Enhancing Geography Education through ICT: A Study of Public Secondary Schools in Ubungo Municipality, Tanzania

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ABSTRACT: This study examines the impact of Information and Communication Technology (ICT) in enhancing Geography education within public secondary schools in Ubungo Municipality, Tanzania. The research focuses on the availability of ICT resources, their utilization, and the challenges faced in incorporating ICT into Geography teaching. Using a mixed-methods approach grounded in Vygotsky's social development theory, data were collected from 500 students, 20 teachers, 4 school heads, 1 Municipal Education Officer, and 4 Ward Education Officers through questionnaires, interviews, and observations. Findings reveal that ICT tools such as interactive whiteboards and GIS software, while moderately available, are inconsistently utilized across schools. The study highlights key challenges including outdated equipment, inadequate teacher training, and insufficient technical support, which hinder effective ICT integration. The study concludes by recommending increased investment in ICT infrastructure and regular professional development for teachers, suggesting that these measures are crucial to realizing the potential of ICT in improving educational outcomes.

KEY WORDS: ICT integration, Geography education, teacher training, GIS, Tanzania

1. INTRODUCTION

The integration of Information and Communication Technology (ICT) into education has significantly transformed teaching and learning processes across the globe, offering enhanced opportunities for engaging students and improving learning outcomes. In geography education, ICT tools such as Geographic Information Systems (GIS), interactive maps, and multimedia resources provide students with immersive, real-world experiences that traditional teaching methods often lack. These technologies have the potential to deepen students' understanding of spatial relationships, environmental processes, and global interconnectivity, making geography more relevant and engaging in the 21st-century learning context (Schleicher, 2019; Lako & Mubita, 2021).

Despite the global trend toward incorporating ICT into education, many Tanzanian secondary schools, particularly in public institutions, face challenges in fully realizing the potential of these technologies. In Ubungo Municipality, Dar es Salaam, the integration of ICT in geography education is hampered by several factors, including limited access to ICT resources, insufficient teacher training, and inadequate technical support (Mgaya & Mgaya, 2019; Ngeze, 2017). The disparity in the availability and use of ICT between schools creates uneven learning experiences for students, potentially limiting their exposure to the benefits that ICT can offer in geography education. While some schools may have basic ICT infrastructure, others are constrained by outdated equipment or a lack of functioning technology, reducing the ability of teachers to integrate ICT effectively into their geography lessons.

The Tanzanian government has recognized the importance of ICT in education and has implemented various policies aimed at improving ICT infrastructure in schools, including the National ICT Policy (URT, 2016). However, the specialized demands of geography education—such as the need for GIS and other spatial analysis tools—are often not met due to resource constraints and the limited availability of subject-specific ICT training for teachers. As a result, many geography teachers continue to rely on traditional teaching methods that may not fully engage students in interactive or inquiry-based learning, which ICT can facilitate (Mwalongo, 2011; Ratemo, 2020). This reliance on conventional teaching approaches undermines the potential of ICT to make geography education more dynamic and aligned with modern pedagogical practices.

This study investigates the contribution of ICT to effective geography teaching in selected public secondary schools in Ubungo Municipality, Dar es Salaam. It sought to assess the availability of ICT resources in these schools and explore how ICT tools are utilized to enhance geography education. The study also examines the challenges faced by geography teachers in integrating ICT into their lessons, focusing on factors such as access to technology, teacher proficiency, and technical support. By understanding these dynamics, the study aims to provide insights into how ICT can be better leveraged to improve geography teaching and learning

outcomes in Tanzanian public secondary schools (Warschauer & Matatu, 2016; Chirwa & Mubita, 2021). Ultimately, the findings are intended to inform policy recommendations and highlight strategies for overcoming barriers to ICT integration in geography education.

2. LITERATURE REVIEW

The social development theory of Lev Vygotsky serves as the foundation for this investigation under the constructivist learning paradigm, which posits that learning is an active process of constructing knowledge rather than passively acquiring it (Newman & Holzman, 2013). Vygotsky, along with other constructivist thinkers such as Piaget and Dewey, believed that knowledge is built on personal experiences and environmental interactions (Shah et al., 2013). Each learner interprets knowledge differently based on these experiences, and learning is heavily influenced by social negotiation (Vygotsky, 1962). Vygotsky's theory emphasizes the importance of socialization in cognitive development, particularly through tools like language and writing, which begin as mechanisms for communication and eventually lead to higher-order thinking (Newman & Holzman, 2013). In this view, cognitive development is deeply intertwined with the social and cultural context in which individuals exist, with ethnicity, social class, gender, family life, and self-concept all playing vital roles in shaping perception and thought processes (Newman & Newman, 2022).

Vygotsky's idea of the zone of proximal development (ZPD) suggests that learners can achieve more with guidance from a "more knowledgeable other," such as a teacher or peer, than they can independently (Vygotsky, 1962). The concept highlights the importance of social interaction in learning, making collaborative learning strategies essential. Teachers are encouraged to structure learning environments in ways that leverage these interactions, allowing less skilled students to develop with the help of their more knowledgeable peers (Newman & Holzman, 2013). ICT tools can play a significant role in fostering this collaboration, improving both numeracy and literacy skills, as evidenced by numerous studies that show how these technologies enhance student engagement, reduce barriers, and increase motivation (Moosavi et al., 2020; Cifuentes & Lents, 2010).

Empirical studies further support the positive impact of integrating ICT into education. Research by Tomlinson (2012) indicates that ICT applications not only improve students' academic performance but also foster communication, social belonging, and motivation. Studies have shown that ICT can be a powerful tool in breaking down social barriers and enhancing collaborative learning, enabling students to access educational content at any time, thereby fostering continuous learning. The Tanzanian government has recognized the importance of ICT in education through various policy initiatives, including the ICT Policy for Basic Education (2007), aimed at empowering teachers, school managers, and students. However, the lack of sufficient ICT infrastructure and training programs for teachers remains a barrier to full implementation.

In Tanzania, teacher education has evolved to focus on improving pedagogy through ICT integration and enhancing teacher competence. Studies, such as those by Wepukhulu (2022) and Kitta (2013), highlight the government's efforts to improve teaching approaches by providing ICT training to teachers and school leaders. While the integration of ICT in teaching has had positive impacts on both teaching and administrative tasks, challenges remain, particularly regarding access to resources and adequate training for teachers. Research indicates that when ICT is effectively used in classrooms, it positively influences students' cognitive development and problem-solving skills (Condie & Munro, 2007). However, challenges such as teachers' limited ability to control students' use of technology and the distraction posed by entertainment technologies must also be addressed.

Technology, when used appropriately, enriches the learning process and assessment. Studies by Tezci (2009) and Umar (2014) emphasize that technology's educational value is maximized when integrated meaningfully into the learning process. However, without proper guidance, technology may lead to misuse, where students prioritize entertainment over educational content. Research also shows that ICT tools such as computers and the internet are invaluable for both skill development and communication in education, helping students access a broader range of knowledge and promoting interaction with educational materials. The integration of ICT into teaching geography, for example, has shown to enhance students' understanding of spatial relationships and improve their problem-solving abilities (Haywood & Hutchings, 2004).

The professional development of teachers is essential in ensuring the effective use of ICT in classrooms. Effective teaching requires a combination of personal traits and professional skills, including decision-making, diverse teaching techniques, and the ability to create a positive learning environment. Teacher development must be continuous, allowing educators to adapt to new technologies and teaching methods. In Tanzania, the Teacher Development Management Strategy (TDMS, 2007) aims to support this growth, yet studies suggest that teachers often lack opportunities for regular professional development, which limits their ability to deliver effective education. Continuous teacher training, particularly in ICT integration, is necessary to improve teaching outcomes, as outlined by Parish (2018). Without these opportunities, teachers are unable to meet the evolving demands of education, particularly in areas such as ICT integration, which plays a critical role in modern education.

3. METHODOLOGY

The study employed a mixed research approach with a cross-sectional survey design, involving a sample of four school heads, twenty teachers from four schools, 502 Form Three and Four students, and five education officers, totaling 531 participants. Sample sizes for teachers and students were determined using Kerlinger's formula, selecting 10% of the population.

Data sources included both primary and secondary. Secondary data were collected through documentary reviews, encompassing relevant journals, books, and empirical studies. Primary data were gathered using structured questionnaires, an observation schedule, and an interview guide. Validity of the research instruments was ensured through expert review for face and content validity, while reliability was assessed using the split-half method to evaluate the internal consistency of the questionnaires by comparing results from divided item groups. Quantitative data were analyzed using SPSS and presented in tables, whereas qualitative data were examined through content analysis. Findings were organized according to the study objectives, with recommendations for further research included. Participants volunteered after being informed about the research's importance, and the researcher maintained the confidentiality of respondents' information, upholding their rights and protecting sensitive data to avoid harm.

4. FINDINGS AND DISCUSSIONS

The findings of this study are organized into several key themes that address the core objectives of ICT integration in Geography education. First, the availability of ICT resources in Ubungo Municipality's public secondary schools is assessed, revealing significant disparities that affect how effectively ICT is incorporated into teaching. The second theme explores the utilization of ICT in Geography classes, highlighting the varying degrees of ICT use and the challenges that limit its full integration. The third theme focuses on ICT's role in enhancing student engagement and learning outcomes, demonstrating how digital tools can make Geography lessons more interactive and improve student understanding. The fourth theme examines how ICT fosters collaboration and communication among students, particularly in group projects, and the final theme discusses the theoretical and empirical implications of these findings, linking them to Vygotsky's Social Development Theory and addressing the broader impact on educational inequality and policy considerations.

Availability of ICT Resources

The findings of this study demonstrate a significant gap between the policy objectives of ICT integration in Tanzanian schools and the actual availability of resources in Ubungo Municipality. While the Tanzanian government's ICT Policy for Basic Education (URT, 2007) emphasizes the provision of ICT infrastructure to enhance teaching and learning, the data reveal that 54% of Geography teachers do not use any ICT tools in their lessons, and only 9% use them regularly. This aligns with the work of Ngeze (2017), who identified that many schools in Tanzania, particularly in underfunded regions, face resource constraints that impede the effective integration of ICT into the curriculum.

This lack of access highlights critical inequities within the education system. Schools that have ICT resources are better positioned to engage students with interactive learning tools, while those without such resources remain entrenched in traditional, less effective teaching methods. This disparity echoes the concerns of Warschauer and Matuchniak (2010), who argued that unequal access to technology in schools exacerbates educational inequalities. These findings suggest that the Tanzanian government's investment in ICT infrastructure, while commendable, has been insufficient in addressing the practical challenges faced by many schools in ensuring the availability of up-to-date and functional ICT resources.

Furthermore, the uneven access to ICT tools can be understood through the lens of Vygotsky's Social Development Theory, particularly the concept of the Zone of Proximal Development (ZPD). ICT tools, when available, can act as mediators within a student's ZPD, offering the scaffolding needed to advance learning. However, without these tools, students are left without the necessary cognitive support to engage with complex geographical concepts. Thus, the current lack of ICT resources severely limits students' potential to benefit from constructivist learning opportunities.

Utilization of ICT in Geography Classes

The findings reveal stark contrasts in how ICT is utilized across schools, reflecting broader challenges in the professional development of teachers and the provision of adequate training. While 70.9% of respondents indicated that ICT is used "always" in Geography lessons, the remaining 29.1% either do not use ICT at all or use it sporadically. This finding supports Mgaya and Mgaya's (2019) assertion that Tanzanian schools face difficulties in consistently integrating ICT due to a lack of teacher training and insufficient technical support.

Where ICT is effectively used, it enhances the teaching of Geography by enabling students to interact with Geographic Information Systems (GIS), digital maps, and other spatial analysis tools. These technologies allow students to visualize geographical phenomena and develop critical thinking skills, a conclusion supported by Chirwa and Mubita (2021). However, as the data also show, the full potential of ICT is not realized due to infrastructural challenges and the irregular use of technology. This echoes the findings of Sedoyeka and Gafufen (2013), who pointed to a lack of ongoing technical support as a significant barrier to the sustained integration of ICT in Tanzanian classrooms.

These findings are also consistent with Vygotsky's concept of the More Knowledgeable Other (MKO), wherein ICT tools, such as GIS, serve as the "expert" that assists students in progressing beyond their current knowledge. In schools where ICT is regularly utilized, students benefit from these MKOs, accessing advanced learning opportunities that foster spatial reasoning and problem-solving. However, in schools with limited or no ICT integration, students are deprived of these opportunities, highlighting the critical role that teacher training and infrastructure development play in promoting equitable access to these cognitive tools.

ICT's Role in Enhancing Student Engagement and Learning Outcomes

The study underscores the positive role of ICT in making Geography lessons more engaging, with 67% of respondents affirming that ICT makes lessons more interesting and interactive. This is consistent with the work of Kilimora (2015), who noted that ICT tools, such as digital maps, virtual simulations, and multimedia presentations, enhance student interest and motivation by transforming abstract geographical concepts into engaging, visual experiences.

However, despite these positive findings, a significant portion of students reported inconsistent access to ICT, which hinders their ability to benefit from such engaging learning environments. This supports Schleicher's (2019) argument that unequal access to technology creates a "digital divide," where students in resource-poor schools are unable to engage in modern, interactive learning processes. The disparity in ICT use across Ubungo Municipality reflects a broader issue in Tanzanian education, where resource limitations prevent many schools from realizing the full benefits of ICT integration.

From a theoretical standpoint, the positive impact of ICT on student engagement can be explained by Vygotsky's concept of scaffolding within the ZPD. ICT tools act as scaffolds that enable students to access more advanced knowledge and skills than they could achieve independently. By providing interactive, real-time learning experiences, technologies such as GIS and virtual simulations help students develop a deeper understanding of geographical processes. However, in the absence of such tools, students are left to rely on more passive learning methods, which may not adequately challenge their cognitive development.

Contribution of ICT to Collaboration and Communication

One of the most significant findings is the role of ICT in fostering collaboration and communication among students. An overwhelming 84% of respondents indicated that ICT consistently facilitates collaboration in Geography projects. This supports the findings of Johnson and Johnson (2009), who argued that collaborative learning environments enhanced by ICT tools lead to improved problem-solving, critical thinking, and teamwork skills.

Through platforms such as Google Docs, WhatsApp, and other collaborative software, students are able to work together on assignments, even from remote locations. This fosters a more dynamic and inclusive learning environment, where students can engage with their peers and learn from each other's perspectives. From a Vygotskian perspective, this reflects the importance of social interaction in cognitive development, as students working collaboratively within their ZPD can extend their knowledge and skills by learning from their peers, who act as MKOs.

However, the study also highlights critical challenges. A notable 16% of students reported limited or no access to ICT tools for collaboration, indicating that infrastructure limitations continue to hinder the full realization of ICT's collaborative potential. This echoes the findings of Clark et al. (2018), who found that barriers such as the digital divide and unequal resource distribution prevent many students from accessing the full benefits of ICT-enabled collaboration.

5. THEORETICAL AND EMPIRICAL IMPLICATIONS OF THE STUDY' FINDINGS

The findings of this study strongly align with Vygotsky's Social Development Theory and underscore the importance of ICT as a mediating tool for cognitive development. In classrooms where ICT is available and effectively utilized, students are exposed to more interactive and collaborative learning environments, which foster deeper engagement with geographical content. The role of ICT as a scaffold within the ZPD is particularly evident, as these tools allow students to access complex geographical data and simulations that would otherwise be inaccessible.

However, the significant disparities in ICT access and utilization across Ubungo Municipality highlight the limitations of current educational policies. The findings suggest that while ICT can be a powerful tool for enhancing teaching and learning, its potential is undermined by infrastructural weaknesses and insufficient teacher training. These challenges must be addressed if the transformative benefits of ICT are to be realized across all schools, not just those that are well-resourced.

Moreover, the study's findings highlight the broader issue of educational inequality in Tanzania. The uneven distribution of ICT resources perpetuates a digital divide that limits the opportunities available to students in underfunded schools. This reinforces Schleicher's (2019) assertion that access to technology is a critical determinant of educational success in the 21st century. If the Tanzanian government is to fulfill its commitment to improving educational outcomes through ICT integration, targeted investments in infrastructure, professional development, and equitable resource distribution are essential.

6. CONCLUSION AND RECOMMENDATIONS

This study highlights the critical role of ICT in enhancing the teaching and learning of Geography in public secondary schools within Ubungo Municipality. While the potential of ICT to transform education is evident, significant challenges remain in terms of resource availability, consistent usage, and the necessary support for both teachers and students. The findings reveal a stark divide between schools that have access to functional ICT tools and those that do not, with many educators unable to integrate ICT into their teaching due to a lack of up-to-date equipment and insufficient training. This inequitable access underscores the need for a more systematic approach to ICT integration, as current efforts have not been uniformly successful across all schools.

ICT has proven to be a powerful tool in fostering student engagement, improving understanding of complex geographical concepts, and promoting collaborative learning. However, these benefits are often limited to schools that are adequately equipped with modern technology and where teachers have received the necessary training to effectively utilize these tools. The inconsistent use of ICT across schools not only impairs students' learning experiences but also exacerbates educational inequalities. Students in resource-rich environments are able to engage more deeply with interactive tools like GIS, while their peers in under-resourced schools struggle to keep pace with more traditional, passive learning methods.

To address these challenges, two key recommendations are proposed. First, the government and educational stakeholders should prioritize improving ICT infrastructure in all schools. This includes ensuring schools have up-to-date computers, reliable internet access, and tools like Geographic Information Systems (GIS). A targeted investment strategy is essential to bridge the digital divide and provide equal opportunities for all students.

Secondly, strengthening teacher professional development is crucial. Continuous training programs should be established to enhance teachers' ICT competencies and equip them with strategies to effectively integrate technology into Geography lessons. This will not only improve teaching outcomes but also ensure that ICT is used consistently and meaningfully across all schools.

By focusing on these two areas—ICT infrastructure and teacher development—significant progress can be made towards creating a more inclusive and effective educational environment, where the benefits of ICT are accessible to all students.

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