Barriers to effective integration of ICT in secondary education in Tanzania: Perspectives of students, teachers, administrators, and stakeholders

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Recommended Reference: Mmari, W. D., Fransic, K. a/p, & Idris, W. I. S. (2025). Barriers to effective integration of ICT in secondary education in Tanzania: Perspectives of students, teachers, administrators, and stakeholders. *African Quarterly Social Science Review, 2*(4), 696–702.

ABSTRACT

This study explored the obstacles to the successful implementation of Information and Communication Technology (ICT) in Tanzanian secondary schools, with an emphasis on infrastructural, pedagogical, and institutional barriers. The research examined the impact of various obstacles on equitable and sustainable ICT adoption among students, teachers, school administration, and education stakeholders, through the lens of the second-level digital divide theory, the Technological Pedagogical Content Knowledge (TPACK) model, and the capability approach, as articulated by Van Dijk, Sen, and educational stakeholders. The study used a sequential explanatory mixed-methods research design, involving a quantitative survey and qualitative interviews, to provide a holistic analysis of the challenges. The population was 216,468 people in the Tanzanian secondary schools, and the sample consisted of 300 people: 255 students, 30 teachers, 15 administrators, and stakeholders. The study employed purposive and stratified sampling techniques to pick the participants who represent the main subgroups. Descriptive statistics was used to analyze quantitative data, whereas the thematic analysis, based on the methodology of Braun and Clarke, was applied to analyze qualitative data. Results indicated that major infrastructure gaps, like poor internet and electricity connectivity, teacher training, ICT confidence, and institutional support, were significant impediments to educational inequities. It is recommended that the country should invest heavily in infrastructure, continuously develop its teacher capacity, ensure that policy is well enforced, provide technical support, and offer incentives to encourage long-term ICT adoption. These measures are vital towards improving digital equity and improving the quality of secondary education in Tanzania.

Keywords: Digital Divide, Educational Equity, ICT Integration, Tanzania Secondary Education, Teacher Training

I. INTRODUCTION

Information and communication technology (ICT) in education refers to the wide range of digital tools, networks, and resources such as computers, the internet, software, multimedia, and communication platforms that make it easier to create, store, share, process, and manage information in order to improve administrative, instructional, and learning processes. ICT represents a wide scope of digital tools, networks, and resources that are used to create, store, share, and manage information (United Nations Environmental Scientific and Cultural Organization [UNESCO], 2018). Integration of ICT in the educational environment is the implementation of these technologies, including computers, the internet, software packages, and multimedia tools, in pedagogical activities to improve teaching and learning (Voogt et al., 2015). The successful implementation of ICT in education enables the creation of an interactive learning space, enhances student engagement, and acquires necessary digital literacy skills.

South Korea is one of the countries globally that has shown how an effective integration of ICT can revolutionize the educational system and promote innovation and equity in accessing learning opportunities. The examples of South Korea's strategic investment in the digital infrastructure, educator education, and curriculum change

demonstrate the potential of ICT to reduce the gap between achievements and prepare students to work in a technology-oriented economy (Lee & Kim, 2021).

In Africa, some nations, such as Kenya, have gone ahead with massive ICT integration projects with an aim of enhancing the quality and accessibility of education. The example of the Digital Literacy Programme in Kenya has been dedicated to the provision of digital tools in primary schools and training of the teachers to utilize ICT in an effective way (Ng'ang'a et al., 2018). However, issues like the poor infrastructure, low internet connectivity, and lack of technical support still persistently diminish the complete potential of ICT in most schools (Mutisya, 2020).

Tanzania also has the same problem but demonstrates good policy intentions since its National ICT Policy on Basic Education and Digital Tanzania Vision 2025 highlight the role of ICT in transforming education (United Republic of Tanzania [URT], 2016; Mtebe and Raisamo, 2014). In spite of these attempts, ICT penetration in Tanzanian secondary schools has still not been uniform, especially between the urban and rural regions and between government and private schools. The obstacles like insufficient electricity, incompetence of teachers in ICT, and deficient institutional support hamper the successful integration and restrain the successful educational outcomes (Mwila, 2018; Mtebe & Raisamo, 2014).

This study discusses the impediments hindering successful ICT integration in the Tanzanian secondary schools through the lens of the students, teachers, administrators, and stakeholders. The research problem identifies digital inequities that worsen the presence of existing educational inequities and hinder the substantial use of ICT in the classroom. The importance of unraveling these obstacles is to make an informed way of coming up with specific interventions to facilitate the equitable and sustainable use of ICT (Mwila, 2018).

The independent variables being studied are infrastructural factors (e.g., electricity, internet access, access to digital devices), pedagogical factors (e.g., teacher training, attitude, ICT self-efficacy), and institutional factors (e.g., policy implementation, administrative support, funds). The dependent variable is the level and efficiency of integration of ICT in teaching and learning processes, which can be determined in terms of frequency, quality, and pedagogical consistency of ICT application in schools.

In spite of the fact that some of these dimensions have been taken care of in previous studies, many of them concentrate on either individual factors or contexts of primary education, with minimal integration of different stakeholders' views or mixed-methodologies (Ng'ang'a et al., 2018; Mtebe & Raisamo, 2014). This study addresses the most critical gaps by taking an extensive approach to incorporate both qualitative and quantitative evidence to examine the multi-level issues and come up with evidence that can be acted upon to enhance ICT policy and practice in Tanzanian secondary schools.

1.1 Research Objective

i. To measure infrastructural, pedagogical, and institutional variables affecting ICT integration in Tanzanian secondary schools
ii. To investigate the experience and attitude of students, teachers, school administrators, and key education stakeholders toward ICT integration in teaching and learning
iii. To formulate evidence-based proposals on how to increase equitable and sustainable ICT integration in Tanzanian secondary schools

II. LITERATURE REVIEW

2.1 Theoretical Review on ICT Integration Barriers

2.1.1 Digital Inequality Theory (Van Dijk, 2005, 2017)

The Digital Inequality Theory illustrated by Van Dijk, views the concept of digital access as a stratified phenomenon that requires physical access but also motivational access, skills access, and usage access (Van Dijk, 2005; Van Dijk, 2017). This model describes the influence of socio-economic inequalities on the opportunities of individuals to take advantage of ICT in the learning setting. Van Dijk (2017) points out that the unbalanced resource allocation and the unequal digital capabilities are also some of the contributors to the persistent gaps, which are particularly applicable in the realm of situations such as the Tanzanian secondary school, where the infrastructural shortages, insufficiency of ICT skills, and motivational views are more than mere obstacles to fairness in ICT interactions.

2.1.2 Technological Pedagogical Content Knowledge (TPACK) Model

The TPACK model emphasizes the overlap of technological knowledge, pedagogy, and subject content knowledge as critical to the inclusion of ICT into instructional methods by educators. It is essential to its implementation in the Tanzanian secondary education because of the flaws in the technological competencies and the lack of adaptation to ICT tools in pedagogy among teachers, which limit the innovative approaches to the practice (Mtebe & Raisamo,

2014). In turn, this framework informs the comprehension of pedagogical obstacles and teacher skills that determine the results of ICT integration.

2.1.3 Capability Approach (Sen, 1999)

The Capability Approach by Amartya Sen changes the depiction towards the resource provision instead of the actual freedom and ability of people to use technology to generate personal and educational growth (Sen, 1999). It can be used in the context of education in Tanzania to shed some light on how institutional and structural factors limit the capacity of teachers and students to acquire critical ICT skills to have empowered learning experiences (Mwila, 2018). It forms the basis of the wider institutional and policy implications towards sustainable, equitable use of ICT.

2.2 Empirical Review

The research in ICT integration in secondary schools across the world indicates that infrastructural, pedagogical, and institutional challenges continue to undermine the possible advantage of digital technology. Successful ICT integration and innovative approaches towards pedagogy have been supported by well-developed infrastructure, continuous educator training, and facilitating policy conditions in developed countries such as South Korea (Kim & Lee, 2020). On the contrary, a lot of developing nations have systemic issues. Nigeria, as an example, has ICT adoption impeded by infrastructural shortcomings in areas like unreliable electricity and the lack of internet accessibility, especially in rural schools (Makinde et al., 2024). The given obstacles impede fair accessibility and efficient pedagogical application.

In Sub-Saharan Africa, such countries as Kenya and Uganda, the study shows that infrastructural insufficiencies, gaps in teacher capacity, and institutional support are still the leading obstacles (Bariu, 2020; Mutisya, 2020). The lack of ICT literacy among teachers and students, poor technical infrastructure, and inconsistent policy are identified as the recurring challenges to the scaling of ICT initiatives (Joseph, 2021).

In Tanzania, there is empirical research that highlights the same problems. Joseph (2021) reported that poor ICT adoption in secondary schools is mostly caused by unstable electricity supply and poor internet connection and rural and public schools have the least privilege. Also, the readiness of teachers becomes an important issue; Mboya (2019) found that teachers do not effectively use available technologies due to insufficient ICT pedagogy training. These barriers are further augmented by institutional problems, such as poor implementation of policies and prioritization of ICT funds (Mtebe & Raisamo, 2014).

Moreover, the adoption levels are affected by attitudinal elements between the teachers and the students. Mtebe and Raisamo (2014) highlight challenges including instructor resistance and lack of awareness about technology benefits. These mental concepts of refusal are indicators of the wider ideas of acceptance and encouragement that are depicted in the international literature.

These barriers have regional relevance, which is supported by the research in the adjacent East African countries. Bariu (2020) noted that ICT adoption in the secondary schools in Kenya is hampered by infrastructural gaps, lack of capacity building, and inconsistency of the policies. Infrastructural and systemic challenges are widespread; nevertheless, the degree and peculiarities differ greatly, and local contextual studies are needed

Regardless of the growing body of regional and international literature, there is a large gap in respect of in-depth, multi-faceted studies that would represent the complete range of infrastructural, pedagogical, and institutional obstacles from the perspective of various stakeholders in Tanzanian secondary schools. Most of the available literature relates closely to individual obstacles or cities, but not the rural-urban gap and interaction between various variables. In this paper, I intend to fill this gap by offering a combined analysis of the stakeholder groups with references to the theoretical frameworks identified above.

III. METHODOLOGY

3.1 Research Design and Approach

The study utilized a sequential explanatory mixed methods design and employed a mixed-method approach that combines the quantitative and qualitative methods of data collection and analysis. The method is also highly appropriate to thoroughly study the complex impediments to ICT integration within Tanzanian secondary schools that will enable quantitative evaluation of both infrastructural and pedagogical predictors and qualitative analysis of the experiences and perceptions of stakeholders. The successive explanatory scheme eased the corroboration and enrichment of results of two types of data in order to respond to the study objectives comprehensively.

3.2 Target Population

The target population of the study consisted of secondary school students, teachers, school administrators, and relevant education stakeholders from regional and district levels in Tanzania. According to the Ministry of Education

report of 2025, the total population included approximately 211,805 students, 4,263 teachers, and 400 school administrators and other stakeholders, totaling 216,468 individuals.

3.3 Sampling Procedures and Sample Size

The sampling was done to pick the participants who represent the main subgroups identified above through purposive and stratified sampling methods. The study involved 300 cases: 255 students, 30 teachers, and 15 administrators and education stakeholders (Mboya, 2019). Stratification was used to provide equal representation on both school ownership (government/ private) and location (urban/ rural) to increase demographic and contextual diversity.

3.4 Reliability and Validity

Quantitative instruments did not require a pre-test to establish reliability, and in this case, the barrier and attitude scales had acceptable internal consistency (Cronbach's alpha exceeding 0.7). Triangulation of quantitative survey outcomes and data, qualitative interview data, and document analysis enhanced construct validity as the triangulated data offered complete and corroborated information (Creswell & Creswell, 2023). The research adhered to ethical standards by obtaining institutional approvals, seeking informed consent, and maintaining the confidentiality of participants.

3.5 Data Analysis Method

The quantitative data were processed in SPSS, where descriptive statistics were used to summarize the patterns of ICT use and inferential statistics (ANOVA, t-tests) were used to investigate the differences in groups. Transcription of qualitative data was followed by thematic analysis, and the six-stage process was used to discover emergent themes related to infrastructural, pedagogical, and institutional barriers. Findings integration used a side-by-side comparison method to eliminate convergence and divergence, giving a subtle meaning in line with the goals of the research.

3.6 Ethical Consideration

The UTAR Scientific and Ethical Review Committee (Approval Ref: U/SERC/56(A)-494/2024) granted the ethical approval. All subjects signed their informed consent in writing, and students younger than 18 had their informed consent signature taken by their parents or guardians. A permit was obtained through COSTECH (Permit No.: CST00001107-2025-2025-00304) as a nationwide permit of Dar es Salaam, Arusha, and Mwanza. Before data was collected, a permission letter was submitted to the school management and regional authorities. The entire process of handling the personal data was anonymized and handled in accordance with the UTAR Personal Data Protection Notice (PDPA), and confidentiality, safe storage, and limited access were ensured at all times during the study. The participants were also told that they had the right to withdraw at any time without any repercussions attached.

IV. FINDINGS & DISCUSSION

4.1 Barriers to Effective ICT Integration

The study provides the findings on the barriers to ICT integration in Tanzanian secondary education that are consistent with the objectives of the research and segmented by stakeholder groups such as students, teachers, administrators, and education stakeholders. The quantitative findings are provided in terms of descriptive statistics and followed by qualitative insights that contextualize and explain the quantitative data.

4.1.1 Student-Reported Barriers

Table 1 summarizes the reported barriers among the students. Internet connectivity was the greatest obstacle, with over half (50.6%) of students saying that it has a negative effect on learning. Other major obstacles were a lack of teacher support (47.1%) and an unstable power supply (43.9%).

Table 1

Student-Reported Barriers

Barrier	Mean	Std. Deviation	Agree & Strongly Agree (%)	Rank
Internet connectivity	3.29	1.15	50.6	1
Teacher encouragement	3.24	1.16	47.1	2
Electricity limitations	3.21	1.17	43.9	3
Inadequate infrastructure	3.18	1.17	41.9	4
Insufficient training	3.17	1.20	42.3	5

These results emphasize the importance of infrastructural and pedagogical barriers according to the students, which aligns with the Second-Level Digital Divide Theory by Van Dijk, which focuses on unequal access and skills that limit digital inclusion (Van Dijk, 2017).

4.1.2 Teacher-Reported Barriers

The perception of teachers is emphasized in Table 2. The first inhibitor was insufficient ICT training, with 53.3% of them concurring on the importance of this training. It has also highlighted the availability of technical support (56.7%) and self-reported confidence in incorporating ICT (33.3%)

Table 2

Teachers Reported Barriers

Barrier	Mean	Std. Deviation	Agree/Yes (%)	Rank
Adequate ICT training	3.43	1.04	53.3	1
Technical support availability	0.57	0.50	56.7 (Yes)	2
Teacher confidence in integrating ICT	3.03	1.13	33.3	3

Focus on capacity-building is consistent with the theory of TPACK, which highlights the significance of an integrated nature between technological, pedagogical, and content knowledge in an effective integration of ICT (Mboya, 2019).

4.1.3 Teachers' Challenges

Table 3 shows thematic challenges of teacher interviews. Absence of ICT training and skills, and the insufficient technical support were stated by 20 percent of the respondents. Also, inadequate infrastructure (13.3%), and opposition to ICT (16.7%) became astonishing subthemes.

Table 3

Challenges Faced by Teachers

Sub-theme	Frequency	%	Representative Quote
Lack of ICT training and skills	6	20	"We lack enough practical exposure to ICT tools in class."
No or insufficient technical support	6	20	"When computers break, no one helps fix them quickly."
Poor infrastructure	4	13.3	"Power cuts and slow internet disrupt ICT-based lessons."
Resistance to ICT use	5	16.7	"Some teachers find ICT difficult or unnecessary."
Limited access to ICT equipment	2	6.7	"Few computers mean lessons can't run smoothly."
Other challenges	7	23.3	"Time constraints and lack of policy enforcement exist."

These informal understandings give some background in justifying the quantitative obstacles, underscoring systemic, structural, and inspirational problems in line with theories that focus on institutional and attitudinal variables (Sen, 1999). Teachers suggested the increased practical ICT training (20%), motivational awareness (26.7%), and specific technical support (16.7%) (Table 4), which supports the results of the earlier studies in East Africa that recommended continuous capacity and institutional support (Rumanyika & Mashenene, 2015).

Table 4

Strategies Suggested by Teachers

Sub-theme	Frequency	%	Representative Quote
More frequent/practical ICT training	6	20	"We need hands-on ICT workshops, not just theory."
Motivational/awareness programs	8	26.7	"Incentives and awareness could motivate reluctant staff."
Dedicated ICT technical support	5	16.7	"Having ICT technicians available would reduce downtime."
Infrastructure improvements	4	13.3	"Better electricity, internet, and computers are needed."
Updated ICT tools	3	10	"New computers and software would ease teaching."
Other strategies	4	13.3	"Clear ICT policies and management encouragement required."

4.1.4 Administrative and Institutional Barriers

According to administrators and other stakeholders, the major problems that negatively affected sustainable ICT integration were financial limitations, a lack of uniform policy, and a lack of technical support. These complex, systemic issues continue to support the value of policy-practice gaps to promote equity in education by enhancing access to ICT (Joseph, 2021).

4.2 Discussion

Findings of the study support the multi-dimensionality of the barriers to ICT integration in Tanzanian secondary schools, which compares well with the theory of Second-Level Digital Divide as well as the TPACK framework. Infrastructural concerns, especially the lack of reliable internet access and unreliable electricity, are some of the basic constraints to the adoption of ICT, especially disadvantaging the rural and marginalized schools. Such infrastructural gaps continue to support educational inequalities, as studies of Tanzanian and broader Sub-Saharan setting contexts have found comparable systemic issues to prevent access to digital education (Ngodu, 2024; Joseph, 2021).

Furthermore, the widespread teacher inability to instill confidence and poor ICT training highlight a very important pedagogical disparity. Recent study on TPACK highlights the integration of technological, pedagogical, and content knowledge as key to the successful use of ICT in teaching (Kafyulilo et al., 2016). The study confirms that ongoing, focused professional development is essential to enable teachers to overcome restricted access and turn it into valuable learning opportunities. This is in line with recent studies indicating that unless teachers receive long-term capacity-building and motivation, they find it difficult to integrate ICT into pedagogy and realize education's potential benefits (Mutisya, 2020; Mtebe & Raisamo, 2014)

These problems are aggravated by institutional factors. These factors are the obvious lack of financial resources, inadequate technical support, and even sporadic policy implementation, which impedes the creation of sustainable ICT ecosystems. The mentioned problems indicate a lack of alignment between the national strategies of digital education and ground-level realities, which is often described as the policy-practice gap that is widespread in the Tanzanian secondary education (URT, 2016; Joseph, 2021). These institutional deficits can be addressed by means of committed financing, long-term technical upkeep, and vigorous policy implementation in order to have a successful ICT integration.

Motivational dynamics are also extended in the discussion. The attitudes and motivation of teachers came out as important predictors of ICT adoption, as they supported the theories that emphasize the influential nature of affective and attitudinal variables in technology integration. Through incentivization of teachers and emphasis on awareness and motivational activities, the resistance could be overcome, and positive engagement with ICT could be encouraged (Rumanyika & Mashenene, 2015)

Concerning the policy, the findings require a detailed and systematic reaction. The areas that need to be invested in should be aimed at improving infrastructure, long-term professional training, technical support, and consistent and implemented policy frameworks to establish fair access and implementation of ICT in Tanzanian secondary schools. This kind of an integrated strategy is necessary to open the potential of digital technologies as driving forces of socio-economic growth and education equity in Tanzania (UNESCO, 2018).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study has established several interconnected obstacles to successful ICT implementation in secondary schools in Tanzania. The most widespread limitations are infrastructural ones, especially unstable internet access and power supply, which disadvantage marginalized and rural institutions disproportionately and contribute to education inequities. The absence of a long-term teacher training program and the insufficient confidence in the use of ICT have a pedagogical effect, as they do not translate the existing technology to meaningful learning opportunities, which resonates with the significance of the integrated knowledge domains of the TPACK framework.

Barriers such as institutional and administrative factors, such as a lack of sufficient financing, a lack of fragmented policy implementation, and a lack of technical support, also hamper the establishment of sustainable ICT environments. Teacher motivation and attitudes were also identified as important factors in successful adoption, as the requirement to cover affective dimensions, as well as technical skills.

5.2 Recommendations

Following these findings and on the same basis as empirical findings by the same or similar situations, the following strategic recommendations are made:

Infrastructure Development: Focus on proper investment in access to electricity and high-speed internet connectivity, particularly in the underprivileged and rural schools, so as to create the background conditions for the use of ICT. *Teacher Training and Capacity Building:* Have ongoing, hands-on, as well as context-based training of teachers in in-service and pre-service, with emphasis on both technical as well as pedagogical integration as a part of the TPACK framework. *Policy Coherence and Enforcement:* Improve coordination and enforcement of national ICT policies by transparent monitoring systems, to ensure that policymaking is in line with school implementation.

Technical Support Systems: Have dedicated ICT support units based on schools or districts so that technical support can be done in time and troubleshooting can be done, the time wastage is reduced, and teachers are made confident. *Motivational and Awareness Programs:* Come up with rewards and awareness campaigns that would make

a positive impact on the attitude of the teachers towards ICT and bring them closer to ICT, and decrease the opposition. *Sustainable Funding Mechanisms:* Ensuring the sustainability of ICT over the long term: Obtaining predictable funding sources, both governmental and donor, to ensure ICT sustainability. Such a multi-faceted approach will be able to resolve the intricate issues of the digital divide in Tanzanian secondary education, leading to equal accessibility, higher teacher performance, and, consequently, better outcomes of education with the help of efficient digital implementation.

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