digital learning to improve their critical thinking and computational skills					
7.	Our students are able to create new learning methods as results of improved digital skills					
8.	Our students are able to share knowledge and resources seamlessly using the digital learning tools					

	Technical-related cost factors	**1**	**2**	**3**	**4**	**5**
9.	The school supports our teachers to improve their technical competency on various digital learning resources					
10.	The school has provided adequate infrastructure to support utilization of digital learning content					
11.	The school has allocated adequate financial and human resources to support the maintenance of digital learning					
12.	The school has invested on necessary hardware to support the maintenance of our digital resources					
13.	The school maintains a collaborative environment with software developers to ensure we utilize emerging technologies in digital learning					

	Resource-related cost factors	**1**	**2**	**3**	**4**	**5**
14.	The school has adequate number of skilled personnel to lead in implementing digital literacy					
15.	The school has access to internet and e-resources necessary for adoption of digital literacy					
16.	The school engages with various partners to improve financing for access new technologies needed for digital literacy					
17.	The school has invested in physical infrastructure required for the smooth utilization of digital learning resources					

	Curriculum-related cost factors	**1**	**2**	**3**	**4**	**5**
18.	The school has fostered the inclusion of digital learning in the curriculum provided to our pupils					
19.	The school regularly participates in training and seminars to improve the skills of our instructors on digital learning content					
20.	The school participates in ministry led digital curriculum development within the country					
21.	The school routinely reviews available digital resources to enhance the quality of learning					

	Stakeholder Involvement	**1**	**2**	**3**	**4**	**5**
22.	The school engages online instructors to facilitate digital learning implementation					
23.	The school collaborates with donor agencies to enhance the funding available for digital learning					
24.	The school relies on stakeholder involvement to develop new policies and strategies to improve digital learning experience					

25.	The school routinely involves guardians/parents in provision of resources needed in adoption of digital learning					

Thank you for participating in this survey.

Appendix II: Interview Schedule

i. In your experience how would you describe the general adoption of digital learning in public schools in the country?

……
……
……

ii. In your opinion, what are the key factors that you think impede the delivery of digital skills in public schools in the country?

……
……
……

iii. Based on your knowledge in the ICT/Education sector what do you think are the key factors impacting the delivery of digital skills in public schools relating to the following areas below

- Technical- related cost factors (technical in this case will mean technological assets such as computers, software programs, digital tools, amongst others)

……

- Resource -related cost factors (resource in this case will mean materials such as books, learning materials in classes, ICT materials, amongst others)

……

- Curriculum – related cost factors (curriculum in this case means ICT related curriculum content, assessment tools, ICT skills and competencies, amongst others.

……

iv. Based on your knowledge of ICT/Education, what do you think is the key stakeholder role and involvement in the delivery of digital skills and what kind of impact do they have on the delivery of digital skills in the public schools? (Stakeholders in this case could mean school administrators,

teachers, parents, students, members of the community, elected officials and members of the school board, government officials)

……

i. In the implementation/delivery of digital learning in the country in public schools, what would you identify as the main challenges?

……
……
……

ii. What are the main recommendations you would suggest to improve the digital learning experience in the public schools in Nairobi County and the country at large?

……
……
……

Thank you for participating in this survey.

Appendix III: Ethical Review Letter

Ms Mwaniki Maureen,
maureen.mwaniki@strathmore.edu

Dear Ms Mwaniki,

RE: Effect of Cost on Delivery of Digital Skills within Public Schools in Nairobi

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** research proposal. Your application reference number is **SU-ISERC1956/23.** The approval period is from **8th February 2024 to 7th February 2025.**
This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

STRATHMORE UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICAL REVIEW COMMITTEE
(SU-ISERC)
08-Feb-2024
Email:ethicsreview@strathmore.edu
P.O BOX 59857-00200
NAIROBI-KENYA

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Appendix IV: NACOSTI Research Licence

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **480279**

Date of Issue: **20/February/2024**

RESEARCH LICENSE

This is to Certify that Ms.. Maureen Wanjiku of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: EFFECT OF COST ON DELIVERY OF DIGITAL SKILLS WITHIN PUBLIC SCHOOLS IN NAIROBI for the period ending : 20/February/2025.

License No: **NACOSTI/P/24/33222**

480279

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions