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Research Article

Digital Literacy Skills of Teachers: A Study on ICT Use and Purposes

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Purpose - This paper examines the challenges encountered in teaching digital competencies among school students in Zambia at the secondary level from a teacher's perspective. Based on this paper's key research objectives.
Design/methodology/approach - The data were solicited from 20 schools in Lusaka. The paper employed a survey design in which a sample of 281 teachers was selected. A questionnaire was used to gather data from teachers, whose findings were analysed using SPSS's latest version.
Findings - The findings show that while teachers in Zambia have access to digital devices and possess moderate to high levels of digital literacy skills, there are challenges in effectively integrating technology into the curriculum and instruction. The lack of alignment, high cost, and limited availability of technology are vital obstacles. Addressing these challenges will require comprehensive policies, infrastructure development, and professional development programs to enhance teachers' digital competencies and ensure equitable access to technology for all students.
Limitations - The study was limited to only Lusaka Province in Zambia.
Originality/value - This study is helpful to the ICT educators and the government of Zambia to know the challenges teachers face in adopting digital technology in their classroom scenarios.

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1. Introduction

The Digital Revolution or the Third Industrial Revolution came as a shift from mechanical and analogue electronic technology to digital electronics that began in the latter half of the 20th century and continues to the present day. This change was driven by the adoption and proliferation of digital computers and record-keeping (Brynjolfsson & McAfee, 2012). The dynamic improved living and affected several areas, including education. Pedagogical research has suggested that it is essential to consider these digital competencies in today's educational practices.

Using technology effectively in the classroom is a crucial skill for teachers today because it is an integral part of the educational environment. Developing teachers' digital competencies ensure students access the best possible education. By providing ongoing professional development, access to technology and resources, and a supportive culture, schools can help teachers develop the skills, knowledge, and attitudes they need to effectively integrate technology into their teaching practices (Gülbahar, 2008; Caena & Redecker, 2019). Digital literacy for teachers also includes understanding digital safety, digital citizenship, and data privacy. Digital competence, on the other hand, is broader and encompasses a more comprehensive range of abilities, including information literacy, communication literacy, problem-solving and critical thinking, and digital content creation. It also includes the attitudes and mindset needed to use digital technologies responsibly and ethically (Falloon, 2020; Bejaković & Mrnjavac, 2020; van Laar et al., 2020; Tohara & Al, 2021).

One of Zambia's main challenges in teaching digital competencies is limited access to technology and resources. This includes issues with internet connectivity, lack of equipment and software, and inadequate teacher training. To address these challenges, the government and other stakeholders should invest in infrastructure and resources, such as providing internet access and computer labs in schools and providing teachers with training and professional development opportunities (Isaacs, 2007).

1.1. Objectives of the Study

The objective of this research is to ascertain how the use of educational digital tools by instructors in the classroom connects to their experiences; analyse instructor's digital competencies for integration in their teaching; analyse the availability and access to Digital tools; and examine the challenges to effective integration of digital tools in teaching.

2. Literature Review

2.1. Digital Technology and Education Industry: Issues and Challenges

The integration of digital technologies into teaching practices has the potential to enhance teaching and learning. However, it requires thoughtful and strategic implementation. Clark-Wilson et al. (2014) highlighted several challenges associated with teaching using digital technologies, including adapting teaching practices, providing professional development and training, ensuring equity and access, integrating technology effectively, addressing pedagogical concerns, managing assessment, and navigating time constraints. Similarly, introducing the Digital Technologies Curriculum presents both challenges and opportunities for educators. It addresses the critical skills shortage in the digital technology industry but requires addressing teacher readiness, limited resources, and curriculum integration (Falkner et al., 2014). This literature section will explore critical themes related to teaching digital competencies, including the digital divide, pedagogical approaches, digital education and policy frameworks, and teacher readiness. It will also address current issues in different regions.

2.2. An Eye on Africa

2.2.1. The digital divide

Teaching digital competencies can only be addressed with access to digital technologies. This is why the concept of the Digital Divide, which defines the gap in access, has gained recognition in technology and digital education, first coined in the mid-1990s (Vartanova & Gladkova, 2019). It refers to the gap between those with access to digital technologies and those without and the unequal distribution of skills and knowledge related to using these technologies. It is about access to technology and the ability to use it effectively (Ramsetty & Adams, 2020). The presence of a digital divide implies that specific individuals or communities have limited or no access to digital resources and technology. This lack of access can significantly hinder their ability to develop digital competencies. The digital divide is therefore identified as impacting digital education equity (Youssef et al., 2022).

According to Makudza et al. (2022), Picturing Africa is still lagging and is far behind the "digital divide" compared to other regions worldwide. The deductions by ITU (2022) state that only 40% of the population in Africa uses the internet, and there is a significant digital divide between urban and rural areas, with a higher internet usage rate in urban areas (64%) than in rural areas (23%). Access is also hampered by relatively high mobile broadband prices, at 6.5% in 2021 and 6.4% in 2022, primarily to low-income individuals. The percentage of individuals owning a mobile phone is relatively low, at 61%, and the population coverage by mobile networks is limited, particularly in rural areas. International bandwidth per Internet user is also relatively low at 85 kbit/s. This indicates a significant gap between those who have access to digital technologies and the internet and those who do not in African nations. This indication poses an adverse impact on the teaching of digital competencies in the region, equally across different regions.

2.2.2. Pedagogical approaches

Pedagogical approaches are another imperative consideration that has gained momentum in studies of how digital competencies are inculcated in learners. These are the instructional methods educators use to facilitate the acquisition of digital knowledge, skills, attitudes, and values (From, 2017). Tafa (2019) explain that these approaches foster active learning, critical thinking, and problem-solving abilities among students, enabling them to understand and address sustainability challenges with digital technologies effectively. Bodsworth and Goodyea (2017) have emphasised that essential questions about pedagogy and digital competencies, such as the specific pedagogy and the pedagogy facilitator, should be explored. It should be noted that it is not only the pedagogy which counts but also the technology integration, teacher competency, desire for change, digital access and digital resources.

Numerous studies have taken a step to highlight the existing gaps in teacher digital competencies in Africa. Many African countries still rely on traditional pedagogical approaches characterised by teacher-centred instruction and rote learning.

However, blended learning initiatives have gained traction recently (Olweny et al., 2022). A recognised combination of face-to-face teaching with digital resources and the widespread adoption of mobile technology has facilitated innovative pedagogical approaches (Draft, 2018). Though, this may be influenced by the digital divide in Africa, according to ITU (2022).

2.2.3. *Digital Education and Policy Frameworks*

Teaching digital competencies in Africa also highlights the impact of digital education policy frameworks. They are a set of guidelines, principles, and regulations established by governments or educational authorities to guide the integration of digital technologies and the implementation of digital education in schools and educational institutions (Ferrari, 2012). In the African region, the landscape of digital education policy frameworks has gained increasing attention in recent years as governments and stakeholders recognise the potential of technology to address educational challenges in the region (Mathers, 2016). This recognition varies across African countries; each country has its governance structures, policies, and priorities concerning digital education.

Kenya has been recognised as a leader in digital education initiatives in Sub-Saharan Africa, with it being a leader in broadband connectivity and general ICT infrastructure (Desta, 2018). This is due to its efforts in formulating policies that support digital education. One of the policy frameworks is the Digital Literacy Program which aims at providing digital devices to every primary school student in the country. Under this program, known as the "Laptop Project," over one million laptops have been distributed to schools. The devices are preloaded with educational content and software tailored to the Kenyan curriculum (Barasa, 2021).

Additionally, the government has rolled out the National Optic Fibre Backbone Infrastructure (NOFBI) project, which aims to connect schools, institutions, and communities to high-speed internet (Onjala, 2012). In April 2022, the government launched its ten-year Digital Masterplan 2022-2032, identifying four key pillars - digital infrastructure, digital services and data management, digital skills, and driving digital innovation. This promises solid support to digital education in the nation, which, if adopted by African countries, will promise a better tomorrow in combating the challenges of teaching digital competencies (Cairns et al., 2022).

However, some African regional initiatives and collaborations focus on lessening the challenges that hamper digital education (Adegoke et al., 2015). The African Virtual University is a pan-African intergovernmental organisation that focuses on expanding access to quality education and training through the innovative use of ICT (Tsuma et al., 2011). Continental Education Strategy for Africa (CESA) is another regional framework adopted by the African Union to guide education development. It emphasises the training and integration of ICT in education and digital technologies to enhance teaching and learning (Union, 2016). Another initiative that promotes the use of open educational resources, teacher training, and the establishment of digital infrastructure is the African Digital Schools Initiative. It is led by the United Nations Educational, Scientific and Cultural Organization (UNESCO), focused on improving digital education in Africa. It supports the development of policies, strategies, and frameworks for technology integration in schools.

These initiatives address challenges such as limited access to education, inadequate infrastructure, shortage of qualified teachers, and outdated teaching methods. They promote the integration of ICT, enhance digital literacy, and improve the overall quality and relevance of education in Africa. However, (Souter, 2014) recognises that the scale and impact of these initiatives may vary across countries and regions, and ongoing efforts are needed to ensure sustained progress in digital education across the continent. (Kolog et al., 2022) has also argued that Africa faces several challenges in implementing comprehensive digital education policies and frameworks. Factors such as limited access to digital infrastructure, lack of resources, and socio-economic disparities contribute to the region's complexity of digital education implementation. Noting this case, efforts are being made to overcome these challenges and leverage digital technologies to enhance education in Africa.

2.2.4. *Teacher readiness*

Teachers' readiness is also one of the leading scientific themes in teaching digital competencies in this region. It is teachers' preparedness, skills, knowledge, and attitudes to effectively integrate digital technologies and promote digital competence development among their students. It encompasses the ability of teachers to use digital tools, resources, and pedagogies in their teaching practices and to guide students in navigating the digital world responsibly. In this comprehension, Hennessy et al. (2022) have noted that teachers' competencies are core to digital education. Digital technologies and tools constantly evolve, and educators must keep up with the latest trends and developments (Tsuma et al., 2011). The situation where teachers may lack the necessary knowledge and skills to teach digital competencies effectively can adversely impact teaching digital competencies. Teachers who struggle to use and understand digital tools may struggle to teach their students effectively (Mathevula & Uwizeyimana, 2014).

Mathevula and Uwizeyimana (2014) found that, like in other regions, teachers' readiness in teaching digital competencies is also considered crucial in Africa. A primary barrier to teachers' readiness and confidence in using ICT is their need for more relevant preparation, either initially or in service Hennessy et al., (2022). For instance, a study by Mukosa and Mweemba (2019) found that many teachers in the African region need more basic digital literacy skills and face challenges in integrating technology effectively into their teaching. Research indicates that, until recently, training opportunities have remained limited in availability and inconsistent in quality. There is an emphasis on providing professional development opportunities for teachers. Training and support are necessary to enhance teachers' digital literacy skills and pedagogical knowledge (Draft, 2018).

2.3. *An Eye on Other Regions: A comparative perspective*

2.3.1. *Digital Divide*

Access to digital technologies is still crucial in other regions, even if they stand better than in Africa. Many findings have highlighted the variations in internet usage and digital connectivity across North America, the European Union, and the Nordic Region. In North America, 83% of the population utilises the internet, achieving gender parity in internet usage. Moreover, urban and rural areas exhibit high internet access rates and relatively low mobile broadband prices. Similarly, the European Union surpasses North America with an impressive 89% internet usage rate, approaching gender parity and demonstrating high connectivity in urban and rural areas. Remarkably, the Nordic Region stands out as a leader in digital connectivity, boasting an internet usage rate of 89%, nearly achieving gender parity. The region showcases high access rates in urban and rural areas, low mobile broadband prices, and near-universal mobile network coverage. These findings underscore the commitment of these regions to foster inclusive digital environments, promoting widespread internet access and facilitating the integration of digital competencies into various domains of society (ITU, 2022). This status of the divide in these regions shows that they are in support and provide a conducive environment with lessened challenges in the teaching of digital competencies, in terms of both availability and access, including gender parties which are even exacerbated by situations like the COVID 19 pandemic (Hill & Reime, 2022)

Regions far behind the digital divide face challenges in digital education. For instance, the digital divide is still significant, particularly in Africa, where internet usage rates are relatively low, and there is a significant gap between urban and rural areas regarding internet access (Makudza et al., 2022). However, access to the Internet is increasing globally, and the gender gap in internet usage is decreasing in many regions. Moreover, the cost of mobile broadband is decreasing, making it more accessible to low-income individuals, and population coverage by mobile networks is increasing globally, particularly for 4G networks. Studies have found that multiple factors, including income, education, urban-rural divide, and political stability, shape the digital divide in these regions. Its significant implications include limited education opportunities (Fuchs & Horak, 2008).

2.3.2. *Pedagogy*

Pedagogical approaches and digital education is other cardinal theme many studies have focused on worldwide. The European Union, North America, and the Nordic Region demonstrate distinct approaches to integrating digital education and fostering digital competencies in their educational systems. The European Union places significant importance on digital skills development, with initiatives and policies supporting teachers in enhancing their digital competencies (Caena and Redecker,&19). Competency-based education and inquiry-based learning are embraced, promoting critical thinking and problem-solving using digital tools. Collaboration is also emphasised through digital platforms (O'Brien et al., 2019). In North America, student-centred learning is a focus, utilising digital tools to foster critical thinking, collaboration, and flexibility through online learning platforms, gamification, and virtual reality to enhance engagement (Marín, 2022). The Nordic Region prioritises personalised learning, tailoring educational experiences with adaptive technologies. Open educational resources promote collaboration, and digital competence is integrated across subjects. These regions highlight the diverse strategies that equip students with the necessary digital competencies for success in an increasingly digital world (Adams et al., 2017).

Equating these findings to Africa, it faces significant infrastructure and internet connectivity challenges, which limits access to digital education compared to other regions (Makudza et al., 2022). North America, the European Union, and the Nordic Region have experienced substantial pedagogical shifts toward student-centred and inquiry-based approaches. However, Africa is still in the early stages of such transitions.

2.3.3. *Digital Education and Policy Frameworks*

Policy frameworks in the context of digital education are guidelines, principles, and regulations established by governments, educational institutions, and other stakeholders to govern the implementation and use of digital technologies in education. These frameworks aim to ensure effective and responsible use of technology, address issues related to access and equity, promote digital literacy, and support the overall goals and objectives of education (Ferrari, 2012).

The European Union (EU) considers Digital education and policy frameworks essential to promoting digital technologies and fostering digital competence in education. This can be seen by the EU's efforts over the years in implementing various initiatives and frameworks to combat challenges in digital education. For example, the Digital Education Action Plan launched in 2018 as a current framework focuses on improving digital infrastructure, enhancing digital skills among teachers and students, and promoting innovative and inclusive teaching and learning (European Commission, 2021). Other frameworks include the DigComp and DigCompEdu, to define necessary digital skills and guide curriculum development and teacher training (Reisoğlu & Çebi, 2020). The Digital Skills and Jobs Coalition also addresses the digital skills gap, while eTwinning and Erasmus facilitates collaboration and knowledge exchange in digital education (Lyons et al., 2019). Digital education support further includes data protection prioritised through the General Data Protection Regulation (GDPR), ensuring responsible data management in educational settings. The EU's efforts reflect its commitment to equipping individuals with digital competencies, promoting inclusion, and fostering innovation in education, making it stand better than Africa and other regions.

Digital education and policy frameworks in the Nordic Region have positioned the region at the forefront of educational innovation. Nordic countries, such as Denmark and Finland, have developed comprehensive policies and frameworks to support the implementation of digital education, emphasising the importance of digital competencies and their integration into the curriculum. For example, Denmark's national policy focuses on technological comprehension and subject-specific digital literacy, while Finland has integrated digital skills into the national curricula for compulsory education (Olofsson et al., 2021). The feature that distinguishes the Nordic policies is their understanding of digital competence as more than just technological proficiency. They recognise that digital competence encompasses various dimensions, including effective use of digital technology and active participation in the digitalised society. This broader perspective ensures that digital education in the region prepares students for both technological advancements and their roles as responsible digital citizens (McGarr & McDonagh, 2019). The Nordic policies also prioritise integrating digital tools and personalised learning approaches in the classroom (Adams et al., 2017). Professional development plays a critical role in the Nordic policies, recognising the importance of equipping teachers with the necessary skills to integrate digital education effectively. Norway's National Framework for Teachers' Professional Digital Competence (PDC) has significantly improved teachers' digital competence and utilisation of digital resources. Additionally, collaborative projects and initiatives contribute to advancing digital education in the region (Gudmundsdottir & Hatlevik, 2018). For instance, the Norwegian Digital Learning Arena (NDLA) provides free digital learning resources, ensuring accessibility and quality materials for students and teachers (Müller, 2021).

Swedish National Agency for Education recommends integrating digital tools, literacy, and assessment methods into teaching practices. These guidelines empower teach successfully ers to incorporate digital education into their classrooms successfully. Evaluation and research initiatives are also integral to the Nordic Region's approach. The Finnish Education Evaluation Centre (FINEEC) conducts evaluations of digital education practices, providing feedback to improve the quality and effectiveness of initiatives (Wollscheid & Opheim, 2016). Similarly, the Icelandic Centre for Research (RANNÍS) funds research projects to promote innovation and evidence-based practices in digital education. The Nordic Region has demonstrated a solid commitment to digital education and has developed comprehensive policy frameworks to support its implementation. This has enhanced digital education in the region, ensuring its effectiveness and relevance in a rapidly evolving digital landscape (Lundström, 2008).

In North America, digital education and policy frameworks have been instrumental in shaping the use of digital technologies in education. Integrating technology in education has been an ongoing process, and various initiatives and policies have been introduced at different times to promote digital learning and support the effective use of technology in schools (Floyd, 2022). Though not the first digital education and policy framework in the history of U.S. education, the ConnectED Initiative, launched in 2013, was a significant and notable digital education initiative in the United States (Tamim et al., 2015). Before this Initiative, some other initiatives and policies aimed to incorporate technology into education. For example, the Enhancing Education Through Technology (EETT) program was authorised under the No Child Left Behind Act in 2001 (Hunt, 2015). In 2014, in the region, Canada developed Digital Canada 150. This national digital strategy ensured Canadians had access to high-speed Internet, digital skills, and online government services. It includes initiatives to improve digital literacy, support innovation, and foster economic growth through digital technologies (Shepherd & Henderson, 2019). This same year, the U.S. Department of Education launched the Future Ready Schools initiative to support digital learning in K-12 schools. It provided districts with s resources, frameworks, and tools to plan and implement effective digital learning strategies (Bakia, 2014). Furthermore, in 2017 CanCode Initiative (Canada) and Pan-Canadian Artificial Intelligence Strategy (Canada) were all initiatives to foster digital education. These policy frameworks demonstrate a concerted effort to promote digital education, improve access to technology, develop digital skills, and integrate technology into educational practices in North America (Floyd, 2022).

In Australia, the Australian Curriculum, Assessment and Reporting Authority (ACARA) has developed the "Australian Curriculum: Digital Technologies" to guide the teaching and learning of digital skills and computational thinking. The curriculum emphasises coding, data analysis, and problem-solving, preparing students for the digital world (Harrington, 2008). The government of South Korea has also implemented the "Smart Education Initiative" to promote the use of digital technologies in schools. This initiative focuses on enhancing digital infrastructure, providing digital learning resources, and training teachers in effectively using technology (Chun, 2018). China has also made significant progress in digital education through its "Smart Education" initiatives. The Chinese government has invested in developing digital learning platforms, promoting online education, and integrating artificial intelligence (AI) technologies into the education system. These efforts aim to improve access to quality education, particularly in rural and remote areas (Zhou et al., 2023).

Furthermore, regional organisations such as the Asia-Pacific Economic Cooperation (APEC) and the Southeast Asian Ministers of Education Organization (SEAMEO) have actively promoted digital education in the region. They facilitate collaboration and knowledge sharing among member countries, supporting the development of digital education policies and frameworks (Kuroda, 2016). Infrastructure limitations, access to technology, and cultural contexts influence the adoption and effectiveness of digital education initiatives (Ferrari, 2012). The Asia-Pacific region's Digital education and policy frameworks highlight the recognition of the transformative power of digital technologies in education. These frameworks aim to equip students with the necessary digital skills and competencies for the future, promote innovative teaching and learning approaches, and address the unique challenges and opportunities of the region.

2.3.4. Teachers Readiness: A Comparative Review

Integrating digital technologies in educational settings has transformed the teaching and learning landscape, necessitating a shift in teacher readiness. As digital competencies become increasingly crucial, it is imperative to understand the factors that contribute to teacher preparedness in effectively teaching digital skills (Perifanou et al., 2021). Studies have deduced significant commonalities and variations in teacher readiness across four regions: Sub-Saharan Africa, North America, the European Union, and the Asia-Pacific, shedding light on the key factors that influence effective digital education.

In Sub-Saharan Africa, the digital divide poses significant challenges to teacher readiness for digital education. Studies have revealed a need for more digital literacy skills among teachers and a need for comprehensive professional development programs. The region has invested in training and capacity-building initiatives to effectively empower teachers to integrate digital tools into their instructional practices (Andema et al. 2013; Bediang et al., 2013; Oluwatayo, 2012).

Teacher readiness for digital education in North America is relatively high compared to other regions. Teachers in this area often possess the necessary digital literacy skills and have access to professional development opportunities. Researchers in Asia-Pacific and North America highlight the significance of teachers' Technological Pedagogical Content Knowledge (Scherer et al. 2021). The related challenges are about keeping pace with rapidly evolving technologies and navigating the abundance of digital resources available. The ongoing professional development programs and robust technology infrastructure contribute to maintaining teacher readiness in North America (Graham et al., 2019).

Though, the Asia-Pacific region demonstrates both variations and commonalities. The level of technological infrastructure varies widely, and government initiatives play a significant role in enhancing teacher readiness. The availability and effectiveness of training and professional development programs differ among countries. For instance, Singapore emphasises teacher professional development in digital education through institutions like the National Institute of Education and the Academy of Singapore Teachers, and also th. The government has asocial support and incentives (Rajandiran, 2021). In Indonesia, challenges exist in the availability and effectiveness of training programs due to limited resources and infrastructure. The country's size and diversity present logistical hurdles for consistent professional development. However, ongoing initiatives by the government, non-profits, and educational institutions aim to address these challenges in improving teacher readiness for digital education in the region (Simamora, 2020).

Within the European Union, teacher readiness for digital education varies among member countries. Many nations have implemented initiatives to enhance digital competencies among teachers, emphasising the effective integration of technology into pedagogical practices. However, ensuring equitable access to quality training and support for all teachers remains a challenge where the proportion varies with other countries in other regions like Africa. Collaboration, continuous investment in professional development programs, and sharing best practices are crucial in improving teacher readiness for digital education in the European Union (Chai et al., 2013).

The Nordic countries place significant emphasis on teacher readiness for digital education. Teachers in this region are generally well-prepared to integrate technology into their teaching practices. They receive comprehensive training on digital literacy skills, pedagogical approaches, and digital tools and resources (Adams et al., 2017). Continuous professional development is prioritised, encouraging teachers to stay updated with emerging technologies and pedagogical approaches. Collaboration is encouraged between educators, academic institutions, and technology professionals to share knowledge, tools, and cutting-edge techniques. The Nordic Region benefits from solid digital infrastructure, easy access to top-notch resources, and a dedication to integrating digital competency across the curriculum (Kirikkaleli et al., 2021).

These regional variations in teacher readiness for digital education across these regions emphasise the importance of technological infrastructure, professional development programs, collaboration, equity considerations, and innovative approaches to enhancing teacher preparedness. The Asi (Hennessy et al., 2022) a-Pacific region and North America highlight the importance of integrating technology into pedagogical practices. However, there may be a variation in the level of emphasis on this concept in Africa. Countries within the Asia-Pacific region and North America with teachers may face challenges due to limited access to technology, but in Africa, the digital divide and limited access to technology may present more significant challenges for teachers in specific communities (Rajandiran, 2021; Scherer et al., 2021).

The European Union and the Nordic Region focus on integrating digital competencies into teacher education programs. This may involve providing relevant training, pedagogical strategies, and content during the initial teacher education (Adams et al., 2017). The extent to which this integration is present in other regions and African teacher education programs may also vary (Adegoke et al., 2015). In addressing these challenges, research has deduced that policymakers, educational institutions, and teachers must prioritise investments in technology infrastructure, develop comprehensive and ongoing professional development programs, foster collaboration among stakeholders, address contextual challenges, and promote equitable access to resources to ensure effective digital education across these regions. By addressing these factors, educators can be better prepared to teach digital competencies and effectively integrate technology into their instructional practices (Chai et al., 2013).

2.4. The Zambian Consideration

Imparting digital competencies in the citizens is one recognised way to affect national growth in Zambia. The nation recognises that the education system plays a significant role in supplying the country's digital skills and competencies. Many efforts have been made to necessitate this (World Bank, 2020). According to the Networked Readiness Index (NRI) published by the World Economic Forum, Zambia ranks 116th out of 190 countries in terms of its ability to leverage information and communication technologies (ICT) for economic and social growth. While the country performs well in the "affordability" pillar, it lags in the "skills" and "use" pillars. The report identifies low mobile broadband penetration and a lack of digital skills as significant challenges in Zambia. Compared to other African countries, Zambia ranks lower than South Africa, Mauritius, and Kenya but higher than Tanzania, Malawi, and Mozambique.

2.4.1. Zambia's Policy Frameworks

Policy frameworks have been implemented since 1998 when the Technical Education, Vocational and Entrepreneurship Training Act was enacted as the most prominent policy guiding digital skill development. The Zambia National Broadband Strategy and Action Plan, implemented from 2016 to 2021, aimed to address the digital divide by increasing broadband connectivity and access nationwide. This strategy recognised the importance of broadband infrastructure for digital skills development and aimed to provide affordable and reliable internet access to facilitate digital learning and skills acquisition (World Bank, 2020). Zambia experienced significant progress in embracing digitalisation, with the internet penetration rate increasing from 6.5% in 2010 to 16.8% in 2020, according to the International Telecommunication Union (ITU). The Seventh National Development Plan (2017–2021) further promoted the integration of digital technologies in various sectors and the provision of digital skills training programs. The Information and Communications Technology Association of Zambia Act (2018) promoted the growth and development of the ICT sector. The National Higher Education Policy (2019) aimed to provide strategic direction for higher education in Zambia, emphasising the integration of ICT in curricula and the development of digital competencies among students and staff. Collaboration between higher education institutions and industry was encouraged to address the digital skills gap.

Additionally, Theal Technical Education, Vocational and Entrepreneurship Training (TEVET) Policy (2019) focused on incorporating digital competencies into TEVET programs to enhance employability and entrepreneurship. The Science, Innovation, and Technology Policy (2019) promoted the development and adoption of science, innovation, and technology, recognising the role of digital skills in fostering innovation and entrepreneurship. Collectively, these policies establish a comprehensive framework for developing digital skills in Zambia. They prioritise the integration of ICT in education and training systems, promote digital technologies for national development, and set standards and guidelines for teaching digital competencies (World Bank, 2020).

Despite Zambia's efforts to enable an environment that supports teaching digital competencies through policy frameworks, many similar studies found challenges related to teaching digital competencies in Zambia (Sikalima, 2021). There was a low level of ICT integration into the educational process (Mulenga & Marbán, 2018). According to the UNCTAD (2022), there are also severe inequalities in Zambia, such as those related to income, gender, and the urban-rural divide. Concerning the political context, one challenge is limited government funding to support digital education strategies. It should be remembered that Zambia is in Africa, and it shares the same challenges affecting the regions compared to other countries in other regions of the world.

3. Methodology

Data were gathered via a paper-based questionnaire. Twenty secondary schools from Lusaka, regions of Zambia, were chosen to participate in the study, making this methodology more appropriate for our assessment. Similarly, it was the most economical way.

3.1. Questionnaire design

The survey had 18 questions. The questionnaire was divided into four main sections:

1. Section A: Teachers' sociodemographic characteristics (4 questions), including their gender, age, educational background, subjects they instruct, and years of experience
2. Section B: ICT use and purpose (8 questions): intended to know if they have computers, internet facilities, and the purpose of using ICT.
3. Section C: Knowledge of digital literacy skills (5 questions): intended to discover teachers' DL self-rating. Teachers used a five-point rating scale to assess their DL: Select 1 for the lowest and 5 for the highest scores.
4. Section D: Difficulties teaching digital competencies to school students (1 question)

3.2. Study population and sampling

Participants are school teachers in Lusaka. It includes government and private schools. The total number of schools in this study is twenty. In this study, researchers used simple random sampling to give equal opportunity to all.

3.3. Data Collection and Analysis

The researchers used printed structured questionnaires to collect the primary data. Two hundred eighty-one teachers were represented as a study sample from ten different schools. For analysing the data, the researchers used SPSS's latest version. Data was presented in table form, including simple frequency, percentage, mean and standard deviation.

4. Results

Part - 1 Socio-demographic details

Gender	Respondents	Percentage
Male	112	39.9
Female	169	60.1

Table 1. Gender Distribution of Respondents

According to Table 1, The study has a total of 281 respondents. 112 males (39.9%) and 169 females (60.1%).

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Age	Respondents	Percentage
21-25	35	12.5
25-30	81	28.8
30-35	75	26.7
35-40	51	18.1
Above 40	39	13.9

Table 2. Age Distribution of Respondents

From Table 2, the age distribution of the respondents is as follows: 35 respondents (12.5%) are between 21-25 years old 81 respondents (28.8%) are between 25-30 years old 75 respondents (26.7%) are between 30-35 years old 51 respondents (18.1%) are between 35-40 years old 39 respondents (13.9%) are above 40 years old.

Highest educational qualifications	Respondents	Percentage
Diploma	157	55.9
Bachelors	74	26.3
Masters	46	16.4
Other	4	1.4

Table 3. Distribution of Highest Educational Qualifications

Table 3 shows the highest educational qualifications of a group of respondents, with the percentage of respondents holding each qualification. 55.9% of respondents hold a diploma, 26.3% hold a bachelor's degree, 16.4% hold a master's degree, and 1.4% have another qualification.

doi.org/10.32388/7VMIK7

Teaching experience	Respondents	Percentage
1-5 Years	49	17.4
5-10 Years	73	26
10 to 15 years	95	33.8
15 to 20 years	36	12.8
More than 20 years	28	10

Table 4. Distribution of Teaching Experience

Table 4 shows the distribution of teaching experience among respondents. 17.4% of respondents have 1-5 years of experience, 26% have 5-10 years, 33.8% have 10-15 years, 12.8% have 15-20 years, and 10% have more than 20 years of experience.

Part - 2 ICT use and purposes

Ownership of Computer or Laptop	Respondents	Percentage
Yes	249	88.6
No	32	11.4

Table 5. Ownership of Computer or Laptop

The results presented in Table 5 show teachers who have their computers or laptop with them. 88.6% of most respondents have a computer or laptop, and 11.4% do not have one with them.

Ownership of Electronic Devices	Respondents	Percentage
Desktop PC	115	40.9
Laptop	197	70.1
Notebook PC	16	5.7
Tablet	43	15.3
Smartphone	265	94.3

Table 6. Digital device ownership

Table 6 shows electronic devices owned by the study respondents. Most of them have smartphones, shown by 94.3%, followed by 70.1% with a laptop, 40.9% have a desktop PC, 15.3% have a tablet, and 5.7% very few respondents have a notebook PC.

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Duration of ICT usage daily	Respondents	Percentage
Less than 1 hour	42	14.9
1-2 hours	80	28.5
2-3 hours	52	18.5
3-4 hours	38	13.5
More than 4 hours	69	24.6

Table 7. Daily Duration of ICT UsageT

Table 7 shows the percentage of respondents who use ICT (Information and Communication Technology) for a specific duration daily. The data shows that 14.9% of the respondents use ICT for less than 1 hour per day, 28.5% use it for 1-2 hours, 18.5% use it for 2-3 hours, 13.5% use it for 3-4 hours, and 24.6% use it for more than 4 hours per day.

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Internet usage daily	Respondents	Percentage
Less than one hour	51	18.2
1-2 hour(s)	99	35.2
2-3 hours	64	22.8
3-4 hours	45	16
4 hours and over	22	7.8

Table 8. Daily Internet Usage

This table 8 shows that 18.2% of the respondents have less than one hour of internet access per day, 35.2% have 1-2 hours, 22.8% have 2-3 hours, 16% have 3-4 hours, and 7.8% have 4 hours or more of internet access per day.

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Internet costs	Respondents	Percentage
Low	37	13.2
Moderate	90	32
High	154	54.8

Table 9. Perception of Internet Costs

Table 9 shows the percentage of respondents' perception of Internet costs. The data shows that 13.2% of the respondents feel that internet costs are low, 32% feel moderate, and 54.8% feel high.

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Duration of Teachers' ICT Facility Usage	Respondents	Percentage
Less than a six month	69	24.6
6 months to 1 year	88	31.3
1 to 3 years	54	19.2
3 to 5 years	34	12.1
More than five years	36	12.8

Table 10. The length of time teachers uses ICT facilities

Table 10 shows the length of time teachers use ICT facilities. 31.3% of respondents used six months to one year. 24.6% of respondents used less than six months. 19.2% of respondents used one to three years. 12.8% of respondents used more than five years, and 12.1% used three to five years.

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Frequency and Purpose of ICT Utilization in the Classroom	Mean	SD
Functional (compile lists of reference, and educational materials, use accessed details to prepare for the test, examinations, lesson plan assignments, and research)	3.95	0.98
Informative (to search, acquire and utilise the information for academic purposes)	3.90	0.96
Communication (using the internet and email to communicate with pupils, teacher educators, and others; participating in chat rooms and forums)	3.62	1.08
Student performance assessment (computers are utilised to create test question papers, question banks, and test materials)	3.48	1.12
Creating (to compose, compile, produce new information, draw, paint, make PowerPoint presentations)	2.97	1.06
Entertainment (to create video clips, watch videos, play music, audio, and play games)	2.92	1.08
Record keeping (computers are used to create and maintain student records for attendance, assignments, and grades)	2.73	1.09
School e-circulars (the Internet is used to notify students about events, activities, schedules, and homework)	2.59	1.10

Table 11. Frequency and Purpose of ICT Utilization in the Classroom

Table 11 shows the mean and standard deviation of how often teachers use ICT in the classroom and for what purpose. The data shows that the highest mean (3.95) is for using ICT for functional purposes such as compiling lists of references, and educational materials, preparing for tests, and research. The second highest mean (3.90) is for using ICT for informative purposes, such as searching and acquiring information for academic purposes. The lowest mean (2.59) is for using ICT for school e-circulars, such as to notify students about events, activities, schedules, and homework. The standard deviation (SD) for each purpose ranges from 0.96 to 1.12, indicating that the data is spread out.

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ICT tools used	Respondents	Percentage
Computers (laptop or desktop)	171	60.9
Radio	41	14.6
Audio notes	33	11.7
Television	34	12.1
Voice recorder	46	16.4
Digital camera	8	2.8
Scanner	72	25.6
DVD player	96	34.2
Multimedia projector	164	58.4
Mobile phones	112	39.9

Table 12. Main ICT Tools Used for Teaching

Table 12 shows highly preferable ICT tools in classroom teaching. The data shows that the most commonly used ICT tools are computers (laptop or desktop) with 60.9%, multimedia projectors with 58.4% usage, DVD players with 34.2%, and mobile phones with 39.9%. Other ICT tools include radio, audio notes, television, voice recorder, digital camera, and scanner.

Perception of the Usefulness of ICT in the Classroom	Mean	SD
It enhances interaction	3.89	1.04
It boosts pupils' motivation	3.83	1.12
It expands the diversity of learning	3.79	1.16
It increases the interest in learning	3.77	1.17
It crucial in the classroom teaching	3.69	1.15
It creates a learning environment	3.64	1.14
It improves my teaching abilities	3.63	1.14
It improves the efficacy of learning	3.48	1.16

Table 13. Perceived usefulness of ICT

This table shows the mean and standard deviation of the perceived usefulness of ICT in the classroom as perceived by the respondents (teachers). The data shows that the highest mean (3.89) is for the belief that ICT enhances interaction in the classroom. The second highest mean (3.83) is for the belief that ICT boosts pupils' motivation. The lowest mean (3.48) is for the belief that ICT improves learning efficacy. Each statement's standard deviation (SD) ranges from 1.04 to 1.16, indicating that the data is spread out. Overall, teachers perceive that ICT is valid in the classroom for different reasons.

Part - 3 Digital Literacy Skills

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Digital Literacy Skills Assessment	Mean	SD
I can communicate with others by sharing knowledge digitally	3.75	1.01
I can search on the internet	3.71	1.05
I can use the information and what I have learned from it to create new work by blending, adapting, applying, designing, inventing	3.61	1.06
I can find the precise information that I want on the internet	3.42	1.05
I can use digital media to create my texts	3.42	1.05
I can communicate with others by exchanging information, sharing knowledge and creating information products to suit the audience, the context and the medium	3.29	1.15
I can manage the information that I find (organise, save and store it for reuse)	3.22	1.12

Table 14. Digital Literacy Skills Assessment

On a scale of 1 to 5 (Very Poor, Poor, Acceptable, Good, Very Good), teachers were asked to rank their perceived level of proficiency in digital literacy. Table 14 presents the findings. The data shows that the highest mean (3.75) is 'I can communicate with others by sharing knowledge digitally.' The second highest mean (3.71) is 'I can search on the internet'. The lowest mean (3.22) is 'I can manage the information I find (organize, save and store it for reuse).' The standard deviation (SD) for each stat is.01 to 1.15, indicating that the data is spread out. The data suggest that respondents possess moderate to high levels of digital literacy skills and can effectively communicate, search and use the information they find.

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Sources for Discovering New Digital Technologies	Respondents	Percentage (N=281)
YouTube	75	26.7
E-Commerce Apps	35	12.5
Colleagues	121	43.1
Family	109	38.8
Magazines	50	17.8
TVs	94	33.5
Websites	123	43.8
Email lists	64	22.8
Friends	180	64.1
Books	32	11.4
Newspapers	41	14.6
Blogs	39	13.9
Social networks	165	58.7

Table 15. Sources of Information for Discovering New Digital Technologies

Table 15 shows the percentage of respondents who learn about new digital technologies through different sources. The data shows that the most commonly used sources are colleagues (43.1%), friends (64.1%), and family (38.8%). Other sources include YouTube (26.7%), e-commerce apps (12.5%), magazines (17.8%), TVs (33.5%), websites (43.8%), email lists (22.8%), books (11.4%), newspapers (14.6%), blogs (13.9%), and social networks (58.7%). Most respondents learn about new digital technologies through their peers, family, friends, and various online platforms like websites, social networks, e-commerce apps, and emails.

Knowledge and Purpose of Digital Technology and Tools	Yes	No
Understand the essential functions of computer hardware components	224 (79.7%)	57 (20.3%)
Have a personal homepage or a personal portfolio on the web	18 (6.4%)	263 (93.6%)
Use keyboard shortcuts	214 (76.2%)	67 (23.8%)
Use the computer for learning purposes	241 (85.8%)	40 (14.2%)
Find it easy to learn something by reading it on the computer screen	185 (65.8%)	96 (34.2%)

Table 16. Knowledge and Purpose of Digital Technology and Tools

Table 16 shows the percentage of respondents who know the purpose of using digital technology and tools. The data shows that 79.7% of the respondents understand the essential functions of computer hardware components, 6.4% have a personal homepage or personal portfolio on the web, 76.2% use keyboard shortcuts, 85.8% use the computer for learning purposes, and 65.8% find it easy to learn something by reading it on the computer screen. While 20.3%, 93.6%, 23.8%, 14.2%, and 34.2%, respectively, do not know or do not use it for the corresponding purpose. Fewer use keyboard shortcuts, have a personal homepage or portfolio online or find it easy to learn by reading it on the computer screen.

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Frequency of Using Various Digital Tools	Mean	SD
World Wide Web	4.50	0.84
Word processor	4.29	0.93
Text chatting	4.09	0.97
Email	4.01	0.98
PowerPoint	3.72	1.03
Voice chatting	3.27	1.17
Spreadsheet (for data organisation)	3.16	1.07
Video conferencing	2.67	1.12
Blog	1.81	1.04
Graphics software	1.80	0.91

Table 17. Frequency of Usage for Various Digital Tools

On a scale of 1 to 5 (Never, Very Rarely, Occasionally, Frequently, Very Frequently) teachers were asked about the level of frequency of use of digital applications. Table 17 presents that the most frequently used digital tools are the World Wide Web, with a mean of 4.50, indicating that most of the respondents use it frequently, followed by word processors with a mean of 4.29, text chatting, with a mean of 4.09, and email with a mean of 4.01. The least frequently used digital tools are a blog, with a mean of 1.81, and graphics software, with a mean of 1.80. The standard deviation (SD) for all the tools is less than 1, which suggests that the data is relatively consistent and that most respondents have similar opinions.

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Confidence Levels in Various Digital Skills	Mean	SD
Using a search engine (e.g., Google)	4.64	0.74
Using social media networking sites	3.65	1.05
Using digital communication (e.g., via email correspondence)	3.57	1.06
Setting up a Wi-Fi network	3.54	1.09
Respecting digital etiquette/netiquette (i.e., the awareness of being a responsible citizen online)	3.25	1.06
Using online banking platforms	2.53	1.14
Applying online security and privacy settings	2.40	1.15
Converting file formats	2.25	1.10
Using cloud storage and file-sharing sites (e.g., Dropbox & Google Drive)	2.11	1.12
Using HTML and basic coding	1.58	0.97
Setting up a website and domain	1.42	0.86
Creating web content	1.41	0.87

Table 18. Confidence in Digital Skills

On a scale of 1 to 5 (Not confident at all, Slightly confident, Somewhat confident, Fairly confident, Completely confident), teachers were asked about their confidence level using in digital tools applications. Table 18 shows that the respondents are most confident in using search engines, with a mean of 4.64, indicating that most respondents feel confident using search engines such as Google. This is followed by using social media networking sites with a mean of 3.65 and digital communication (e.g., via email correspondence) with a mean of 3.57. Respondents need more confidence in using online banking platforms and applying online security and privacy settings, with 2.53 and 2.40, respectively. The least confident skills are using HTML and basic coding, setting up a website and domain and creating web content, with means of 1.58, 1.42, and 1.41, respectively.

Part 4 - Difficulties to Teach Digital Competencies in Classroom

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Difficulties in Teaching Digital Competencies in the Classroom	Mean	SD
Lack of alignment between technology, curriculum, and instruction	4.14	0.98
Cost of new technology is high	4.11	1.05
Lack computers in schools	3.95	1.02
Maintenance and technical problems	3.92	1.11
Lack of skilled personnel	3.90	0.98
Poor network infrastructure	3.87	1.05
Do not have IT infrastructure	3.86	1.07
Resistance to change (Teachers un-willingness to adopt)	3.86	1.07
ICT tools are technically too complicated to use	3.77	1.08
Lack of learning equipment tools, and resource	3.62	1.08
Lack of confidence	3.61	1.09
Lack of professional training	3.57	1.10
Students do not have the computers as their own	3.36	1.1
Students' lack of access to technology at home	2.84	1.10

Table 19. Challenges in Teaching Digital Competencies in the Classroom

On a scale of 1 to 5 (Strongly Disagree to Strongly Agree), teachers were asked about difficulties in teaching digital competencies in the classroom. Table 19 shows that the most significant difficulties are lack of alignment between technology, curriculum, and instruction, with a mean of 4.14, indicating that most respondents find it very difficult. This is followed by the high cost of new technology, with a mean of 4.11, and the lack of computers in schools, with a mean of 3.95. Other difficulties include maintenance and technical problems, lack of skilled personnel, poor network infrastructure, and resistance to change (teachers' unwillingness to adopt), with means of 3.92, 3.90, 3.87, and 3.86, respectively. The least significant difficulties are students' lack of access to technology at home, with a mean of 2.84, indicating that most respondents find it moderately difficult. The standard deviation (SD) for all the difficulties is less than 1, suggesting that the data is relatively consistent and that most respondents have similar opinions.

5. Discussion

Educational practices have been reshaped by ever-evolving technology advancement, and digital technology is not a new topic in the realm of education. The research conducted in this study provides valuable insights into the challenges faced by teachers in Zambia when teaching digital competencies in secondary schools. The findings shed light on the socio-demographic details of the respondents, their ICT use and purposes, digital literacy skills, and the difficulties encountered in teaching digital competencies in the classroom. This discussion will analyse the research findings in the context of the digital divide, pedagogical approaches, digital education and policy frameworks, and teacher readiness in Zambia, as well as draw comparisons with other regions like Sub-Saharan Africa, North America, the European Union, and the Asia-Pacific regions.

One of the key findings in this study is the gender distribution of the respondents, with 60.1% being female and 39.9% male. This distribution reflects female teachers' participation in teaching digital competencies in secondary schools in Zambia. Gender disparity in teaching is not unique to Zambia and is a common issue in many regions worldwide. Efforts should be made to promote gender equality in the teaching workforce, particularly in digital education, as diverse perspectives and role models can positively impact students' learning experiences.

The research also highlights the availability of digital devices among teachers in Zambia. Most respondents (88.6%) reported owning a computer or laptop, and a significant percentage (94.3%) owned smartphones. This indicates a relatively high level of digital device ownership among teachers, crucial for incorporating technology into the classroom. However, it is essential to consider that device access does not guarantee effective utilisation or digital literacy. Teachers' proficiency in using and integrating these devices into teaching practices should be further explored (Tafa, 2019).

For digital literacy skills, the study finds that respondents had a moderate to high degree of digital literacy. They claimed competency in communication, internet surfing, and learning with digital tools. However, there were several areas where teachers could have been more confident, such as managing internet information and creating web content. It shows that focused professional development programmes and support are needed to improve teachers' digital literacy skills in these areas.

The findings also highlight the challenges faced by teachers in teaching digital competencies. The most significant difficulty was more alignment between technology, curriculum, and instruction (Mukosa & Mweemba, 2019). Emphasises the need for comprehensive policy frameworks and educational strategies that effectively integrate digital technologies into the curriculum and provide teachers with guidance and resources to align their instructional practices with technological advancements (Kolog et al., 2022). The high cost of new technology and the lack of computers in schools were also significant challenges (ITU, 2021). Underscores the importance of investment in infrastructure and resources to bridge the digital divide and ensure equitable access to technology for all students and teachers (Chun, 2018; European Commission, 2021; Souter, 2014).

When the findings of this study are compared to those of other regions, it is clear that the issues of teaching digital capabilities in secondary schools are not unique to Zambia. The digital divide is a global issue, especially in Sub-Saharan Africa, where access to technology and internet connectivity is frequently limited (Makudza et al., 2022). Other locations have similar issues but to varied degrees. North America, for example, and the European Union, for exampled access to digital resources. However, there are still challenges with curriculum alignment, teacher preparedness, and the cost-effectiveness of technology adoption (Floyd, 2022). The Asia-Pacific area, on the other hand, is highly diverse, with some nations leading the way in digital education and others having severe hurdles (Rajandiran, 2021).

6. Conclusion

This study sheds light on the difficulties teachers in Zambia encounter when teaching digital competencies in secondary schools. The findings highlight the importance of comprehensive policies, infrastructure development, and teacher professional development programmes for closing the digital divide, aligning technology with curriculum and instruction, and improving teachers' digital literacy skills. Comparisons with various regions demonstrate the universality of similar difficulties but with differences depending on the situation. Addressing these issues necessitates.

Declarations

Funding - Not applicable.

Data availability - The datasets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

Ethics statement - Ethical review and approval were not required for the study on human participants by the local legislation.

Consent to participate - All participants provided their informed consent to participate in the study.

Consent - The participants were informed about the confidentiality of the study and that it was voluntary to participate. Informed consent was obtained from all the respondents.

Conflicts of interest - The author declares that there is no conflict of interest.

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