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Teachers' ICT Skills and the Integration of Digital Technologies in Teaching and Learning in Tanzanian Secondary Schools

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Abstract

In today's knowledge-based and digitally driven global economy, information and communication technology (ICT) competence is essential for effective teaching and learning. However, in developing contexts, digital transformation in education remains uneven due to structural and institutional barriers. Despite Tanzania's ICT policies, the classroom integration of digital technologies in public secondary schools remains inconsistent, particularly in rural and semi-urban areas. This study examined teachers' ICT skills and the integration of digital technologies in Tanzanian secondary schools. Guided by the technological pedagogical content knowledge (TPACK) framework and constructivist learning theory, the study adopted a qualitative descriptive design. Purposive sampling was used to select sixteen (16) secondary schools, and 128 subject teachers, 32 school leaders, and 6 ward education officers were selected as participants based on their experience using ICT. Data were collected through semi-structured interviews, focus group discussions, and classroom observations, and were analysed thematically. Findings revealed that teachers had basic ICT competencies but rarely applied them in instruction, with limited use of educational software and constraints from inadequate ICT infrastructure. ICT use was largely administrative, while classroom integration remained minimal. The study recommends strengthening ICT infrastructure, enhancing continuous professional development, and promoting pedagogically meaningful use of digital technologies in teaching and learning.

1.0 Introduction

In the 21st century, information and communication technology (ICT) has become a critical component of education worldwide (Ignjatović, 2024). ICT integration in teaching and learning expands access to diverse educational resources, promotes interactive learning, strengthens

students' critical thinking, and prepares learners for participation in a knowledge-based economy (Shah, 2022; Mare et al., 2022). Countries that have effectively incorporated ICT in schools report improvements in teacher effectiveness, student outcomes and overall school performance (Zou et al., 2024; Mwangi & Omwenga, 2020). Research consistently shows that teachers' digital competence is a key determinant of successful ICT integration in classrooms, often outweighing infrastructure availability (Xu Qing & Guo Jing, 2024; Mpumuje, 2024).

In Africa, secondary and technical education institutions are increasingly recognizing the role of ICT in producing competitive, skilled graduates capable of meeting the demands of the digital economy (Mpumuje, 2024). Integrating ICT into teaching and learning improves instructional efficiency, fosters independent learning, and motivates both teachers and students (Habibu, 2020; Ignjatović, 2024). In particular, Technical and Vocational Education and Training (TVET) institutions serve as crucial platforms for equipping learners with skills relevant to the modern labor market, making ICT integration essential for quality education outcomes.

In Tanzania, the government has introduced policies and initiatives to promote ICT in education, including the National ICT Policy (2003) and the ICT Competency Framework for Teachers (ICT-CFT) by UNESCO (2008,2011, 2018,2022-2023), which emphasize developing teachers' digital literacy to enhance teaching and learning (UNESCO,2018; Joseph, 2021; Mmari, 2025). Additional programs, such as the e-Schools Project and the introduction of ICT curricula in secondary schools, aim to strengthen ICT adoption (Mmari, 2025). Despite these efforts, many schools face challenges, including inadequate infrastructure, limited internet connectivity and insufficient teacher skills (Bitegeko et al., 2024; Mmari, 2025). Teachers often have only basic competencies in widely available tools such as Microsoft Word, PowerPoint, and Excel, limiting the potential benefits of ICT in lesson preparation, teaching, and assessment (Peter, 2022; Mmari, 2025).

At the local level, districts in the Kilimanjaro Region face additional challenges that constrain the effective integration of ICT in education. Limited access to ICT devices, unreliable electricity supply, and inadequate training opportunities impede teachers' ability to incorporate digital technologies into classroom instruction meaningfully. As a result, students in these districts may be disadvantaged in acquiring the ICT competencies essential for participation in the knowledge-based economy envisioned in Tanzania's Vision 2025 and Tanzania's Vision 2050 (Policy Forum, 2025).

Aligned with the aspirations of Tanzania's Vision 2025 and Vision 2050, ICT integration in education aims to develop a digitally competent workforce. This objective underscores the need to ensure equitable access to ICT infrastructure, strengthen teachers' digital pedagogical skills and promote the effective use of technology in teaching and learning. Ultimately, it emphasizes enhancing digital literacy, encouraging innovation and equipping learners with the technological capabilities required for a knowledge-driven and globally competitive economy.

Given the critical role of teachers' ICT skills in effective technology integration, it is essential to assess teachers' ICT competence and examine how they apply these skills in teaching and learning in secondary schools in Kilimanjaro Region. Such an assessment is vital for identifying gaps, informing policy, and designing targeted interventions to improve ICT adoption and educational outcomes.

Despite national policies and programs promoting ICT integration, secondary schools in Tanzania, particularly in districts of the Kilimanjaro Region, continue to experience challenges in adopting digital technologies effectively. While government initiatives provide an important foundation for ICT use in education, many teachers lack the advanced digital competencies required to meaningfully integrate technology into teaching and learning processes (Mmari, 2025). Evidence suggests that ICT infrastructure alone is insufficient; teacher competence remains the most decisive factor influencing successful ICT adoption (Mwangi & Omwenga, 2020; Zou et al., 2024).

Empirical studies in Tanzania indicate that although teachers are generally aware of ICT policies, they integrate digital technologies into classroom pedagogy inconsistently (Bitegeko et al., 2024). Multiple barriers persist, including limited access to ICT devices, inadequate teacher digital competence, unreliable internet connectivity, and insufficient opportunities for continuous professional development (Mpumuje, 2024; Xu & Guo, 2024). Furthermore, district-level studies examining teachers' ICT skills and classroom technology integration remain scarce, creating a contextual knowledge gap regarding localized challenges and opportunities (Mare et al., 2022).

This situation not only limits effective classroom innovation but also constrains secondary schools' capacity to prepare students with the digital competencies required in an increasingly knowledge-based and technology-driven global economy. Education systems play a critical role in developing human capital that can participate in competitive labor markets, foster innovation, and support entrepreneurship. However, when ICT integration remains weak, students risk graduating without essential digital literacy, problem-solving abilities and technological adaptability. Such limitations undermine national aspirations articulated in Tanzania's Development Vision 2025 and Tanzania's Vision 2050, which emphasize the transformation toward a semi-industrialized and digitally empowered economy (URT, 1999, 2023).

Therefore, this study examines teachers' ICT skills and the integration of digital technologies in Tanzanian secondary schools, with particular focus on teachers' ICT competence and the extent to which digital technologies are integrated into teaching and learning processes. In order to guide the study and ensure alignment with its objectives, the following research questions were formulated to explore teachers' ICT competence and its application in instructional practice within public secondary schools:

(i) How do teachers in Tanzanian secondary schools perceive their ICT skills?
(ii) How do teachers demonstrate their ICT skills in instructional practice?

(iii) How are digital technologies integrated into teaching and learning processes in Tanzanian secondary schools?

2.0 Review of Literature

2.1 Theoretical Literature Review

Information and Communication Technology (ICT) has become a central component of modern education, enabling interactive teaching, expanded access to global knowledge, and preparing learners for participation in knowledge-based and digitally driven economies (UNESCO, 2022). However, successfully integrating ICT into classroom practice goes beyond simply having technological devices or software. Effective integration requires teachers to have not only technical competence but also pedagogical expertise (Rakisheva & Witt, 2023) that enables them to embed technology meaningfully in instructional processes.

In this context, the Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), provides a robust theoretical lens for examining ICT integration in education. The TPACK framework conceptualizes effective technology integration as the dynamic interaction of three core domains of teacher knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). According to Mishra and Koehler (2006), meaningful ICT integration occurs when teachers synthesize these domains to design and deliver instruction that enhances student learning outcomes.

The framework emphasizes that technology should not be treated as an isolated skill but as an integral part of pedagogy and subject-matter instruction. For example, a science teacher demonstrates effective TPACK when using digital simulations or virtual laboratories (TK) to explain scientific concepts (CK) through learner-centered instructional strategies (PK) that foster inquiry, interaction, and critical thinking. Thus, TPACK highlights the importance of teachers' ability to align technology with both curricular content and pedagogical approaches.

Complementing the TPACK framework, this study is further informed by Constructivist Learning Theory, primarily associated with the works of Jean Piaget (1952) and Lev Vygotsky (1978) (Schunk, 2020). According to Schunk, constructivism posits that learning is an active, student-centered process in which learners construct knowledge through interaction, experience, inquiry, collaboration, and reflection. Rather than passively receiving information, learners engage in meaningful activities that promote deeper understanding and cognitive development.

Integrating ICT into teaching and learning aligns closely with constructivist principles. Digital technologies provide opportunities for active engagement through simulations, multimedia resources, virtual experiments, collaborative platforms, and access to diverse information sources. These tools enable learners to explore concepts, solve problems, collaborate with peers, and develop critical thinking skills. From a constructivist perspective, ICT serves as a mediational tool that enhances learner-centered pedagogy by fostering participation, interaction and knowledge construction.

Within the Tanzanian education context, national policies such as the National ICT Policy (2003) and the ICT Competency Framework for Teachers (ICT-CFT) underscore the importance of developing teachers' digital competencies to enhance teaching and learning (Mpumuje, 2024; Bitegeko et al., 2024). These policy initiatives recognize teachers as central agents in successfully adopting and integrating ICT in schools. Despite these efforts, empirical studies indicate that ICT integration in Tanzanian secondary schools remains constrained by limited teacher digital competence, inadequate infrastructure, unreliable internet connectivity, and a persistent gap between policy directives and classroom realities (Peter, 2022; Mmari, 2025; Mwangi & Omwenga, 2020).

Given these challenges, the combined application of the TPACK framework and Constructivist Learning Theory is particularly relevant to this study. While TPACK provides a structured approach for analyzing how teachers integrate technological knowledge with pedagogical strategies and subject content, Constructivist Learning Theory offers a pedagogical foundation for understanding how ICT integration enhances learner-centered teaching and supports active knowledge construction. Specifically, these theoretical perspectives support an examination of how teachers in public secondary schools in the Kilimanjaro Region combine technology, pedagogy, and content knowledge to facilitate interactive, learner-centered teaching and learning. By applying these frameworks, this study seeks to identify competence gaps, instructional practices, and contextual barriers influencing ICT integration at the classroom level.

2.2 Empirical Literature Review

2.2.1 Teachers' ICT Skills and Competence

Teachers' ICT skills are widely recognized as critical determinants of effective ICT integration in classroom practice. Empirical studies in Tanzania indicate that many teachers have basic digital literacy skills, including proficiency in Microsoft Word and moderate competence in PowerPoint, but show limited capability in Excel and other advanced applications (Peter, 2022; Bitegeko et al., 2024). These competencies are essential for lesson preparation, assessment design, classroom data management, and enhancing instructional delivery. Research further suggests that teachers with higher levels of ICT competence are more likely to integrate technology frequently and meaningfully into their teaching practices (Xu Qing & Guo Jing, 2024; Zou et al., 2024).

However, ICT competence varies across school types. Evidence shows that teachers in private schools often exhibit stronger ICT skills compared to their counterparts in public schools, largely due to better access to technological resources, more reliable infrastructure, and greater professional development opportunities (Mwangi & Omwenga, 2020; Peter, 2022; Xu Qing & Guo Jing, 2024). This imbalance contributes to unequal technology integration experiences among students.

2.2.2 Pedagogical Integration of ICT in Teaching and Learning

Beyond foundational ICT skills, the pedagogical integration of technology plays a crucial role in improving student engagement and learning outcomes (Dzidzornu & Xu, 2025). ICT integration

involves using multimedia tools, simulations, computer-aided design (CAD) software, online educational resources, and interactive presentations to support learning (Ignjatović, 2024; Dzidzornu & Xu, 2025). Studies demonstrate that when technology is effectively integrated, it enhances students' understanding of complex concepts, promotes independent and active learning, improves lesson planning and assessment practices, and increases learner motivation, particularly in science and technical subjects (Mare et al., 2022).

2.2.3 ICT Integration in Secondary Education Context

Secondary education is a strategically critical stage within the education system, serving as the gateway to higher education, Technical and Vocational Education and Training (TVET), and entry into an increasingly digitalized labour market. At this level, learners must engage with complex, abstract, and specialized subject content that demands higher-order thinking, problem-solving, and independent learning competencies, all of which can be significantly enhanced through the effective integration of digital technologies. Furthermore, secondary schools play a decisive role in shaping students' digital literacy and technological adaptability, competencies that are essential for participation in knowledge-based economies. However, despite this strategic importance, ICT integration in Tanzanian secondary schools remains constrained by persistent structural and pedagogical barriers, including limited access to digital devices, unreliable internet connectivity, inadequate infrastructure, and insufficient teacher competence in applying ICT pedagogically (Peter, 2022; Mmari, 2025). Even when teachers understand ICT policies and the potential benefits of educational technologies, many struggle to translate this knowledge into effective classroom practice, revealing a significant policy-practice gap.

2.2.4 ICT and National Development Goals

ICT's role in achieving national development goals further underscores its importance in education. Tanzania's Development Vision 2025 and Vision 2050 emphasize the need for a competitive workforce equipped with the knowledge, creativity, and digital competencies needed to participate in a knowledge-based, technology-driven economy (URT, 1999, 2023). Technical and Vocational Education and Training (TVET) institutions are particularly central to this agenda, as they prepare learners with practical skills aligned with evolving labor market demands. Integrating ICT within these institutions enhances instructional effectiveness and improves graduate employability (Kimboka & Mhina, 2026).

2.2.5 Research Gaps in ICT Integration in Teaching and Learning

Nevertheless, empirical literature shows limited attention to ICT integration in secondary schools, especially at regional and district levels. In regions such as Kilimanjaro, studies examining teachers' ICT competence and classroom technology integration remain scarce, creating a contextual and geographical knowledge gap.

The reviewed empirical literature reveals several gaps. First, a contextual gap is evident, as much of the existing research provides generalized accounts of ICT use while offering limited insights into localized practices within specific district contexts. Second, a skills and pedagogical gap

persists, with prior studies largely emphasizing basic ICT literacy while paying insufficient attention to how teachers integrate technology into pedagogy through frameworks such as TPACK. Third, a policy-practice gap remains, whereby teachers may demonstrate awareness of ICT policies yet struggle to translate this knowledge into effective classroom implementation. While these gaps are interrelated, this study focuses primarily on the pedagogical integration gap, particularly the disconnect between teachers' ICT competence and their ability to apply digital technologies meaningfully in teaching and learning. Addressing this gap will provide critical insights into how teachers enact technological knowledge in classroom practice in public secondary schools in the Kilimanjaro Region and contribute to contextually grounded strategies for strengthening technology-driven pedagogy.

3.0 Methodology

This study used a qualitative research approach to gain an in-depth understanding of teachers' ICT skills, experiences, and classroom practices related to integrating digital technologies in teaching and learning. The qualitative approach was appropriate because the study explored participants' experiences, interpretations, and meanings associated with ICT use within their natural school contexts, rather than quantifying variables or testing predetermined relationships.

The study used a descriptive qualitative research design, which is suitable for providing a comprehensive, contextually grounded account of phenomena as experienced by participants (Ishtiaq, 2019; Etikan, 2016). This design enabled the researcher to describe how teachers understand and enact ICT use in instructional practices, as well as how school contexts shape these practices.

The design was particularly appropriate for capturing detailed accounts of everyday classroom realities and generating a nuanced understanding of ICT integration in public secondary schools, which quantitative approaches may not adequately reveal.

Data were collected using multiple qualitative methods to enhance the depth, richness and credibility of the findings through methodological triangulation (Creswell, 2014). Specifically, the study employed semi-structured interviews, focus group discussions and non-participant classroom observations.

The study conducted semi-structured interviews with key educational leaders, including heads of schools, academic masters/mistresses, and ward education officers (WEOs). The study selected these participants because of their central roles in school management, policy implementation, and supervision of instructional practices. The semi-structured interview format allowed flexibility for probing and clarification while ensuring systematic coverage of key issues such as ICT policy implementation, institutional support mechanisms, leadership practices and challenges affecting ICT integration. This method was appropriate for eliciting in-depth insights from participants with administrative and supervisory responsibilities (Creswell, 2014).

Focus Group Discussions (FGDs) were conducted with subject teachers to explore their shared experiences, perceptions, and classroom practices related to ICT integration. FGDs were considered suitable because they facilitate interaction among participants, allowing them to reflect on and build on each other's views and generate rich, nuanced data (Etikan et al., 2016). This method enabled the study to capture collective perspectives on ICT use, professional experiences, and contextual challenges within the school environment.

In addition, non-participant classroom observations examined the natural teaching and learning environment and documented actual ICT use in instructional practices. Observation was essential for verifying self-reported data from interviews and FGDs and for capturing real-time classroom dynamics, teacher-student interactions, and the availability and use of ICT resources. Observation provided direct evidence of classroom practices, thereby strengthening the validity of the findings through data triangulation (Ishtiaq, 2019). Together, these methods provided a comprehensive understanding of ICT integration by capturing perspectives from both instructional and administrative levels while grounding the findings in observed classroom realities.

The study was conducted in Same District, which was purposively selected as a context that reflects prevailing conditions under which ICT integration is implemented in Tanzanian secondary schools. The district represents a rural semi-urban educational setting characterized by constraints related to ICT infrastructure, access to digital devices, electricity reliability, internet connectivity and limited opportunities for teacher professional development. These conditions are not unique to Same District but are commonly observed across many districts with similar socio-economic and educational characteristics in Tanzania. As such, the district provided an appropriate and information-rich setting for examining teachers' ICT skills and their application in instructional practice. While the study does not seek statistical generalization, the findings may offer analytically transferable insights to other contexts facing comparable structural and institutional constraints. The study involved participants who were directly engaged in teaching and educational leadership within public secondary schools. These included subject teachers, heads of schools, academic masters/mistresses and Ward Education Officers (WEOs). These groups were selected because they occupy central roles in the adoption, implementation, leadership, and supervision of ICT-related practices at both classroom and administrative levels. Teachers provided insights into instructional practices, ICT competence and classroom experiences. At the same time, school leaders and Ward Education Officers contributed perspectives on institutional support, leadership strategies, policy implementation and systemic challenges influencing ICT integration.

The study employed purposive sampling to select participants with relevant knowledge and experience in ICT use in education. The study purposively selected sixteen (16) public secondary schools to capture variation in geographical location, ICT resource availability, and infrastructure conditions. From each selected school, the study included ten (10) respondents: 8 subject teachers and 2 school leaders (1 head of school and 1 academic master/mistress). In addition, six Ward Education Officers were purposively selected as key informants to provide administrative- and

policy-level perspectives on ICT integration across schools. This resulted in a total sample of 166 respondents, which was considered adequate for generating qualitative insights (Creswell, 2014). Participant selection continued until data saturation was achieved, whereby additional interviews yielded no substantially new themes.

The sample size was not predetermined by numerical requirements but was guided by data saturation, with data collection continuing until no substantially new themes emerged (Creswell, 2014). The selected participants were considered information-rich cases capable of providing in-depth insights into teachers' ICT skills and the integration of digital technologies in teaching and learning.

Data were analyzed thematically following Braun and Clarke's (2006) framework (Ishtiaq, 2019). The analysis process involved careful organization and preparation of the data, including transcribing interview and focus group discussion recordings and organizing field notes from classroom observations. This was followed by repeated data familiarization, systematic coding, pattern identification, category development, and theme generation.

This rigorous analytical procedure enabled the interpretation of participants' narratives, interactions, and observed classroom practices while ensuring methodological transparency and analytical depth. The team continuously reviewed, compared, and refined emerging themes to ensure they accurately represented participants' perspectives and contextual realities across all data sources (Creswell, 2014).

The study followed ethical guidelines throughout. Relevant authorities granted ethical clearance, and participants were informed of the study's purpose, voluntary participation, confidentiality, and their right to withdraw at any stage. The study secured informed consent before data collection and maintained anonymity through pseudonyms and coded identifiers.

4.0 Results and Discussion

4.1 Teachers' ICT Skills in Public Secondary Schools

Findings indicate uneven levels of ICT competence among teachers, reflected in both self-reported abilities and observed classroom practices. Teachers generally reported confidence in using basic computer applications such as word processing, spreadsheets, and presentation software. However, classroom observations and discussions showed that this competence was largely confined to document preparation and administrative tasks rather than instructional use. Familiarity with more advanced or pedagogically oriented digital tools was limited, and their application in teaching and learning processes was rarely observed. This study aligns with Peter (2022) and Bitegeko et al. (2024), who argued that teachers in similar contexts possess basic ICT literacy but demonstrate limited classroom application of these skills.

Teachers consistently reported minimal engagement with educational software, multimedia tools, and simulations. Participants attributed this limitation not to lack of interest, but to structural constraints, particularly inadequate ICT infrastructure, unreliable electricity supply, and restricted

access to functional computer facilities. In several schools, computers were either unavailable, non-operational, or reserved primarily for administrative purposes. As a result, teachers' opportunities to practice and expand their digital competencies remained constrained. This finding aligns with Mmari (2025), who emphasized that infrastructural challenges significantly limit teachers' ability to use ICT effectively in instructional settings.

Interestingly, although teachers expressed confidence in basic ICT applications, classroom observations revealed a persistent reliance on handwritten lesson notes and traditional chalk-and-talk instructional approaches. Even teachers who acknowledged prior training in PowerPoint and other applications rarely integrated these tools into daily teaching practices. This discrepancy suggests that technical skills do not automatically translate into pedagogical use (Ignjatović, 2024), and it further supports Xu Qing & Guo Jing (2024) and Zou et al. (2024) that competence alone does not guarantee meaningful classroom integration of ICT.

Interview data further revealed that most teachers acquired their ICT skills during pre-service training at colleges or universities. However, participants emphasized that such training often focused on general computer literacy rather than subject-specific pedagogical integration. Participants described in-service professional development opportunities as infrequent and typically oriented toward administrative functions, such as record-keeping and reporting, rather than instructional innovation. This study aligns with Mwangi & Omwenga (2020) and Peter (2022), who noted that limited and poorly targeted professional development contributes to gaps in teachers' ability to apply ICT in pedagogically meaningful ways.

From a TPACK perspective, these findings suggest that teachers' technological knowledge (TK) remains largely foundational and insufficiently integrated with pedagogical knowledge (PK) and content knowledge (CK). Teachers' experiences illustrate that technological competence without pedagogical alignment limits the transformative potential of ICT in teaching and learning (Mpumuje, 2024). In other words, teachers may know how to use certain tools but lack clarity on how to teach with them, a concern echoed in Dzidzornu & Xu (2025) and Mare et al. (2022), who emphasize the importance of integrating technology with pedagogy and content.

These findings both align with and extend previous research. Consistent with earlier studies in Tanzanian secondary schools, teachers exhibited basic ICT literacy but limited classroom integration (Mtebe & Raisamo, 2014; Peter, 2022; Mmari, 2025). However, the present findings highlight a critical nuance: the challenge is not solely skill deficiency but the interplay between competence, infrastructure, and pedagogical application. Teachers' narratives suggest that even when technical skills are present, contextual barriers discourage experimentation and sustained ICT use, reinforcing the infrastructural concerns noted in prior empirical literature.

Furthermore, while some literature assumes that younger or formally educated teachers are more likely to integrate ICT (Ignjatović, 2024; Dzidzornu & Xu, 2025; Mmari, 2025), these findings complicate that assumption. Teachers across experience levels expressed similar constraints,

indicating that systemic factors may outweigh individual characteristics. This observation contributes to the growing body of evidence emphasizing that ICT integration challenges in developing contexts are predominantly institutional rather than purely individual. Therefore, the findings underscore that strengthening ICT integration requires moving beyond basic digital literacy toward pedagogically embedded technological competence, supported by reliable infrastructure, accessible resources, and continuous professional development.

4.2 Availability and Ownership of ICT Facilities in Schools

The findings revealed a pervasive absence of institutional ICT infrastructure across the sampled public secondary schools. None of the schools possessed functional computers designated for teaching and learning, and essential facilities such as computer laboratories, instructional laptops, or classroom-based digital devices were largely unavailable. This infrastructural deficit significantly constrained opportunities for technology-supported pedagogy. Although a small number of teachers reported owning personal computers, they used these devices mainly for personal or non-instructional tasks. Similarly, while some teachers owned smartphones or tablets, only a limited proportion indicated using them for lesson preparation or accessing educational resources. This study aligns with Peter (2022) and Mmari (2025), who reported that inadequate ICT infrastructure limits effective utilization of digital tools in instructional settings.

Access to ICT tools was reported to be comparatively higher among school leaders, particularly head teachers and academic officers, as well as Ward Education Officers. However, these technologies were primarily employed for administrative and managerial functions, including report preparation, record management, and official communication. The concentration of ICT use in administrative domains rather than instructional practices suggests that technology integration in schools remains operationally oriented rather than pedagogically driven. This finding aligns with Mwangi & Omwenga (2020) and Peter (2022), who similarly observed that ICT usage in many educational settings is often confined to administrative purposes rather than classroom teaching.

The findings further indicated that only a minority of respondents had participated in in-service ICT training. They described these training opportunities as short-term, typically lasting one to two days, and largely focused on administrative applications rather than classroom-oriented digital pedagogy. The limited duration and scope of these professional development initiatives restricted teachers' capacity to develop deeper competencies in integrating instructional technology. This study aligns with Zou et al. (2024), who emphasized that insufficient and poorly structured training limits effective ICT adoption, and it further supports observations by Bitegeko et al. (2024) and Xu Qing & Guo Jing (2024) about gaps in teachers' technological competence.

Despite government efforts to provide tablets to support teaching and learning, teachers used them minimally. Teachers reported using tablets mainly for personal communication, with some indicating that they rarely brought the devices to school. The study also noted device loss and underutilization. These findings underscore a critical disconnect between policy-level ICT

investments and classroom-level instructional practices. This study aligns with Mmari (2025) and Peter (2022), who similarly highlighted implementation gaps between ICT provision and actual classroom use.

This pattern shows that providing ICT devices alone cannot transform teaching and learning processes (Ishtiaq, 2019). Effective integration requires not only access to technology but also supportive institutional conditions, including pedagogically focused training, ongoing technical support, leadership encouragement, and accountability mechanisms. This study aligns with Dzidzornu & Xu (2025) and Mare et al. (2022), who argue that without enabling environments, ICT tools risk remaining underutilized and symbolic rather than functional instructional resources.

From a TPACK perspective, the absence of school-based ICT facilities undermines the development and enactment of Technological Pedagogical Knowledge (TPK) and Technological Content Knowledge (TCK) (Rakisheva & Witt, 2023). While teachers may possess foundational technological knowledge (TK), limited access to relevant tools restricts their ability to experiment with, adapt, and embed technology within pedagogical and disciplinary contexts (Iwu et al., 2013). This study aligns with Dzidzornu & Xu (2025), who emphasize that the interaction between technology, pedagogy, and content weakens when access to ICT resources is limited.

Viewed through the lens of Constructivist Learning Theory, limited ICT availability further constrains opportunities for learner-centered instructional approaches (Mare et al., 2022). Digital technologies can facilitate interactive, collaborative, and inquiry-based learning environments that support active knowledge construction (Joseph, 2021). However, the scarcity of technological resources reinforces reliance on traditional teacher-centered pedagogies, thereby limiting student engagement, exploration, and participatory learning experiences. This study aligns with Peter (2022), who similarly noted that the lack of ICT resources contributes to the continued dominance of teacher-centered approaches.

These findings resonate with prior studies conducted in Tanzanian secondary schools, which consistently identify inadequate ICT infrastructure as a persistent barrier to effective classroom technology integration (Mtebe & Raisamo, 2014; Peter, 2022). Similar trends have been documented across Sub-Saharan African contexts, where structural and resource limitations constrain pedagogical innovation despite policy commitments to digital transformation. This study aligns with Mwangi & Omwenga (2020), reinforcing the regional relevance of the findings.

Importantly, these findings extend the literature by showing that even when digital devices are supplied, instructional uptake depends on institutional culture, pedagogical preparedness, and sustained support systems. This suggests that ICT integration challenges are not solely technological but deeply organizational and pedagogical. This study aligns with Mmari (2025) and Dzidzornu & Xu (2025), who emphasize that effective ICT integration depends on the interplay between institutional readiness and pedagogical support structures.

4.3 Integration of ICT in Teaching and Learning Processes

The findings revealed that ICT integration in teaching and learning processes was minimal across the sampled public secondary schools. Teachers consistently described reliance on handwritten lesson preparation and traditional chalk-and-talk instructional approaches. Although a few teachers reported occasionally using smartphones to search for teaching materials or prepare lesson notes, these practices were largely confined to preparation and rarely extended into classroom instruction. This study aligns with Peter (2022) and Mmari (2025), who reported similarly limited pedagogical application of ICT among teachers.

Classroom observations corroborated these accounts, indicating an absence of ICT-supported pedagogical practices. There was little to no evidence of multimedia presentations, educational software, simulations, or internet-based resources being used during lessons. The consistency between teachers' narratives and observational data suggests that ICT integration was not simply limited but structurally constrained. This finding aligns with Mwangi & Omwenga (2020) and Bitegeko et al. (2024), who highlighted how infrastructural and resource limitations hinder effective ICT integration in educational settings.

Teachers attributed this pattern to several interrelated factors. Prominent among these were limited access to functional ICT tools, unreliable electricity and connectivity, and insufficient pedagogically oriented ICT training. Participants frequently emphasized that even with basic technological skills, the lack of supportive infrastructure and institutional support made classroom ICT integration impractical. This study aligns with Peter (2022) and Zou et al. (2024), who similarly identified infrastructural and training-related constraints as major barriers to ICT use in teaching.

From the perspective of the Technological Pedagogical Content Knowledge (TPACK) framework, the findings suggest that teachers' technological knowledge remained largely decontextualized from pedagogical practice. While some teachers demonstrated familiarity with basic ICT applications, this competence did not evolve into Technological Pedagogical Knowledge (TPK) or Technological Pedagogical Content Knowledge (TPACK) (Rakisheva & Witt, 2023). In practice, technology-related knowledge functioned as an isolated skill rather than as an integrated component of instructional design and delivery. This study aligns with Xu Qing & Guo Jing (2024) and Dzidzornu & Xu (2025), who emphasize the gap between technological familiarity and meaningful pedagogical integration.

Notably, the findings highlight a recurring paradox in ICT integration research: basic ICT competence does not necessarily translate into classroom application. This challenges assumptions that technological literacy alone is sufficient for pedagogical transformation. Instead, the results underscore the situated and systemic nature of ICT integration, where knowledge, beliefs, institutional support, and resource availability intersect. This study aligns with Dzidzornu & Xu (2025), reinforcing the argument that effective ICT integration depends on multiple interacting factors, not technical skills alone.

Viewed through the lens of Constructivist Learning Theory, the limited use of ICT technologies constrains opportunities for learner-centered pedagogical practices. Digital tools are widely recognized for their potential to facilitate interactive learning, collaboration, visualization of abstract concepts, and active student engagement (Ignjatović, 2024). However, the predominance of teacher-centered instructional strategies observed in this study suggests that classrooms remain largely transmissive, thereby restricting students' participation in inquiry-based and exploratory learning experiences. This study aligns with Bitegeko et al. (2024), who similarly reported limited learner-centered practices in contexts with low ICT integration.

These findings have substantial pedagogical implications. Minimal ICT integration may limit opportunities to enhance student engagement, diversify instructional strategies, foster critical thinking, and develop digital literacy competencies (Bitegeko et al., 2024). Consequently, learners may be inadequately prepared for participation in digitally mediated academic and professional environments. This finding aligns with Peter (2022) and Mmari (2025), who highlighted similar concerns about the educational consequences of limited ICT use.

These findings resonate with prior qualitative studies conducted in Tanzanian and comparable Sub-Saharan African contexts, which similarly report limited classroom ICT integration despite policy-level emphasis on digital transformation (Mwangi & Omwenga, 2020; Peter, 2022; Mmari, 2025). However, this study extends the literature by showing how infrastructural deficiencies, limited pedagogical training, and weak institutional cultures collectively shape teachers' instructional choices, deepening the contextual understanding of ICT integration challenges.

Overall, the findings reinforce the argument that meaningful ICT integration does not depend solely on teacher competence or awareness of technological benefits. Rather, sustainable pedagogical transformation requires coherent alignment among infrastructure, teacher professional development, leadership practices, and supportive institutional ecosystems (Xu Qing & Guo Jing, 2024). This study aligns with the broader empirical patterns established in the literature review, emphasizing that ICT integration is a multidimensional process requiring systemic support.

4.4 Administrative Use of ICT versus Pedagogical Use

A notable finding was the uneven distribution of ICT use between administration and teaching. Head teachers, academic officers, and Ward Education Officers reported relatively better access to ICT tools and indicated frequent use of these technologies for administrative functions. ICT was primarily utilized for report preparation, record management, communication, and other managerial tasks. However, this access and utilization did not meaningfully extend to classroom instruction or structured teacher professional support. This study aligns with Peter (2022) and Mwangi & Omwenga (2020), who reported similar disparities between administrative ICT use and pedagogical application in educational settings.

This pattern suggests that ICT implementation within the sampled public secondary schools is disproportionately oriented toward administrative efficiency rather than pedagogical enhancement. While administrative ICT use improves organizational effectiveness, documentation accuracy, and communication processes, limited integration of ICT into teaching and learning undermines the transformative potential of educational technologies. This finding aligns with Xu Qing & Guo Jing (2024) and Dzidzornu & Xu (2025), who emphasize aligning ICT use with pedagogical purposes to achieve meaningful instructional transformation.

The findings highlight a critical imbalance in ICT adoption priorities. Educational technologies are intended not only to streamline school management but also to improve instructional delivery, learner engagement, and academic outcomes (UNESCO, 2022). When ICT use is concentrated primarily at the administrative level, its potential to enrich classroom interaction, support learner-centred pedagogies, and foster students' digital competencies remains largely unrealised. This study aligns with Bitegeko et al. (2024) and Mmari (2025), who likewise observed limited classroom integration of ICT despite its availability for administrative purposes.

This imbalance has significant implications. Overemphasis on administrative ICT use, coupled with limited pedagogical integration, may result in minimal impact on teaching quality and learning effectiveness (Rakisheva & Witt, 2023). Without embedding ICT within instructional practices, schools risk maintaining traditional teacher-centered approaches that restrict active learning, collaborative knowledge construction, and the development of higher-order thinking skills. This study aligns with Mmari (2025) and Peter (2022), who reported similar concerns about ICT's limited influence on classroom practices in contexts where its use is largely administrative.

From the perspective of the Technological Pedagogical Content Knowledge (TPACK) framework, this disparity reflects a systemic disconnect between technological access and pedagogical application. Effective ICT integration requires aligning institutional ICT investments with classroom-oriented teaching practices (Mpumuje, 2024; Mare et al., 2022). However, when ICT resources are predominantly allocated to administrative purposes, opportunities to develop teachers' Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPACK) remain constrained. This study aligns with Xu Qing & Guo Jing (2024), who highlight the importance of integrating technology into pedagogy rather than limiting its use to administrative functions.

Furthermore, the limited pedagogical use of ICT may reinforce teachers' perceptions that technology is primarily a managerial rather than instructional tool. This perception can weaken motivation for pedagogical experimentation, reduce innovation in teaching strategies, and perpetuate resistance to technology-enhanced instruction (Rakisheva & Witt, 2023). This study aligns with Dzidzornu & Xu (2025), who emphasize that perceptions of ICT influence its adoption and classroom application, thereby limiting the instructional impact of available technologies.

These findings align with previous research indicating that ICT initiatives in many developing educational contexts tend to prioritize administrative modernization over instructional transformation, thereby limiting the educational impact of technology investments (Agyei & Voogt, 2011; Tondeur et al., 2017). This study further corroborates the contextual realities discussed in Mwangi & Omwenga (2020) and Peter (2022), reinforcing the argument that ICT adoption in schools remains unevenly distributed between administrative and pedagogical domains.

5.0 Conclusions and Recommendations

This study examined teachers' ICT competence, availability of ICT facilities, and the extent of ICT integration in teaching and learning processes in public secondary schools in Same District. The findings reveal a critical disconnect between teachers' reported basic ICT competence and the actual pedagogical use of digital technologies in classrooms.

Although a substantial proportion of teachers demonstrated high competence in foundational ICT applications such as word processing, spreadsheets, and presentation software, they rarely translated this competence into instructional practice. Skills related to educational software, multimedia tools, and simulations remained largely underdeveloped and unpracticed, mainly because of the lack of supportive infrastructure and limited pedagogical training opportunities.

The study further established that ICT facilities for teaching and learning were virtually nonexistent across the sampled schools. The lack of functional computers, computer laboratories, and instructional ICT tools significantly constrained teachers' capacity to experiment with and integrate technology into classroom practices. While government-supplied tablets represented a notable investment in educational technology, their instructional utilization remained minimal, reflecting challenges related to pedagogical preparedness, institutional culture, and monitoring mechanisms.

ICT use in schools was concentrated at the administrative level, where school leaders and education officers used digital tools mainly for managerial functions. This administrative bias in ICT application undermines the transformative potential of educational technologies, as meaningful improvements in teaching quality, learner engagement, and educational effectiveness require sustained pedagogical integration.

From the perspective of the Technological Pedagogical Content Knowledge (TPACK) framework, the findings indicate weak development of Technological Pedagogical Knowledge and Technological Pedagogical Content Knowledge. Teachers' technological competence, in the absence of enabling infrastructure and pedagogical support, was insufficient to foster effective classroom ICT integration.

Overall, the study concludes that ICT integration in teaching and learning within public secondary schools in Same District remains limited not because of a lack of teacher qualifications or general ICT awareness, but because of systemic, infrastructural, and pedagogical constraints. Without

deliberate alignment between ICT provision, teacher professional development, and classroom practice, the anticipated benefits of educational technology for improving learning outcomes may remain unrealized.

Based on the findings of this study, the following recommendations are proposed:

1. ICT Infrastructure: The government and stakeholders should ensure public secondary schools have functional ICT resources, including computers, reliable electricity, internet connectivity and equipped laboratories to support classroom integration.
2. ICT Training: In-service training should emphasize sustained, pedagogy-focused development, highlighting classroom integration, subject-specific applications, digital content creation, and learner-centered approaches aligned with TPACK.
3. Pedagogical ICT Culture: School leaders should promote a supportive culture by encouraging innovation, peer learning, recognition of effective practices, and integration of ICT into instructional planning and evaluation.
4. Monitoring and Support: Effective monitoring, technical support, and accountability mechanisms should guide the instructional use and sustainability of government-supplied ICT devices.
5. Policy Alignment: ICT policies should balance administrative and pedagogical uses, ensuring technology investments directly enhance teaching and learning outcomes.

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