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Contribution of Information and Communication Technology Infrastructure in Supporting Technological Advancement in Public Secondary Schools in Longido District Council, Tanzania

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Abstract: *This study investigated the contribution of information and communication technology (ICT) infrastructure in supporting technological advancement in public secondary schools in Longido District Council. The objectives were to; explore how available ICT infrastructure supports technological advancement and determine strategies for improving ICT infrastructure for technological advancement in public secondary schools. Technology Acceptance Model Theory guided the study. Convergent mixed methods design was adopted. Target population was 4335 (4050 students, 271 teachers, 13 school heads and one District Secondary Education Officer (DSEO). The sample size was 200 respondents (98 students, 91 teachers selected by stratified and simple random sampling while 10 school heads and one DSEO obtained through purposive sampling techniques). Questionnaires and interview guides were used for data collection. Validity was established through expert judgment. Reliability of questionnaires determined using Cronbach Alpha Method in Statistical Package for Social Sciences (SPSS) version 25 generated coefficient r = 0.759 for Students' Questionnaire and r=0.757 for Teachers' Questionnaire. The trustworthiness of the interview guide was ensured through triangulation and peer debriefing. Descriptive statistics was used to analyze quantitative data and results were presented in tables. Qualitative data were analyzed thematically alongside research questions and presented in narrative forms. The study revealed that teacher training is essential for effective integration of ICT in teaching and learning. In conclusion, strategic planning and needs assessments at the school level are essential for successful ICT integration. The study recommends partnership between the government and private sector entities to supplement public investment in ICT.*

Keywords: *Technology, Infrastructure, Public, Schools, Longido, Tanzania*

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1. Introduction

Information and Communication Technology (ICT) infrastructure plays a crucial role in improving educational outcomes in secondary schools worldwide. The integration of ICT into education has revolutionized teaching and learning methods globally, supporting more interactive and student-centered approaches. This transformation enhances students' engagement, critical thinking, and problem-solving abilities, equipping them with the skills needed for the digital age (Msambwa et al., 2024). Information and Communication Technology integration in education has been a key focus of educational reforms globally, with widespread recognition of its potential to improve both the quality and accessibility of education. The optimism surrounding ICT's ability to transform

teaching and learning processes is significant (Dúo-Terrón et al., 2022).

The integration of ICT in educational institutions has become increasingly essential in fostering technological advancement. In public secondary schools, ICT infrastructure plays a crucial role in transforming traditional teaching and learning practices, facilitating access to information, and enabling effective communication between educators and students (Snyder and Roberts, 2021). ICT infrastructure encompasses the physical and technical resources such as computers, internet connectivity, interactive whiteboards, and learning management systems (LMS) that are needed for the effective implementation of technology in the classroom. The growing popularity of ICT in education is largely due to its ability to engage students, foster creativity, and provide access to a diverse range of digital resources (Haleem et al., 2022).

Globally, there has been a growing recognition of the potential of ICT in enhancing educational outcomes. For example, in many developed countries, schools are increasingly adopting digital tools to enhance teaching methods, encourage collaborative learning, and equip students with necessary digital skills for the modern workforce (González and Martínez, 2020). However, in many developing countries, the availability and quality of ICT infrastructure in public secondary schools remain a significant challenge, often due to factors such as inadequate funding, lack of training for educators, and poor internet connectivity (Bawa and Tunde, 2021).

In Tanzania, the government has recognized the importance of technology in education and has made efforts to incorporate it into the national curriculum. The Education Sector Development Plan (2016/17-2020/21) outlines the government's commitment to improving ICT infrastructure in schools and enhancing the ICT skills of teachers and students. The Tanzanian government has introduced various policy papers and initiatives to promote effective use of ICT in education. Despite the benefits of technology integration which are widely acknowledged, the extent of its integration and its contribution to technological advancement can vary significantly due to factors such as infrastructure, teacher expertise, and the level of support from educational authorities. In the context of countries like Bangladesh, Nigeria, and Tanzania, addressing these challenges is imperative for achieving equitable access to quality education (Chowdhury and Ali, 2022). This study sought to address this gap by exploring the role of ICT infrastructure in fostering technological advancement in secondary schools within Longido District Council.

1.1 Research Questions

The study investigated the following research questions:

1. How are the available ICT infrastructure used to support technological advancement in public secondary schools in Longido district council?
2. What are the strategies for improving ICT infrastructure for technological advancement in public secondary schools in Longido district council?

2. Literature Review

This study was guided by Technology Acceptance Model (TAM) developed by Davis in 1989.

2.1 Theoretical Review

2.1.1 Technology Acceptance Model

The Technology Acceptance Model is a widely used framework that explains and predicts how users come to accept and use new technologies. The Model posits that two main factors, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), significantly affect the user's decision to adopt technology (Davis & Wilson, 2020). If users believe that technology is easy to use and beneficial to them, they are more likely to adopt it.

2.1.2 Strengths of Adult Learning Theory

The Model provides clear, straightforward support that can be used to assess the factors influencing technology adoption across different industries and types of technologies. This adaptability has contributed to its widespread application in studying the acceptance of various technologies such as software, mobile apps, and online platforms. Moreover, the model's focus on perceived ease of use and perceived usefulness makes it easy for organizations to identify critical areas for improving user acceptance.

2.1.3 Application of Adult Learning Theory

The model's core constructs - PU and PEOU - are particularly useful for understanding how ICT tools are valued and adopted in an educational setting. Perceived usefulness refers to the degree to which individuals believe that ICT tools enhance their performance. Perceived ease of use pertains to the simplicity and effortlessness of using ICT tools, which can be influenced by user-friendly interfaces and adequate technical support. These factors influence individual attitudes and intentions to use ICT, which ultimately determine its actual adoption and integration into educational practices.

2.2 Empirical Literature Review

Through the critical evaluation of previous studies with regard to the research themes, the researcher was able to justify the significance of the investigation.

2.2.1 How Available ICT Infrastructure Support Technological Advancement in Public Secondary Schools

Snyder and Roberts (2021) examined the role of ICT infrastructure in fostering technological advancements within U.S. public secondary schools. The research focused on how the availability and quality of ICT resources contribute to the integration of technology in teaching and learning processes. The authors found that strong ICT infrastructure in schools plays a crucial role in enabling the adoption of a variety of technological tools, such as digital learning platforms, online collaboration tools, and interactive devices. These tools enhance students' engagement, foster creativity, and improve collaboration among students and teachers. Schools with better access to high-speed internet, modern computers, and interactive technologies were more likely to successfully integrate these tools into everyday teaching practices. In Nigeria, according to Olanusi and Adeniyi (2022), ICT infrastructure is fundamental to fostering technological advancement in public secondary schools by equipping both students and teachers with the necessary tools to facilitate teaching and learning processes. This study identified critical components of ICT infrastructure, such as computers, projectors, internet connectivity, and digital learning platforms, as essential for enabling the effective delivery of education.

In a Zambian context, Bwalya (2023) reported that although many schools have computer labs, their usage is hampered by overcrowding, equipment shortages, and the absence of consistent technical support. These structural limitations often diminish the pedagogical potential of the labs. Farinkia and Tambi (2023) found that most public secondary schools in Cameroon lacked multimedia tools such as projectors, smart boards, and audio-visual equipment that enhance interactive learning, undermining efforts to implement a robust ICT curriculum. Their findings call for the modernization of classroom technologies to support differentiated instruction. The current study aims to explore how the available ICT infrastructure is used to support technological advancement and the strategies for improving ICT infrastructure for technological advancement in public secondary schools in Longido district council.

Fidelis and Onyango (2021) conducted a study in Ngara District, Tanzania, to assess the availability of ICT facilities and teachers' competence in public secondary schools. They found that while ICT resources like computers and projectors were available in some schools, their functionality was hindered by poor internet connectivity, unreliable electricity, and insufficient teacher training. The study emphasized that access alone was not enough to ensure effective ICT integration in the classroom. The research provides a valuable contextual understanding of infrastructure issues in rural Tanzania but is limited by its small sample size and lack of quantitative metrics on how ICT infrastructure in supporting technological advancement in public secondary schools.

2.2.2 Strategies for improving ICT infrastructure for technological advancement in public secondary schools

The study by Keen (2021) highlighted the role of ICT infrastructure in advancing technology use in U.S. secondary schools: Strategies for improvement. This research focused on strategies to enhance ICT infrastructure in public secondary schools in the United States. The authors recommend investments in broadband expansion, greater integration of digital tools into the curriculum, and ongoing professional development for educators. Chowdhury and Ali (2022) explore strategies for improving ICT infrastructure in public secondary schools in Bangladesh. Guided by Diffusion of Innovations (DOI) Theory, the research highlights the challenges faced by schools, particularly in rural and underdeveloped areas, in integrating technology into the education system. The study identifies government investment in ICT infrastructure, particularly in rural areas, establishing dedicated ICT teams within schools to handle the maintenance and troubleshooting of technology and ensuring that devices and networks remain functional as the key strategies that can enhance ICT infrastructure and promote technological advancement in schools.

Furthermore, a study by Kisanga and Ireson (2022) emphasize the importance of capacity-building initiatives, especially regular teacher training programsmes to equip educators with the necessary skills and confidence to integrate ICT into pedagogical practices. Without well-trained teachers, even the most advanced infrastructure may remain underutilized. This aligns with the Ministry of Education, Science and Technology's (MoEST, 2022) policy recommendations that stress ongoing professional development and continuous support as cornerstones for successful ICT integration in schools. The study by Joseph (2021) focused on the pivotal role that teacher training plays in the successful integration and utilization of ICT in secondary schools. The study noted that despite the availability of technology in many schools, many teachers face significant challenges in using ICT effectively in the classroom, primarily due to inadequate training. The author advocated for regular in-service training and workshops for teachers, aimed at enhancing their ICT competencies. The study only focused on the role of teacher training

consequently the current study sought to establish other strategies.

3. Methodology

The study employed a convergent mixed methods design with a mixed research methods approaches that incorporates both quantitative and qualitative data collection. This mixed research methods is recommended by Creswell & Creswell (2018) for its ability to produce both types of data, facilitating data complementarities and triangulation across research methods and sources. The study population comprised of the 13 public ordinary level secondary schools in Longido district with a total number of 4050 form four students (MoEST, 2025). The study also targeted one DSEO, 13 school heads, and 271 teachers from different departments namely Academic, Information & Computer Studies (ICS), Science and Mathematics in public secondary schools in Longido district council. Form four students were selected for the study since they have interacted with ICT infrastructure for a longer period compared to other classes. Therefore, they understand the contribution of infrastructure in supporting technological advancement in their school. While teachers were relevant since they have first-hand information regarding ICT infrastructure and technological advancement in school. School heads were involved based on their roles in improving ICT infrastructure hence they provided the relevant information required in the study. DSEO are the custodians of all information about ICT infrastructure in the district thus their participation is vital in the study.

The sample size of students was calculated using Yamane statistical formula (Yamane, 1967). Given the population of 4050 students in the study area and the confidence level of 95%, error margin of 5% was considered. The sample size was calculated by using the statistical Yamane formula as follows:

From; $n=\frac{N}{1+N(e)^2}$ where n= required sample size, N= target population and e= margin of error (0.1).

Therefore:

$$n=\frac{N}{1+N(e)^2}$$

$$n=\frac{4,050}{1+4,050\ (0.1)^2}$$

$$n=\frac{4,050}{1+4,050(0.01)}$$

$$n=\frac{4,050}{1+40.5}=\frac{1,440}{41.5}$$

$$n=97.56 = 98 \text{ students}$$

Therefore, sample size estimation for students was 98.

A total of 10 public ordinary level secondary schools in Longido district were involved in the study. These schools were chosen since they have form four classes. The remaining three schools are newly established and have only form one and form two classes. Consequently, 10 school heads, 91 teachers teaching form four classes and are assigned duties in the three departments, one DSEO and 98 students were involved in the study. In summary, the total size was 203 respondents. The sampling matrix of study respondents is presented in Table 1.

Table 1: Sampling Matrix

S/N	Category of respondents	Population	Sample size	Sampling procedure
1	Students	4050	98	stratified & simple random
2	DSEO	1	1	Criterion Purposive sampling
3	Heads of school	13	10	Purposive sampling
4	Teachers	271	91	stratified & simple random
	Total	**4335**	**200**	

Source: Researcher, (2025).

The researcher adopted simple and stratified random sampling technique to select 7 students each from 10 schools, 9 students from two schools and 10 students from one school. Students were grouped into gender to form the strata in which the selection was based. In the first 10 schools, for 7 students (3 boys and 4 girls) were selected randomly from one intact form four class using written papers. For 9 students (5 boys and 4 girls) were selected randomly from one intact form four class. For 10 students (5 boys and 5 girls) were selected randomly from one intact form four class. In addition, simple random sampling was applied to select 3 teachers from Academic department, 2 teachers from Information & Computer Studies (ICS) department and 2 teachers from Science & Mathematics departments from each school. Purposive sampling technique was employed to select DEO (Criterion) and 10

school heads in each selected school for in-depth interviews. This study employed questionnaires and interviews guide to collect data from respondents.

After preparing the instruments mainly, questionnaires and interview guide, the researcher submitted them to the research expert in the ICT department who checked the relevance of the items if they were addressing the research objectives. The experts also looked at language clarity and suggested the necessary modifications to improve the instruments' validity. Their suggestions were incorporated in improving the face and content validity of instruments. In order to check for reliability of quantitative instrument (questionnaires) the researcher conducted a pilot study and select the 15 sample of respondents where research tools were administered and then later the research tools were administered to different groups of respondents whereby those who were subjected to the preliminary study were excluded during the actual study. The analysis was done by the researcher using SPSS and the results were correlated using Cronbach Alpha Coefficient method. The questionnaires for students gave a correlation coefficient of r= 0.759 while the questionnaire for teachers gave a correlation coefficient of r=0.757. This indicated a good level of internal consistency, as values above 0.70 are generally considered acceptable in social science research (Doval et al., 2023). The results suggest that the items in the students' questionnaire reliably measure the same underlying constructs. Also, the reliability for qualitative instrument (interview guide) was ensured through peer debriefing and different trials of interview to observe if the repeated data collection through qualitative instrument brought similar responses about the study objectives.

Data which were obtained from quantitative instruments (closed ended questions) were entered according to various variables and research questions in the Statistical Package for Social Sciences (SPSS) version 25 and were analyzed using descriptive statistics. The results were presented in tables of mean, frequencies and percentages. Qualitative data were thematically coded and analyzed alongside research questions. The findings were presented in narrative forms. The study also ensured voluntary participation, anonymity confidentiality and in order to avoid plagiarism and fraud, the researcher acknowledged all the authors of the works that have been be cited.

4. Results and Discussion

The findings are discussed in accordance with the themes generated from the research questions that the study sought to answer.

4.1 The extent teachers' willingness to participate in in-service training influenced their professional growth in public primary schools

The first question sought to explore how available ICT infrastructure support technological advancement in public secondary schools in Longido district council. The researcher started by asking the secondary school students and teachers to indicate the statement that best describe their views by using a five-point likert scale where 5=strongly agree, 4=agree, 3=neutral, 2=disagree and 1=strongly disagree. This interpretation framework allowed the researcher to understand whether the respondents generally perceived ICT infrastructure as supportive, neutral, or ineffective in advancing technology in teaching, learning, and school operations. Mean scores were computed to assess overall agreement on how available ICT infrastructures support technological advancement in public secondary schools with higher mean indicating greater agreement. In addition, a mean score greater than 3 indicated ICT infrastructures that are majorly used to support technological advancement, while a mean score lower than 3 suggested otherwise. A mean score exactly equal to 3 implies the ICT infrastructures that moderately support technological advancement (Chyung & Hutchinson, 2023). Responses from students are summarized in table 2.

Table 2: Students' Response on how the Availability of ICT Infrastructure Support Technological Advancement in Public Secondary Schools (n=98)

Statement	Strongly agree		Agree		neutral		disagree		strongly disagree		
	f	%	f	%	f	%	f	%	f	%	M
The available ICT infrastructure has enabled the adoption of technology in teaching and learning processes in our school.	29	29.6	47	48.0	17	17.3	5	5.1	0	0.0	4.02
The available ICT resources has enhanced teachers' and students' technological skills in our school.	30	30.6	18	18.4	31	31.6	19	19.4	0	0.0	3.60
The available ICT infrastructure has improved the digital literacy levels among students and teachers in our school	30	30.6	45	45.9	18	18.4	5	5.1	0	0.0	4.02
The availability of ICT infrastructure has increased the use of online resources for both teaching and learning activities.	45	45.9	26	26.5	13	13.3	9	9.2	5	5.1	3.99
Internet connectivity has supported technological advancement by providing access to global knowledge resources in our school.	28	28.6	47	48.0	18	18.4	5	5.1	0	0.0	4.00
The presence of ICT infrastructure has fostered innovative teaching approaches and improved student engagement.	25	25.5	50	51.0	18	18.4	5	5.1	0	0.0	3.97
Grand mean score											**3.93**

Source: Field Data (2025)

Based on table 2, the available ICT infrastructure has enabled the adoption of technology in teaching and learning processes in our school. The majority of students expressed agreement with the statement that ICT infrastructure has facilitated the integration of technology in teaching and learning. A combined 77.6% of respondents either strongly agreed (29.6%) or agreed (48.0%), while only 5.1% disagreed, and none strongly disagreed. The calculated mean score of 4.02 reflects a high level of consensus that technological tools are being utilized in the classroom. This finding agrees with the observations of Bendera (2024), who found that the availability of ICT infrastructure plays a crucial role in the adoption of digital teaching practices in Tanzanian schools. When digital devices, projectors, and internet access are available, teachers can easily incorporate multimedia content, digital notes, and online assessments into their lessons. However, while these findings are promising, they also highlight a need to explore whether this technology adoption is consistent across subject areas and whether it enhances academic performance or is limited to surface-level usage.

Student responses were more varied regarding the availability of ICT resources has enhanced teachers' and students' technological skills in our school. While 49% of students agreed (30.6% strongly agreed and 18.4% agreed), a notable proportion of 31.6% remained neutral, and 19.4% disagreed. This led to a lower mean score of 3.60, indicating uncertainty or inconsistency in how effectively ICT tools have contributed to skill enhancement. This aligns with the findings by Joseph (2023), which highlight that simply having access to ICT does not automatically translate into skill acquisition. Without sufficient training and practice opportunities, both students and teachers may

struggle to develop advanced ICT competencies. The neutrality in responses may also suggest that the ICT tools available are used only occasionally or in limited ways that do not significantly build proficiency. These findings indicate the need for more structured ICT training programmes and practical exercises embedded within the curriculum.

The available ICT infrastructure has improved the digital literacy levels among students and teachers in our school. Responses to this statement were predominantly positive, with 30.6% of students strongly agreeing and 45.9% agreeing, translating to 76.5% in agreement. Only 5.1% of students expressed disagreement, and the mean score was 4.02. This suggests that the presence of ICT tools has led to measurable improvements in users' ability to navigate digital environments, utilizing software, and accessing information online. In this regard, Msambwa and Daniel (2024) stress that digital literacy is not just about knowing how to use a computer but also involves critical thinking, online communication, and evaluating digital content. The relatively high level of student agreement indicates that schools may be doing well in exposing both students and teachers to technology. However, the 18.4% who responded neutrally raise the possibility that digital literacy gains are not uniform across the students' population. Future strategies should focus on making digital learning experiences more equitable and tailored to diverse learning needs.

The availability of ICT infrastructure has increased the use of online resources for both teaching and learning activities. This statement also received strong support from students, with 45.9% strongly agreeing and 26.5% agreeing, resulting in a 72.4% agreement rate and a mean score of 3.99. Students clearly acknowledge that ICT infrastructure has opened access to online learning platforms, digital libraries, educational videos, and other web-based content. According to Njiru (2022), the shift toward digital content use in Kenyan schools is directly linked to improved ICT infrastructure, including internet connectivity and device availability. However, the presence of 13.3% neutral responses and a combined 14.3% disagreement indicates that not all students are equally benefiting from these resources possibly due to intermittent internet access, lack of personal devices, or limited time in computer laboratories. Thus, while the overall perception is positive, further investment in connectivity and device-to-student ratios is needed to close this gap.

Internet connectivity has supported technological advancement by providing access to global knowledge resources in our school. This statement had a high level of student endorsement, with 28.6% strongly agreeing and 48.0% agreeing, translating to 76.6% approval. The mean score of 4.00 suggests that students perceive internet access as a vital enabler of educational advancement. The internet facilitates exposure to a wide array of global educational materials, including MOOCs (Massive Open Online Courses), virtual experiments, and interactive forums. While giving support, Bendera (2024) identifies internet connectivity as one of the most influential components of ICT infrastructure in Tanzanian schools. However, the same study also found that in rural or underfunded schools, internet access is often unreliable. The small percentage of students who disagreed (5.1%) may be attending schools where such connectivity is inconsistent or too slow to support educational activities. Ensuring stable internet access across all schools should therefore be a top policy priority.

The presence of ICT infrastructure has fostered innovative teaching approaches and improved student engagement. Students showed considerable agreement with this statement as well, with 25.5% strongly agreeing and 51.0% agreeing, leading to a cumulative 76.5% positive response rate and a mean score of 3.97. This supports the notion that ICT tools have not only been used for content delivery but have also encouraged more student-centered and participatory teaching methods. These might include interactive simulations, virtual discussions, group research projects, and the use of educational games methods known to increase student motivation and retention. As observed by Msambwa and Daniel (2024), when teachers are trained to control ICT tools innovatively, students become more engaged, and learning becomes more meaningful. Nevertheless, the continued reliance on traditional teaching methods in some schools, coupled with uneven ICT integration, may explain the 18.4% neutrality and 5.1% disagreement. To maximize the potential of ICT, ongoing teacher professional development in instructional design and innovation is essential.

While responding to open ended question on how available ICT infrastructure support technological advancement in public secondary schools in Tanzania, a teacher remarked that; *the available ICT infrastructure enables access to digital learning materials, facilitates interactive and student-centered education that supports the development of digital literacy skills.*

This reflects growing familiarity with digital devices and software, which is critical for participating effectively in an increasingly technology-driven educational environment. Improved digital literacy not only enhances classroom engagement but also prepares students for future academic and career opportunities that require proficient ICT skills.

Finally, the presence of ICT infrastructure was widely credited with fostering innovative teaching approaches and improving student engagement. An impressive number of teachers agreed that technology encourages creative instructional methods and active participation in the classroom. This finding highlights how ICT tools like multimedia presentations, interactive simulations, and

online discussions can transform traditional teaching practices. Such innovations can make learning more enjoyable, relevant, and effective, ultimately contributing to better academic performance.

4.2 Quantitative Findings on the Strategies for Improving ICT Infrastructure for Technological Advancement in Public Secondary Schools

The second research question determined the strategies for improving ICT infrastructure for technological advancement in public secondary schools. The researcher started by asking the secondary school students and teachers to indicate the statement that best describe their views by using a five-point likert scale where 5=strongly agree, 4=agree, 3=neutral, 2=disagree and 1=strongly disagree. Mean scores were computed to assess overall agreement on the strategies for improving ICT infrastructure for technological advancement in public secondary schools with higher mean indicating greater agreement. In addition, a mean score greater than 3 indicated most preferred strategies, while a mean score lower than 3 suggested otherwise. A mean score exactly equal to 3 implies the strategies that moderately preferred (Chyung & Hutchinson, 2023). Responses from teachers are summarized in table 3.

Table 3: Teachers' Response on Strategies for Improving ICT Infrastructure for Technological Advancement in Public Secondary Schools (n=91)

Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
	f	%	f	%	f	%	f	%	f	%	M
Increased government investment in ICT can enhance the availability of technology in our school.	47	51.6	23	25.3	9	9.9	6	6.6	6	6.6	4.09
Regular teacher training programmes will improve educators' ability to integrate ICT into teaching and learning.	27	29.7	48	52.7	14	15.4	2	2.2	0	0.0	4.10
Public-private partnerships can provide additional resources to improve ICT infrastructure in schools.	31	34.1	33	36.3	15	16.5	11	12.1	1	1.1	3.90
Building and upgrading computer labs will ensure students and teachers have adequate access to ICT tools.	32	35.2	28	30.8	17	18.7	14	15.4	0	0.0	3.86
Improving internet connectivity will enable efficient access to online educational resources.	26	28.6	41	45.1	18	19.8	6	6.6	0	0.0	3.96
Providing access to educational software will enhance the learning experience for students.	27	29.7	20	22.0	29	31.9	15	16.5	0	0.0	3.65
Implementing e-learning platforms can support digital teaching and broaden learning opportunities.	31	34.1	43	47.3	15	16.5	2	2.2	0	0.0	4.13
Promoting digital literacy programs will equip students and teachers with essential technological skills.	29	31.9	44	48.4	16	17.6	2	2.2	0	0.0	4.10

Source: Field Data (2025)

From Table 3, increased government investment in ICT can enhance the availability of technology in schools. More than three-quarters of teachers (51.6% strongly agreed and 25.3% agreed) support the idea that increased government funding is essential for improving ICT infrastructure. This reflects the understanding that government plays a key role in allocating resources to schools for purchasing and maintaining technology. However, 13.2% disagreed, which may indicate concerns about how government funds are managed or skepticism about whether increased funding will effectively translate into better resources. The mean score of 4.09 highlights strong overall support for this strategy. A study by Mwaura (2023) found that Kenyan public schools with higher government ICT budgets reported significantly better access to computers, projectors, and internet connectivity. This investment enables procurement of devices, maintenance, and support services, which are essential for sustained ICT integration.

Regular teacher training programmes will improve their ability to integrate ICT into teaching and learning. This strategy received strong support, with over 80% of teachers agreeing that ongoing training is vital. The high mean score of 4.10 emphasizes the recognition that even with adequate infrastructure, teachers need continuous professional development to effectively incorporate technology into their teaching practices. Training enhances teachers' confidence and skills, enabling them to influence ICT tools to improve student engagement and learning outcomes. This finding aligns with the Technology Acceptance Model (TAM) that guided the current study. The model's core constructs - PU and PEOU - are particularly useful for understanding how ICT tools are valued and adopted in an educational setting (Davis & Wilson, 2020).

Public-private partnerships can provide additional resources to improve ICT infrastructure in schools. About 70% of teachers agreed or strongly agreed that collaborations between the government and private entities can help bridge resource gaps. While the mean score of 3.90 shows good support, there was also some disagreement (13.2%), possibly due to concerns about dependence on private sector interests or questions about the sustainability and equity of such partnerships. Still, public-private partnerships are generally viewed as a promising avenue to supplement government funding and introduce innovative solutions.

While responding to open ended question on possible strategies for improving ICT infrastructure for technological advancement in public secondary schools in Tanzania, one respondent remarked that; *these strategies may include increased government funding, partnerships with private companies, teacher training programmes and the integration of ICT in educational policies and curricular. In addition, establishing reliable internet access, maintaining and upgrading existing hardware, and ensuring equitable distribution of resources are also critical for sustainable technological advancement.*

Building and upgrading computer laboratories will ensure students and teachers have adequate access to ICT tools. This received moderate support, with 66% agreement and a mean score of 3.86. While many teachers acknowledge the need for improved physical facilities to accommodate technology use, nearly 34% were neutral or disagreed. This may reflect varying conditions across schools, where some already have decent laboratories while others lack basic infrastructure. It underscores the need for targeted investments to ensure equitable access.

Improving internet connectivity will enable efficient access to online educational resources. In this regard, majority of teachers (73.7%) agreed that reliable internet is critical for accessing digital learning content. The mean score of 3.96 reflects broad acknowledgment that internet connectivity is a backbone for ICT-enabled education. Nonetheless, some neutral and disagreeing responses suggest that challenges such as bandwidth limitations, outages, or costs remain obstacles.

Providing access to educational software will enhance the learning experience for students. This statement had the lowest mean score of 3.65 and comparatively higher neutrality (31.9%) and disagreement (16.5%). This indicates some uncertainty or dissatisfaction about the availability, quality, or use of educational software. It suggests a need for more effective integration of digital learning applications and possibly better training on how to use these tools to enrich the curriculum. A literature by Mtebe and Raisamo (2023) in Tanzania further contribute to the discussion by examining the challenges faced during the implementation of e-learning platforms in secondary schools. They argue that while infrastructure development is necessary, ensuring the availability of contextually relevant educational software and digital content is equally critical.

Implementing e-learning platforms can support digital teaching and broaden learning opportunities. With a mean score of 4.13 and over 80% agreement, teachers strongly support the use of e-learning platforms. These platforms can facilitate remote learning, resource sharing, and personalized instruction, expanding educational access beyond the traditional classroom. This enthusiasm highlights teachers' recognition of the benefits of digital education technologies. Kisanga and Ireson (2022) aligns their findings to that of this study by highlighting the urgent need for increased government investment to improve infrastructure, which includes the provision of adequate hardware, reliable internet connectivity, and the development of computer laboratories.

Promoting digital literacy programmes will equip students and teachers with essential technological skills. Similarly, there is strong support (mean score 4.10) for initiatives

aimed at improving digital literacy. This strategy focuses on building the foundational skills necessary for both teachers and students to effectively use ICT tools, which is crucial for maximizing the benefits of available technology and preparing learners for a digital future. While giving support, Chowdhury and Ali (2022) argued that government investment in ICT infrastructure, particularly in rural areas, is essential for narrowing the digital divide.

During interviews with heads of school about their suggestions on the strategies for improving ICT infrastructure for technological advancement, the following were noted;

> As a head of school, the first step I would recommend is conducting a thorough assessment of the current computer lab facilities. This includes evaluating the available space, electrical capacity, internet connectivity, and the number and condition of existing devices. Understanding the school's specific needs and limitations allows for a focused upgrade plan that prevents unnecessary expenses and ensures resources are well allocated (personal interview, 13th May, 2025).

The response from school head 5 reveals that this will prepare good starting point for the improvement to take place in the ICT infrastructure to bring technological advancement. In the views of Njiru (2022), schools with detailed ICT needs assessments report higher sustainability and better integration of technology into teaching and learning, as upgrade plans address real challenges rather than assumed needs. Therefore, conducting a thorough assessment ensures that limited financial and technical resources are optimally allocated, avoiding wasted expenditures and improving long-term ICT success.

Furthermore, during the interviews, majority of heads of school commented that government should prioritize the budget for ICT department to make things better than how they are right no. One school head maintained that:

> From my perspective as an administrator, the government should first increase funding specifically earmarked for ICT infrastructure. Many schools struggle to maintain or upgrade their technology because the budget is limited or unpredictable. With reliable funding, schools can invest in better computers, improve internet connectivity, and maintain the existing equipment (Personal interview, 13 May 2025).

In this respect, teachers observed that government has something to offer in order to make a combination of funding, training, partnerships, and connectivity improvements that would create a more sustainable and impactful ICT environment in schools. In this line, Nyandwi, et al (2020) shed light on the role of ICT support services, including technical maintenance and troubleshooting, which are often overlooked yet essential for sustainable ICT use in schools.

5. Conclusion and Recommendations

5.1 Conclusion

Based on the findings, the following conclusions were drawn:
The study revealed that teacher training is essential for effective integration of ICT in teaching and learning. While infrastructure is foundational, it is the ability of educators to use these tools effectively that determines the impact on learning outcomes. Teachers require continuous professional development to gain both technical competence and pedagogical strategies necessary for incorporating digital tools into their classroom practices. Without such training, ICT facilities may remain underutilized or be used ineffectively, limiting their educational potential.

The findings also highlighted significant disparities in the access and use of ICT infrastructure among students. Although some schools have computers and tablets, access is often constrained by insufficient quantities, maintenance issues, or scheduling limitations. This creates an inequitable learning environment where some students benefit more than others from available technologies. Addressing these disparities requires more equitable distribution of resources and targeted investments in schools that lack basic ICT infrastructure.

In addition, public-private partnerships (PPPs) were recognized as valuable in supplementing government efforts to improve ICT in schools. Students and teachers alike viewed such collaborations as an opportunity to bring in additional resources and innovative solutions. However, concerns about sustainability and equity suggest the need for clear frameworks to guide PPPs, ensuring that they serve the educational needs of all learners rather than specific interests.

The importance of digital literacy and reliable internet connectivity also emerged as key themes. Students and teachers emphasized the need for strong digital skills to fully engage with technology-enhanced learning environments. Similarly, reliable internet access is foundational to accessing online educational content, conducting research, and participating in virtual learning

activities. Efforts to improve ICT infrastructure should therefore include investments in digital skill-building and internet expansion, particularly in rural areas.

Another conclusion drawn from the study is the under-utilization of educational software and e-learning platforms. While there is strong support for these tools, the findings suggest gaps in availability, integration, and user competence. To maximize the benefits of ICT, schools should invest not only in hardware but also in quality educational software, relevant digital content, and user training to support effective usage.

Lastly, the study concluded that strategic planning and needs assessments at the school level are essential for successful ICT integration. Schools that conduct detailed evaluations of their existing infrastructure and specific needs are better positioned to allocate resources effectively and implement sustainable improvements. Such assessments help to avoid unnecessary spending and ensure that ICT investments address real challenges within the school environment.

In conclusion, improving ICT infrastructure for technological advancement in public secondary schools requires a comprehensive approach. This approach should combine government funding, teacher training, equitable access to resources, effective partnerships, reliable connectivity and strategic planning. Only through coordinated efforts in these areas can schools fully harness the potential of ICT to enhance teaching and learning.

5.2 Recommendations

Based on the conclusions of the study, the following recommendations were made:

1. The government should allocate adequate and consistent funding specifically for the development of ICT infrastructure in public secondary schools. This funding should support the procurement of computers, tablets, internet connectivity, maintenance of digital tools, and the establishment of computer laboratories. Prioritizing ICT in the national education budget will help address existing disparities, especially in under-resourced and rural schools where technological access remains limited.

2. Teachers need to be equipped with both technical and pedagogical skills to effectively use ICT in the classroom. Regular in-service training and professional development programs should be implemented to build teacher confidence and competence in integrating digital tools into their teaching practices. This continuous capacity building will enable teachers to deliver more engaging, inclusive, and technology-enhanced lessons that benefit student learning.

3. Partnerships between the government and private sector entities should be encouraged to supplement public investment in ICT. These collaborations can bring in additional resources such as hardware, software, and training opportunities, as well as innovative solutions to enhance digital learning environments. Public-private partnerships offer a practical and sustainable approach to improving ICT access and use in schools.

4. Efforts should also be directed toward improving internet connectivity across all public secondary schools. Reliable and affordable internet access is essential for accessing online resources, participating in digital learning, and integrating e-learning platforms into the curriculum. Priority should be given to expanding connectivity in rural and underserved areas to ensure equitable access to educational opportunities.
5. To promote fairness and inclusion, schools should ensure that ICT resources are distributed equitably among students. Increasing the number of available devices and enhancing physical infrastructure such as computer labs will help provide more students with regular access to digital learning tools. ICT policies should be designed to maximize student engagement and minimize disparities in access and use.
6. Educational software and e-learning platforms should be effectively integrated into the teaching and learning process. Schools need to invest in high-quality, curriculum-aligned digital content and ensure that both teachers and students are trained in its use. This integration will help create interactive and personalized learning experiences that support academic achievement and digital literacy.

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