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Original Article

Digital Technology Adoption in Public Secondary Schools in Tanzania: A Case of Handeni District

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Schools.

This study investigates the challenges of adopting digital technology in Tanzania's Handeni District public secondary schools. The rapid advancement of technology has changed several sectors, including education. ICTs can improve teaching and learning by providing various materials, facilitating interactive learning, and increasing critical thinking. In developing countries like Tanzania, adopting digital education technology is challenging. This qualitative case study examines digital technology integration in the Handeni District, teachers' perceptions, adoption barriers, and possible solutions. The study used teacher reports, observations, and document review, whereby Tanzania's ICT policy for basic education, draft National digital education strategy 2024-2030, and ICT guidelines were analyzed. Triangulating data from these sources allowed the study to fully comprehend digital technology usage in Handeni District public secondary schools. The findings show that limited access to digital devices, poor digital competence among teachers and students, inadequate internet connectivity, and inconsistent classroom use of digital tools hinder digital technology adoption. The study recommends extensive teacher training, infrastructure improvements, measures to lower the cost and accessibility of digital devices and internet services, and stakeholder collaboration to improve digital technology integration in education. The study aims to improve educational outcomes and teach students modern digital skills by addressing these challenges.

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INTRODUCTION

Worldwide, technology is transforming education. Tanzania must enhance its educational system if it is to adapt. Teaching and learning, in particular, rely heavily on ICTs. Digital technology is a game-changer for education. Thanks to the Internet and its global resources, education is now more adaptable and dynamic. The traditional classroom model is under siege by new kinds of distance education, such as video lectures, online classes, and interactive learning platforms (Chauhan, 2024).

This varied approach to education allows students the freedom to learn at their own speed. Education resource sharing is promoted by ICTs. Through the internet, educators and students may interact, share materials, and have access to information from all around the world. Students benefit from this worldwide tool in the classroom (Najam Abbas et al., 2025). There are a lot of ways in which the use of ICT enhances educational information resources (Ayeh, 2024). Musonda & Mabbolobolo (2025), declare that people concerned about education around the world are concerned that incorporating ICT into schools, particularly classrooms, will lead to more learning for teachers and students who are already comfortable with technology. With the use of relevant skills and ICT, both teaching and learning are enhanced. Students can develop skills applicable to their future careers and assess a wide range of academic fields in today's technologically advanced classrooms. By 2025, all schools in Europe will have access to gigabit Internet (OECD, 2023), one of their broadband targets. At 100 Mbps, less than 20% of students in Europe attend classes (Eurostat, 2024). Schools in smaller towns and rural

areas are not keeping up with their Nordic counterparts. Various computers, iPads, and interactive whiteboards are at your disposal. Teachers worry that students won't be able to access digital resources if these gadgets aren't readily available. Interestingly, instructors in the EU utilize ICT in different ways (García-Vandewalle García et al., 2023). Computer use among Dutch and Danish educators exceeds 75% every week. Professors in Germany, Poland, and Croatia utilize ICT less than half of the time.

Perhaps this difference can be explained by differences in educational priorities, technology, training, and support for teachers. Learning that is dynamic, collaborative, creative, integrative, and evaluative is made easier with the help of ICT (Dr. Iqbal Ahmad et al., 2025). The Internet, interactive whiteboards, and laptops all work together to make learning and teaching new and exciting. By shifting the focus from the instructor to the students, ICT is making education more engaging. Educators in Europe can use DigiCompEdu to pinpoint where their students are lacking in digital competency by choosing from six different categories, as shown in a recent study (Quaglio et al., 2016). The EU's reference framework for lifelong learning and the European Commission's framework of different competencies both state that national primary education standards should prioritize the development of digital literacy. Teachers help students grow their knowledge and abilities by instructing them in the use of information and communication technologies. Information and communication technology simplifies management and instruction.

Minjie (2021) indicates that technology affects classroom instruction in two ways in China. Through the use of ICT, children can be raised morally and culturally aware. Technology helps students both in and out of the classroom. Students and learning can be better managed with the use of ICT in the classroom. Even while on vacation or at the weekend, students can complete assignments and take notes on the go using their mobile devices. Young people's imaginations and unique learning styles are nurtured in this way. Student groups can work together remotely using online discussion boards, platforms, and projects. The skills of problem-solving, effective communication, and collaboration are imparted to the students. Learners all across the world may now work together thanks to digital tools. They gain more knowledge as their perspectives and civilizations expand (Hong et al., 2024).

Some schools have banned the use of ICT in the classroom because teachers are unhappy with it. Teachers are concerned that students who use technology may engage in unethical or poorly executed work. Phones may be banned in class (Hébert et al., 2021). This highlights the significance of informing teachers about the advantages of ICT. Online educators can better equip their students for success in the current digital economy if they are well-versed in the information and communication technology (ICT) tools that can enhance the learning experience.

Zeb et al. (2022) found that both teacher educators and trainees felt that teacher education courses lacked a solid framework for integrating technology. Even though schools stress the use of ICT in teacher preparation curricula, they often lack the necessary computers and other resources. Preservice and rookie teachers need ICT training. Learning with technology is more effective than conventional classroom methods. Preparation programmes for educators

When it comes to secondary education, many

African countries have a hard time incorporating ICT. There is an extreme scarcity of informatics and technology teachers. The absence of ICT-savvy teachers in most Ugandan schools is a major obstacle to the incorporation of technology in education (Ngaya et al., 2024). Secondary schools in Kenya are underfunded and unsupported due to the majority of education stakeholders' refusal to acknowledge the need to integrate ICT. Nigerian ICT education demand exceeds teacher supply (Onyinye Okoh, Nnaemeka Chijioke Okorie, 2025).

Problems with infrastructure, such as internet connectivity, make things more complicated. Due to sluggish or sporadic internet connections, many schools' teachers and pupils are unable to utilise online resources. Internet connectivity in schools is unreliable due to high prices. Fahm (2025) claims that the absence of adequate classroom and study space in Nigerian schools is a major obstacle to student achievement. Improving Nigeria's educational infrastructure is crucial if the country is to fully integrate ICT. Computers, projectors, smart TVs, and power backups are essential for effective communication, affordable education, and student management.

Students' digital abilities, which are highly valued by society, are limited due to these challenges, which degrade the quality of education. Better information and communication technology (ICT) infrastructure, such as more computers and the internet, is essential to address these problems. For teachers to make good use of ICT, they require continuous training and assistance (Sudeshna Majumdar et al., 2024). Reliable power is essential for the effective usage of classroom ICT. Schools in rural Africa often experience unreliable power and frequent power outages. This problem hinders the integration of ICT into the curriculum since it limits the availability of computers, projectors, and internet connections.

Classrooms and contemporary learning equipment in Nigeria are negatively impacted by power outages. When the electricity goes out, it affects the

schools in South Africa. Digital resources and e-learning platforms improve education, but they can't be used or maintained without reliable energy (Ogbu, 2023). Without power, school administration is more difficult because student data and communication are dependent on it. Process delays and increased personnel workload might be caused by inadequate electricity. Some professional educators may lean towards more eco-friendly urban areas.

Oluwaseun Augustine Lottu et al. (2023) indicate that solar power and other innovative methods improve the reliability of school energy. Regardless of authority conflicts, this approach has made schools welcoming places. The widespread implementation of these solutions necessitates substantial funding and improvements to infrastructure, particularly in underserved rural areas. Visions of ICT in education vary among educators and stakeholders. While some see the potential benefits of ICT in the classroom, others are hesitant owing to issues with training, expense, or the possibility that technology would supplant more conventional approaches (Hrehová & Teplická, 2020). By facilitating more tools and cooperation, many educators feel that modern technology enhances student involvement and participation in the classroom. People who are hesitant to use technology in the classroom may be concerned about the expense of information and communication technology infrastructure or feel they do not have the necessary skills or training to do so.

The adoption of technology in education is influenced by how stakeholders perceive it, according to research. Pérez Echeverría et al., (2025) highlighted that when both educators and stakeholders value information and communication technology, its use in the classroom increases, and teachers might be inspired to embrace new approaches and technologies with this optimistic view. Digital resources and devices may enhance student engagement and learning if teachers

acknowledge the advantages of ICT and employ them in the classroom. Stakeholders who are hesitant about the use of ICT in education will need extensive support and training before they can be convinced. Educators learn about technology as part of their continuing education. Less resistance and more positive attitudes towards technology might result from schools' investments in ICT infrastructure and resources.

Educational technology in Tanzania includes the use of films, simulations, and interactive tools. Students can understand and remember more using this adaptable method. By utilizing ICT for adaptive learning, students can learn at their own pace. Individualized support for each student's progress is provided (URT, 2024). Nevertheless, digital tools enable educators to accurately and quickly assess students. They help students save time and get the feedback they need to progress quickly. Technology has made grading and keeping records much easier. As a result, educators will have more time to focus on student needs and develop engaging lessons.

Unfortunately, not many secondary schools in Tanzania have adequate resources to teach technology. The dearth of portable electronic devices is concerning. High student-to-computer ratios make it difficult for many kids to benefit from using computers in the classroom. Making matters worse is the fact that some schools do not even have computers. The internet's unreliability is an issue. App and tool usage by educators and students is hindered by internet outages. Online courses, instructional materials, and collaborative platforms are essential for modern educators; nevertheless, poor connectivity might make these things difficult to access. Education may be hindered in remote places with poor infrastructure due to expensive internet access.

A Statement of the Problem

Digital technology can improve teaching methods, provide access to diverse learning resources, and create interactive and collaborative learning

environments, but public secondary schools in Tanzania's Handeni District struggle to adopt it. Challenges include:

Limited Digital Devices, High student-to-computer ratios, and an absence of computers in many schools limit digital technology integration into teaching and learning. Another challenge is poor digital literacy; teachers and students cannot use digital tools and resources, impeding technology adoption.

Moreover, there is a poor internet connection. Low internet speeds limit teachers' and students' access to online materials and platforms, limiting digital technology in education. Infrequent classroom technology use, digital tools are rarely used for teaching and learning, mostly for administrative functions. Lack of digital gadgets, internet connectivity, and teacher pre- and in-service training is to blame.

These problems demonstrate a substantial gap between the potential benefits of digital technology in education and its present usage in Handeni District public secondary schools. Addressing this gap is essential for strengthening education and equipping students with current digital skills.

Research Questions

1. What is the status quo of teachers' digital technology integration in Handeni public secondary schools?
2. What are the barriers hindering the adaptation of digital technology in Handeni public secondary schools?
3. What are the strategies that can help to overcome the limitations of digital technology adaptation in Handeni public secondary schools?

LITERATURE REVIEW

ICT Policy in Tanzania

Tanzanian schools have consistently employed ICTs. This effort began in the late 1960s and early 1970s when schools obtained radios to help students

listen to RTD's instructional broadcasts. Unfortunately, nothing was done to incorporate mid-1990s television technology into instruction. A 2002 stakeholders' workshop by the Ministry of Education and Culture and the Dutch NGO International Institute for Communications Development (IICD) revived ICTs in education. 11 project concepts were created from the workshop's roundtables' identified ICT intervention areas. This raised awareness of the benefits of integrating ICTs into education, making them a priority in educational planning.

Tanzania's first National ICT Policy, adopted in 2003, provides a framework for information and communication technology to contribute to national growth and a knowledge-based society. The country has been actively devising and implementing ICT policies to improve its education system for thirteen years, which has helped the ICT industry thrive, creating jobs, increasing productivity, and improving efficiency.

A 2007 ICT Policy for Basic Education was created to help students learn and use many ICT skills and knowledge. ICT integration in pre-primary, primary, secondary, teacher education, non-formal, and adult education was established under the 2007 ICT policy for Basic Education. Several national and international policy documents, including the Tanzania Development Vision 2025, the National Strategy for Growth and Reduction of Poverty (NSGRP), the Millennium Development Goals (MDGs), the National Information and Communications Technologies Policy, the Education and Training Policy of 1995 (ETP), the Education Sector Development. In 2004, ICT contributed 1.5% to GDP; in 2013, 2.4%. In 2016, the National ICT Policy was updated to suit changing ICT conditions. This strategy aims to accelerate digital transformation, ICT infrastructure development, cyber security, local content production, and e-waste management.

To accelerate digital transformation, Tanzania updated its National ICT Policy in 2023. Continuing

the 2016 policy's achievements, this approach emphasizes digital infrastructure, skills, innovation, and inclusivity. The new National ICT Policy 2024 puts ICT in education and builds secure and reliable ICT infrastructure nationwide. The projected National Digital Education Strategy for 2024-2030 uses seven core and six supporting pillars to improve learning outcomes through digital education.

Integration of Digital Technology in the Teaching and Learning Process

Studies show that the use of specialized digital tools, such as GeoGebra, in mathematics education can significantly improve students' comprehension and performance in geometry (Syahrir et al., 2024). This aligns with comprehensive studies demonstrating that effective ICT integration improves children's academic achievement, conceptual understanding, problem-solving skills, and creativity. Furthermore, Agyei (2021) confirms that digital platforms like Moodle can enhance students' writing skills, creativity, and motivation in fields such as biology. This suggests that the prudent integration of digital tools might make complex subjects more comprehensible and engaging for students.

The incorporation of ICT positively impacts instructors' attitudes, practices, and beliefs around instruction. The TPACK paradigm, which stands for Technological Pedagogical Content Knowledge, emphasizes the importance for educators to develop a comprehensive understanding of the interplay between technology, pedagogy, and content knowledge. This notion aids teachers in developing more effective and customized instruction Ngeze, (2017), hence enhancing their professional development and the whole teaching process. Furthermore, digital technology enables personalized and flexible learning experiences. Students can access instructional resources at their convenience, which is particularly beneficial for those needing additional support or wishing to learn at their own speed. This versatility enables

educators to tailor their instruction to meet the diverse needs of their pupils, thus fostering a more inclusive educational environment.

Teachers' Perception of Digital Technology Integration in Teaching and Learning

Studies show that educators' digital technology pedagogy and attitudes affect their preparedness and capacity to use technology in the classroom. Teaching with digital tools is more likely for those who believe they boost student engagement, motivation, and learning. Alternatively, educators who distrust digital technology's efficacy or perceive it as a distraction may resist it. Technology effectiveness, training, and experience can modify digital technology integration attitudes. Technology promotes student learning, thus, some educators may rethink their thoughts.

Integration demands digital technology skills from instructors. Digital platform professionals teach with technology more often. They can handle digital resources, address technological problems, and give students amazing educational experiences with this competence. Competence influences school digital technology integration confidence. Digitally confident teachers try new tech more freely. Their confidence helps them overcome integration obstacles. Teacher digital skills training can enhance technology integration confidence and self-efficacy.

Teachers' digital technology integration opinions depend on infrastructure and resources. Instructors can use laptops, tablets, the internet, and other devices to incorporate technology during lessons. In colleges with well-equipped computer labs, reliable internet connectivity, and various digital resources, academics consider technology integration as pragmatic and beneficial. Providing teachers with tools, training, and technical support may improve their view of digital technology integration. Policy and financial administrative support, technology user coaching, and professional advancement are covered.

Supported and empowered teachers integrate technology more effectively.

With digital technology integration, educators also need professional development. Technology-integrated teaching can be achieved with extensive technological and teaching training. They must be ongoing, relevant to educators, and promote collaboration and best practices. Teachers require continuing training as digital technology changes. Continuing professional development helps teachers stay current on technical changes and pedagogical techniques, making technology integration more dynamic.

Teachers' perspectives on digital technology can be influenced by secondary school culture. Innovative, adaptable, and technologically integrated cultures view digital technologies as essential to modern teaching approaches. Conservative settings may be less open to change and uncertain about technology. Teachers' attitudes toward digital technology may be influenced by parents, pupils, and the community. Communities that embrace technology integration and understand its benefits may inspire instructors to use digital technologies.

Barriers Hindering the Adaptation of Digital Technology in Teaching and Learning

Many teachers doubt their ability to use modern technology in the classroom (Bishel, 2022). Teachers may lack trust in technology because they lack training or knowledge of its functions, making them unprepared to use it in their teaching. Additionally, they lack the pedagogical competence to effectively integrate digital tools into their classroom. They may struggle to use technology to improve learning rather than for its own sake. Fang et al. (2021) suggest that insufficient professional development on technology in education may cause pedagogical preparation issues.

Students don't always have access to digital tools outside of school. According to Momčilović & Ninković, (2024), the digital gap can create educational discrepancies as students without home

access to gadgets or the internet may struggle with assignments and online learning. Rural and economically poor students may have less access to technology than their peers. Students may lack digital literacy to use technology for education. This could include computer skills or critical online content evaluation. Students may fail to connect with digital content or participate in online debates without these skills, limiting their education.

Many educational institutions, especially in low-income or developing nations, lack the infrastructure and resources to use digital technology extensively. Insufficient computer resources, old technology, or inconsistent internet connections are examples. In Cambodia, many schools lack computers and stable electricity for technological use (Khine & Liu, 2022). Digital technology acquisition and maintenance may be costly for educational institutions. This includes device and software purchases, maintenance, upgrades, and technical support. Insufficient financing can prevent schools from purchasing digital education technology and infrastructure. Agyei (2021) also noted that school administrators must encourage and lead digital technology integration in education. Administrators must provide resources, define expectations, and promote technology use. Teachers may lack motivation and resources to use technology if administrators don't support them. Traditional curricula and assessments may not be enough to include digital technologies. The curriculum may not match technological integration, hindering teachers' ability to integrate technology. Additionally, high-stakes testing and standardized exams may force educators to prioritize traditional teaching techniques over technological integration (Boruah, 2022). Digital schooling may be culturally opposed in some countries. Technology's position in society or its impact on traditional educational techniques and values may cause this. Some communities value face-to-face interaction and traditional pedagogy over technology.

RESEARCH METHODOLOGY

This study was conducted in the Handeni District, Tanga region. To obtain enough data for the topic of study, a researcher required social intimacy, direct conversations, and intensive discussion with the participants on the study phenomenon in their real settings. The study adopted a qualitative research approach with a case study design. According to Creswell (2013), the design enables the researchers to get in-depth information and a deeper understanding of digital technology adoption among public secondary school teachers. On the other hand, the choice of a qualitative approach was because the approach considers a researcher as the primary instrument; thus, capturing complex human experiences under study was done effectively while adapting and responding to the environment.

The study utilized semi-structured interviews with ward education officers and head teachers to explore technical, administrative, and digital technology aspects of teaching in public secondary schools. Document Review, where district office data on secondary school digital technology policy was collected. Researchers observe how teachers use digital gadgets in selected Handeni District secondary schools for teaching and learning.

The study used teacher reports, observations, and document review, whereby Tanzania's ICT policy for basic education, draft National digital education strategy 2024-2030, and ICT guidelines were analyzed. Triangulating data from these sources allowed the study to fully comprehend digital technology usage in Handeni District public secondary schools.

The researchers chose Handeni due to multiple strategic reasons. First, the accessibility of essential data was a significant factor, the district presumably possessed meticulously maintained records, dependable information sources, and accessible databases that could furnish researchers with the requisite data. The availability of data enabled the

researchers to collect extensive and pertinent information to support their study objectives.

However, the site's excellent accessibility rendered it an optimal selection. This indicates that the researchers could effortlessly go to and from the neighbourhood without encountering logistical obstacles such as inadequate infrastructure or isolated sites (Koswara, 2022). This accessibility not only conserved time and resources but also guaranteed that the researchers could perform their fieldwork effectively.

Additionally, the ability to cultivate rapport and trust with the local population during data collection was crucial. Establishing a robust rapport with the district's populace is essential for acquiring precise and dependable data. When researchers establish trust within the community, participants are more inclined to candidly share their experiences and information. Trust can be cultivated by regular interactions, respect for local norms and traditions, and a sincere concern for the community's welfare. It also mitigated the danger of discovering data deficiencies or inconsistencies, which may have compromised the validity of their conclusions.

The targeted population of this study was secondary school teachers, heads of schools, and ward education officers in the Handeni District (Aseey, 2021). Researchers rely on specific groups of people to obtain comprehensive insights and guarantee the pertinence of their results. By delineating a specific target audience, they can customize their research inquiries and methodologies to address the distinct traits, behaviours, or requirements of that group. This methodology is especially advantageous for examining specialist topics or elusive populations, when conventional sampling techniques may prove ineffective. Targeted population sampling enables researchers to allocate resources efficiently by focusing on a segment of the population that is most pertinent to their study (Goodley et al., 2024). It facilitates comprehensive data collection, yielding intricate and refined information that can result in more precise and actionable findings.

A sample size of 45 people was deliberately chosen to accomplish this. Researchers select samples because examining the full population is frequently unfeasible owing to time and budget limitations. An appropriately selected sample can epitomize the broader population, enabling researchers to extrapolate their conclusions to the entire cohort. The study employs random sampling, the technique is favoured as it guarantees that each member of the population has an equal probability of selection (Ramsey & Rostron, 2024). This mitigates selection bias, rendering the sample more representative of the population. Consequently, the results from the sample can be more dependably extrapolated to the total population, thereby augmenting the validity and dependability of the research (Jamal et al., 2024).

The purposive sample strategy was utilised to recruit participants for the study. This research utilised purposive sampling to strategically acquire rich, detailed, and pertinent data from persons directly engaged in the educational system of the Handeni District. This methodology enabled the researchers to establish rapport with the local people, optimise resource management, and guarantee that the results would be both thorough and relevant to analogous situations. To ensure that the information provided was sufficient, the study used Semi-structured interview methods to gather data. The researchers used the interview as an interpersonal conversation administered to obtain relevant in-depth information (Magaldi & Berler, 2020). Interviews were carried out with the ward education officers and head teachers for an in-depth understanding of technical, administrative, and digital technology in teaching in public secondary schools.

On top of that, documents were reviewed to collect official data from the office concerning the policy implementation of digital technology in Secondary schools. Also, the research observed how teachers use gadgets during the teaching and learning

process among the selected secondary school teachers in the Handeni district.

FINDINGS

This chapter highlights the findings from qualitative research conducted in Handeni District, Tanga region, Tanzania. The study sought to investigate the current state of digital technology integration in public secondary schools, educators' perceptions regarding technology integration, obstacles to its adoption, and prospective strategies to mitigate these challenges. The findings are categorized into four principal themes: the existing status of technology integration, educators' perceptions, barriers to adoption, and strategies for overcoming challenges.

Quo Status of Digital Technology in Tanzania

Like financial, health, industrial, mobile, and other sectors, the Tanzanian educational sector has undergone significant transformations from the early 21st century to the present. The modern era emphasizes the shift from traditional education to the integration of digital interactive learning environments as a complementary, yet essential, component of conventional educational principles. The transition has involved interactive, non-linear, exploratory, discovery-oriented, engaging, and individualized activities frequently facilitated through digital resources.

The researcher observed that, at the secondary education level, both government and non-government secondary schools possessed 31,445 desktop computers and 10,932 laptops. Nonetheless, merely 4,276 (72.2%) of these secondary schools were linked to the national grid. Diverse specialized training and capacity-building initiatives have been executed at various tiers of basic education. In 2021, UCSAF provided ICT training to 650 public secondary school educators, emphasizing the integration of ICT into pedagogy and fundamental troubleshooting competencies (URT, 2024).

Additionally, the Tanzania Secondary Education Quality Improvement Project (SEQUIP) has facilitated the training of 15,282 secondary school teachers (26.08% female, 73.92% male) against a target of 20,000. SEQUIP prioritizes digitally enhanced effective pedagogy and the implementation of digital instruction in STEM disciplines. Additionally, the Government delivered ICT training to 4,500 educators from 1,300 secondary schools in 2023, to improve their proficiency in employing ICT for instructional and educational reasons (URT, 2024). Secondary Education Quality Improvement Project (SEQUIP) has provided training on the utilization of ICT in teaching and learning to 500 secondary school students.

Notwithstanding the Tanzanian government's endeavours to augment public secondary schools with digital technologies, considerable challenges persist in the effective implementation of these projects. This circumstance underscores the imperative for formulating regulations that facilitate the incorporation of information and communication technology (ICT) in public secondary education.

Mkude B, (2023) asserts that the Tanzanian government must acknowledge the imperative for remedial actions to address current deficiencies and guarantee the proper implementation of these initiatives. The research has identified several critical areas where governmental interventions are necessary for the effective integration of digital technology in public secondary schools. The government must adopt a more proactive strategy to ensure the availability of vital teaching and learning infrastructure, including reliable and inexpensive access to the electrical grid for educational institutions. Secondly, there is an urgent necessity for the development of policy measures that assist schools in the efficient incorporation of ICT into educational curricula and assessment practices. Concurrently, relevant regulatory frameworks must

be instituted to promote and enable the integration of ICT competency into the curriculum.

Thirdly, the new curriculum designates computer science as a mandatory subject for students opting for the Information and Communication Technology (ICT) stream in general education, while it serves as an elective for those in Ordinary Secondary Education seeking to establish a foundation in Computer Science and its associated careers. The objective of studying Computer Science is to enhance the student's understanding, skills, and competencies in utilizing computer science techniques to address real-world issues. Furthermore, despite the existence of policies and curricula that prioritize digital integration, the reality indicates that numerous educators possess inadequate proficiency in utilizing technology across various domains, including instruction.

Limitations on Digital Technology Adoption in Teaching and Learning

Limited Access to Digital Devices

The findings revealed that public secondary schools in Handeni District face a significant shortage of digital devices such as computers and tablets. In some schools, the student-to-computer ratio was extremely high, with some schools lacking a single computer. This limited access severely restricts the integration of digital technology into teaching and learning processes.

“The scarcity of computers and tablets prevents many students from meaningfully engaging with digital content, hindering their learning and disadvantaging them compared to peers with better access. It's disheartening to see eager students unable to explore new concepts due to this lack.” T₂

Moreover, Aseey (2021) argued that, in education, the absence of digital resources can greatly hinder a student's learning ability. As technology becomes increasingly integrated into educational environments and online learning becomes more

common, students who lack access to devices like laptops, tablets, or smartphones risk falling behind their peers. This digital divide can impair educational inequalities, particularly for students from economically disadvantaged backgrounds or those living in rural areas.

Additionally, the lack of digital devices can severely hinder their ability to learn effectively. In today's digital age, many educational resources and materials are available online, and without devices to access these resources, students miss out on a wealth of information and opportunities for self-directed learning. They cannot engage in online research, collaborate with peers through digital platforms, or utilize educational apps and software that can enhance their understanding of various subjects (Donelle et al., 2020). This can lead to gaps in their knowledge and skills, as they are unable to keep pace with the evolving demands of the modern education system. In an interview one of the respondents argued that,

"I've heard that digital technology can be really helpful for learning, but without computers or tablets in our school, we can't take advantage of those benefits. It's like we're stuck in the past, and it's hard to see how we can compete with students from other schools when we don't have access to the same tools." S₁

Poor Digital Literacy

Digital literacy in Tanzania is a crucial concern that profoundly influences the acceptance and successful utilization of digital technology in education. As per the National Digital Education Strategy (2024-2030). When educators lack the proficiency to successfully employ digital tools and resources, they cannot develop compelling and dynamic learning experiences for their students. This may result in antiquated pedagogical approaches, restricted access to varied educational resources, and insufficient opportunity for students to cultivate vital 21st-century competencies, including critical thinking, problem-solving, and

creativity via technology. Moreover, when students lack digital literacy abilities, they encounter difficulties in navigating the digital landscape, accessing information efficiently, and engaging in online communication and collaboration. This may lead to academic challenges, restricted professional prospects, and an incapacity to engage fully in a progressively digital world.

Inadequate Internet Connectivity

Nyakito et al., (2021) demonstrated that inadequate Internet access in schooling has significant repercussions. It inhibits students from accessing digital resources, participating in online classes, and engaging in collaborative learning activities. The disparity is particularly pronounced among students from disadvantaged backgrounds and isolated areas, which frequently lack adequate network connectivity. Without reliable Internet access, pupils are deprived of educational opportunities, leading to an inequitable distribution of information and skills in the contemporary digital landscape. Educators have challenges in effectively delivering course content and assessing student achievement. Internet connectivity emerged as a significant obstacle.

The study reveals that numerous schools in the Handeni district encounter sluggish or inconsistent internet connectivity, impeding the efficient utilization of online resources and applications. The lack of reliable internet access hinders teachers and students from effectively utilizing educational platforms and collaborative technologies.

"It's truly disappointing to witness the available potential of online learning tools because of inconsistent Internet access. There are fantastic educational platforms available that could significantly improve our teaching approaches, yet without dependable connectivity, it's akin to having a library devoid of books. Consequently, we're compelled to depend on conventional methods, which, although effective, lack the

same degree of involvement and dynamic interaction." T₂

Moreover, another respondent added,

"I worry about the students falling behind because they can't access the same resources as their peers. In a district like Handeni, where many families struggle financially, it's not feasible for them to afford better Internet services. This puts our students at a disadvantage compared to those in more connected areas, and it's our responsibility to ensure every child has an equal chance to succeed."

Moreover, research findings reveal that numerous schools lack the requisite infrastructure to ensure dependable internet connectivity. This encompasses obsolete network apparatus, inadequate bandwidth, and subpar network coverage. In many instances, schools may lack access to fundamental internet services owing to inadequate communications infrastructure in the region. Additionally, technical issues such as signal interference, network congestion, and equipment failures contribute to insufficient internet connectivity. In certain instances, internet service providers (ISPs) may be unable to provide dependable services to remote or rural regions.

Infrequent Integration of Technology in Classrooms

Despite the prospective advantages of digital technology, its application in educational settings remained sporadic. Educators said that they utilize digital tools sporadically, mainly for administrative purposes rather than for improving instruction and learning outcomes. The absence of digital gadgets and inconsistent internet connectivity led to this sporadic usage. Educators exhibit the most confidence in their digital proficiency regarding safety, communication, teamwork, and information and data literacy. They have diminished confidence in intricate skills such as coding. Male educators typically experience greater satisfaction in coding

and programming compared to their female counterparts. The findings revealed that most secondary school teachers in Handeni District exhibited limited proficiency in incorporating ICT into their teaching practices, attributed to several issues such as insufficient ICT resources, inadequate computer laboratories, and a deficiency in comprehensive pre-service and in-service training for educators.

Moreover, the UNESCO ICT Competency Framework for Teachers (UNESCO, 2011) delineates fundamental attributes of professional educators as: (1) the capacity to study through ICT, (2) the capability to address intricate real-world challenges utilizing ICT, and (3) the proficiency to generate new knowledge via ICT. During the interviews, researchers noted that teachers lack the competence to incorporate contemporary technology into their pedagogical approaches, presenting a substantial barrier to the implementation of modern technology in secondary education within the Handeni region. This corresponds with Betrina Mkude, (2023) study, which indicated that most teachers are unable to properly integrate current technologies into teaching and learning.

Through a focus group discussion, respondent noted,

"Our chances to practice and investigate ICT integration are further limited by the inadequacy of the computer labs. There isn't enough room or technology for pupils to utilize innovative digital teaching methods, even if I were to implement them. Without sufficient exposure to digital devices and software in a regulated and instructional setting, it is unrealistic to expect students to develop tech-savvy learning skills." T₅

Furthermore, the finding revealed insufficient pre-service training is one key issue. Teacher education programs may not adequately prepare future educators to use digital tools effectively in the

classroom. As a result, new teachers enter the profession without a solid foundation in ICT - integrated teaching methods. For instance, they may be unfamiliar with how to use learning management systems to track student progress or how to incorporate multimedia elements into their lessons to cater to different learning styles.

Quinlan, (2000) indicates insufficient in-service training also contributes to the infrequent use of technological tools in the classroom. Upon entering the workforce, teachers may lack access to continuous professional development opportunities centred on digital technologies. The swift advancement of technology necessitates ongoing training for educators to remain informed on the most recent tools and pedagogical methods. Without such training, they may feel overloaded and uncertain about integrating new digital technologies into their teaching methodologies.

Eliminating the Limitations of Digital Technology Adaptation in Handeni District

Comprehensive Teachers' Training

The study finds that incorporating digital literacy into education is vital for providing students with the necessary digital competencies required in the contemporary digital environment. Digital literacy programs must be included in the formal education system from an early age to guarantee that students attain proficiency in utilizing technology successfully. Comprehensive teacher training programs can effectively mitigate the challenges of digital technology adaptation in Handeni District, Tanzania, by providing educators with the essential skills and knowledge to integrate digital tools into their teaching practices, thereby enhancing their confidence in digital competence. This was disclosed during a focus group discussion in which a participant asserted that.

"I acknowledge that my proficiency in using ICT in my teaching is insufficient. I recognize numerous methods to utilize digital tools for

improving learning; yet, I lack the appropriate knowledge and experience to implement them effectively. I am not familiar with educational software that facilitates formative evaluations or individualized learning. I desire more extensive training to enhance my proficiency in this domain." T₃

Moreover, teachers frequently experience difficulties in utilizing digital technology because of insufficient competency. Thorough training equips educators with practical experience and an extensive understanding of many digital tools and platforms, allowing them to seamlessly integrate these technologies into their instruction. Successful incorporation of digital technology necessitates not only technical expertise but also comprehension of how to utilize these tools to augment learning. Training programs may concentrate on enhancing pedagogical skills, including the creation of compelling lesson plans that utilize digital resources and the application of various teaching strategies to accommodate multiple learning styles.

Physical Infrastructure Improvement

Study results indicate upgrading the physical digital technology infrastructure is essential for advancing the integration of digital solutions within the educational sector, particularly in developing areas such as the Handeni District in Tanzania. Improvements can be made in several crucial areas, including the Computer Lab, digital technology devices, connectivity, and energy distribution. Computer laboratories can facilitate training sessions and workshops aimed at enhancing digital literacy. This encompasses fundamental computer competencies, internet navigation, and advanced proficiencies such as programming and data analysis.

Moreover, enhancing internet quality for the adaptation of digital technology in the educational process at Handeni secondary schools in Tanzania presents a complex challenge necessitating collaborative efforts from many stakeholders. The

Tanzanian government should prioritize investments in broadband infrastructure to enhance network coverage in rural and underserved regions. This encompasses collaborations with telecommunications firms to implement sophisticated technology, like 4G and fibre optic networks, facilitating swifter and more dependable internet connections.

Address Affordability and Accessibility

The study indicates that numerous schools face difficulties with internet access, thus it is beneficial for the government to recognize the necessity of issuing guidelines to mobile phone companies to lower bundle costs and establish conditions for users, enabling affordability for parents and teachers, which will facilitate the teaching and learning process. Although the government has endeavoured to provide electricity to primary and secondary schools nationwide, it is imperative to also prioritize the provision of adequate digital devices, including computers, tablets, and smartphones, to all educational institutions, enabling technology to be taught practically rather than merely theoretically.

“One way to revitalize the use of technology in teaching and learning is for teachers to be sure of the bundle, the government should connect the internet to every school to simplify this because mobile companies are offering unsatisfactory packages with conditions, I pay a huge amount of money for a bundle and am I subject to conditions that I have to use before a certain time? Here too, the government should look, at whether the bundles come down in price and the conditions are removed, it will help teachers in preparing for teaching as well as simplifying the assessment process” W₁.

Moreover, the expansion of network coverage in Tanzania is a complex endeavour designed to improve connectivity, foster digital inclusion, and stimulate economic growth. Tanzania has had a significant increase in internet subscriptions, rising

from 23.1 million in 2019 to 86.8 million in 2024, representing a 275% gain. Furthermore, mobile internet is regarded as the principal mode of access, with 47.9 million subscriptions recorded as of December 2024. This is corroborated by the implementation of 4G (88% coverage) and the nascent 5G (20% coverage) technology. Nonetheless, numerous urban and rural regions continue to have internet difficulties, which persist as a barrier to digital technology integration in the educational process.

Strengthen Collaboration with Other Education Stakeholders

To overcome the obstacles associated with technology in education, it is essential to engage stakeholders from many sectors, including TANESCO, telecommunications firms, and IT specialists, to collaboratively address pertinent issues. TANESCO can facilitate electricity availability by executing initiatives like as the 320MW Somanga Fungu Gas Fired Power Project, which will substantially augment generation capacity in the national system and address anticipated power demand. Telecommunications firms like Vodacom and Airtel can facilitate Internet access by broadening their network coverage and delivering dependable connectivity to educational institutions in the Handeni District. IT specialists can oversee the technical facets of IT equipment, encompassing maintenance, and troubleshooting, to guarantee that digital devices remain functional and prepared for use. Through collaboration with these partners, Handeni District can foster a conducive climate for the integration of digital technology in secondary schools, ultimately enhancing educational outcomes and promoting broader digital inclusion. A participant in the focus group discussion emphasized that,

“I appreciate the efforts being made to involve various sectors in improving our educational infrastructure. Reliable electricity and internet connectivity are crucial for the effective use of technology in teaching and learning. This

*collaboration will not only benefit our current students but also future generations by providing them with the digital skills they need to succeed."*H₁

DISCUSSION

The integration of digital technology in education is a worldwide occurrence that has experienced diverse degrees of success and obstacles throughout various locations. In industrialized nations, the integration of ICT in education has been more prevalent and efficacious owing to superior infrastructure, resources, and support systems. Arruda et al., (2024) highlighted the use of information and communication technologies in secondary school is becoming more common throughout European countries, while there are still large gaps. High rates of information and communication technology adoption have been attained by nations such as Denmark and the Netherlands as a result of extensive training programs and strong infrastructure.

The United Kingdom and Germany, on the other hand, have challenges with high expenses, inconsistent levels of teacher preparation, and geographical disparities. So that every student receives the life-changing benefits of digital technology in the classroom, legislators, educators, and stakeholders must work together to overcome these obstacles. Nevertheless part of the administrative agreement known as "DigitalPakt Schule," a program that aims to elevate the federal government. By providing states with a total of 5 billion euros in funding, this federal project aims to encourage the digital transformation of the educational system by creating and growing digital education infrastructures (Wohlfart O, 2022).

In contrast, developing countries such as Tanzania encounter significant challenges in the integration of digital technology into education. The Handeni District, as emphasized in the paper, illustrates the difficulties faced in other rural regions of Tanzania. The issues encompass limited internet access, a

deficiency of digital gadgets, and insufficient teacher preparation. The student-to-computer ratio is too elevated, and in many instances, schools possess no computers at all. The restricted access to digital devices significantly hinders the incorporation of digital technology into educational practices. Moreover, inadequate digital literacy among educators and learners hinders the effective utilization of digital resources in education. Furthermore, in China, the impact of ICT on education is twofold, augmenting both information awareness and ethical comprehension from a cultural perspective, while facilitating skill development within and outside the classroom from a technological perspective. Wang, X., & Li, (2024) indicate secondary schools in China have benefited from significant investments made by China in the improvement of their digital infrastructure. Computers, tablets, and high-speed internet access are all included in this provision for educational institutions. For the purpose of facilitating learning and instruction, the government has also placed a high priority on the creation of e-learning platforms and digital educational resources. Despite the fact that these initiatives have resulted in a broader adoption of information and communication technology (ICT) in education, barriers such as the digital gap between urban and rural areas continue to exist.

On the counterpart, African countries, such as Uganda, Kenya, and Nigeria, encounter considerable obstacles to the incorporation of ICT in education. A primary issue is the scarcity of proficient ICT teachers, which hinders the successful integration of technology into education. Infrastructural inadequacies, including inadequate internet connectivity and inconsistent electricity supply, pose further challenges. Schools in Nigeria frequently lack adequate teaching and learning resources, potentially hindering effective education. The lack of dependable power negatively impacts the operation of electronic equipment crucial for integrating ICT into the curriculum.

Notwithstanding these problems, initiatives are underway to enhance the situation. The Tanzanian government has made progress in developing and implementing ICT policies to improve the education sector. The National ICT Policy and the ICT Policy for Basic Education seek to promote the acquisition and effective use of ICT in education. Initiatives such as the Tanzania Secondary Education Quality Improvement Project (SEQUIP) have delivered ICT training to several secondary school educators, highlighting the incorporation of ICT into teaching methodologies.

In conclusion, although the incorporation of digital technology in education can revolutionize teaching and learning methodologies, considerable hurdles persist, especially in poor nations. Addressing these difficulties necessitates comprehensive initiatives, such as enhancing digital infrastructure, offering ongoing training and support for instructors, and promoting collaboration among diverse stakeholders. By surmounting these challenges, nations can guarantee that pupils possess the digital competencies essential for the contemporary landscape.

RECOMMENDATIONS

Based on the Handeni District research, several solutions might be proposed to overcome the barriers to digital technology adoption in public secondary schools. We must first create significant teacher training programs to increase our nation's educators' technological and pedagogical skills. The main purpose of these programs should be to teach teachers how to use technology effectively. By using technology in the classroom, teachers can engage students and make learning more dynamic. To learn about and implement the latest education and technology advancements, teachers need constant professional development.

To integrate technology, schools must enhance their physical infrastructure. This includes modernizing computer labs, ensuring internet connection, and providing enough PCs and tablets. The government

should prioritize broadband infrastructure to improve network coverage in rural and underdeveloped areas. Telecom alliances to develop 4G and fibre optic networks can boost internet speeds and dependability. Schools should have backup power systems due to frequent power outages.

The third challenge is to make digital devices and internet services more affordable and accessible. The government and cell phone carriers should cut internet bundle prices and remove usage limits. This would lower student and teacher online resource costs. School digital device subsidies can help close the digital gap. Making sure every school has enough computers lets students use digital materials in class.

Fourth, education stakeholders must work together to remove digital technology adoption barriers. Technical support, internet connection, and electricity availability can be addressed by TANESCO, telecommunications providers, and IT specialists. TANESCO may increase power-producing capacity to ensure schools always have electricity. Telecom companies can expand their networks to give schools reliable access. IT professionals provide vital technical support and maintenance for digital devices.

Lastly, technology must be accepted by teachers and other stakeholders with a positive attitude to succeed. To reassure suspicious stakeholders, provide comprehensive support and training. Professional development programs should prioritize teachers' digital skills and confidence. If they work in an inclusive environment with professional development, resources, and support, teachers can appreciate technology in the classroom. By discussing digital benefits with parents and children, schools may foster a culture of technological integration. The Handeni District can overcome digital adoption in public secondary schools with these proposals, improving education and giving youngsters real-world IT skills.

CONCLUSION

This Digital technology research in Tanzanian public secondary schools in Handeni District identifies major difficulties and possible solutions. Limited availability of digital equipment, low digital literacy among teachers and students, inadequate internet connectivity, and infrequent classroom usage of digital tools hamper digital integration in Handeni schools. Poor pre-service and in-service teacher preparation, infrastructure, and resources exacerbate these issues.

Comprehensive teacher training programs to increase digital literacy, pedagogy, and digital tool confidence are essential. Better computer labs and internet connections are needed for technology integration. To preserve stable electrical and internet connectivity, TANESCO, telecommunications companies, and IT specialists must work together to make digital gadgets and internet services inexpensive and accessible. To tackle these challenges, the research recommends early digital literacy, extensive teacher training, infrastructural changes, and affordable and accessible digital tools. Handeni District can fix these issues to improve education and teach students digital skills. This will enhance learning outcomes and give kids modern-day digital capabilities.

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