

INTEGRATION OF TECHNOLOGY IN GEOGRAPHY LEARNING: EVIDENCE FROM PUBLIC SECONDARY SCHOOLS IN MOROGORO MUNICIPALITY, TANZANIA

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ABSTRACT

This study explores the use of technology tools in teaching and learning Geography in public secondary schools in Morogoro Municipality, Tanzania. From a Constructivist Learning Theory perspective, which maintains that knowledge is constructed through active interaction and experience, (Piaget, 1936; Vygotsky, 1978). This study employed a pragmatic paradigm and convergent mixed-methods design. Quantitative data were collected from 110 students using structured questionnaires, while qualitative data were obtained through semi-structured interviews with 10 Geography teachers and 8 school heads. The reliability of the questionnaire was ensured at 0.723 Cronbach's Alpha, while its content validity was checked by experts and pre-tested to ensure that it measured what it intended to measure. Quantitative data were analyzed using descriptive statistics, that is, frequencies, percentages, and means, through SPSS software, while qualitative data were analyzed for themes. Ethical considerations: informed consent, confidentiality, and anonymizing institutions and participants. Results indicate that though computers, projectors, smartphones, tablets, and online platforms (YouTube, Google Earth) are mainly used to enhance the visualization of concepts and student engagement, their effective use is constrained by inadequate infrastructure, mostly unreliable electricity and internet, and limited training of teachers. Therefore, the study suggests increased investment in ICT infrastructure, teacher professional development, and revision of curricula to support technology-enhanced learning and teaching of Geography for attaining Sustainable Development Goal 4.

Keywords: Technology integration, Geography Subject, Public secondary schools, ICT.

1. INTRODUCTION

Technology, particularly Information and Communication Technology, has become an increasingly important agent of change in modern educational settings, fundamentally altering how knowledge is accessed, delivered, and experienced (Liao & Cao, 2025).

Digital aids, such as GIS, online maps, simulations, and several other interactive applications, have opened new avenues in Geography teaching, making learning more active, participatory, and student-centered (Kerski, 2023). These tools provide immediate access to a wide range of resources, fostering independent inquiry, critical thinking, and a deeper understanding of spatial and environmental concepts (Demeuov et al., 2021). In this context, modern education needs to determine which concrete technological tools are specifically used in public secondary schools for Geography instruction, since this also underlines their contribution to enhancing learning

outcomes and also provides an opportunity to develop more inclusive and efficient learning processes (Mirsharapovna, 2022).

1.1 Statement of the problem

In the teaching and learning of geography in public secondary schools, several technological tools have been identified to enhance student engagement and improve learning outcomes. These tools include Geographic Information Systems, interactive maps, computer simulations, and other digital platforms to enhance visualization and interactivity in the teaching and learning of geography in public secondary schools (Tuma, 2021). However, this is limited within the Tanzanian context because, among other reasons, resources are not readily available, teachers have received inadequate training, there is poor digital preparedness of schools, and there are a number of infrastructural hurdles. It is important first to identify the technology tools currently in use to understand their role in supporting effective geography education within public secondary schools.

1.2 Research Objective

To identify various Technology tools employed in learning the geography subject in public secondary schools.

1.3 Research Question

What technological tools are utilized in teaching geography in public secondary schools?

1.4 Theoretical Framework.

This study adopts the Constructivist Learning Theory developed by Jean Piaget (1936) and later refined by Lev Vygotsky (1978), which views learners as actively building knowledge through experience, exploration, and interaction with their environment (Sasan & Rabillas, 2022). Within the context of geography education, the theory provides a strong framework for understanding the role of technology tools in encouraging active and student-centered learning. Technologies such as Geographic Information Systems, virtual fieldwork, digital maps, and multimedia applications support inquiry-based learning by giving students the opportunity to explore, analyze, and interpret spatial information in purposeful ways. These will facilitate collaboration, critical thinking, and problem-solving, transforming the classroom from a teacher-centered environment into an active space for participative learning (McKenzie, 2022). Through real-world learning tasks and interactive digital learning resources, students further develop their geographic knowledge and skills in data and spatial reasoning. Such constructivist approaches present some difficulties when considered against others, in terms of assessment and time management, but they do offer scope for showing how technology can seriously enhance access and depth of learning in geography education within public secondary schools.

2. METHODOLOGY

The study adopted a pragmatic philosophical stance and a mixed-methods approach to identify various technology tools used in teaching geography in public secondary schools. In this regard, pragmatism is appropriate, as it focuses on practical inquiry into how technological tools are actually implemented in the classroom. A convergent mixed-methods design was adopted in which quantitative and qualitative data would be collected concurrently to provide a comprehensive understanding of the problem statement. Quantitative data were collected using descriptive surveys

that included 110 students in order to establish the frequency and types of technologies used. Qualitative data were sought through interviews with 10 geography teachers and 8 school heads to understand their experiences in integrating technology in teaching geography. The Morogoro Municipality was chosen because of its diverse educational contexts, coupled with varying technological infrastructure across all public secondary schools. Sampling of students was done using stratified random sampling, which considered different schools to ensure that the sample was representative, while purposive sampling targeted teachers and school heads for their expertise. The tools used to collect data were structured questionnaires and semi-structured interviews, both of which had been validated through expert review and piloting. Reliability was assured at a Cronbach's Alpha of 0.723, which indicates acceptable internal consistency. Quantitative data were analyzed descriptively using means, frequencies, and percentages with SPSS to ascertain patterns in the types of technology tools and their frequency of use. Qualitative responses were analyzed thematically to find patterns in the types and usage of technology tools. Throughout the study, ethical considerations were upheld through informed consent by respondents, assurance of confidentiality, and anonymizing school institutional identity. In so doing, the methodological approach sets the study to realize its aim of establishing credible and complete findings on the technological tools that support teaching and learning geography in Tanzanian public secondary schools.

2.1. Significance of The Study

The contribution of this manuscript therefore lies in an understanding of the technological landscape that supports the teaching and learning of geography in public secondary schools within Morogoro Municipality, Tanzania. By establishing the current technology tools being utilized, its findings make for valuable recommendations for educators, policy planners, and curriculum developers who look forward to the integration of digital technologies into instructional practices. For teachers, this study uncovers a wealth of knowledge about effective resources that enhance lesson delivery, visualization of spatial concepts, and student engagement in geography classrooms. These resources include GIS software, projectors, computers, and online learning platforms. For students, the study shows how these technologies motivate students toward active learning, acquiring a deeper understanding of geographical phenomena. Policymakers and education administrators should take these results to motivate strategic planning and investment in ICT infrastructure and professional growth opportunities for teachers to ensure equity in access to digital technologies across schools. Finally, this study contributes to the growing literature on educational technology in geography by providing empirical data important for the attainment of quality, inclusive education in the call for Sustainable Development Goal 4 (SDG 4) in Tanzania.

3. FINDING AND DISCUSSIONS

The main objective of the study was to identify different technology tools used in teaching and learning Geography in public secondary schools in Morogoro Municipality, Tanzania. The findings revealed that in Geography lessons, both teachers and students employed various technological tools, including computers, tablets, smartphones, projectors, printers, and online platforms like YouTube and Google Earth. However, their adoption is constrained by poor infrastructure, inconsistent access to the Internet, and insufficient teacher training.

3.1 Integration of Technology Tools in Geography Education

The findings indicated that technology has become an integral component of teaching Geography in public secondary schools, although it is used differently. Assisting in making such lessons appealing, teachers make use of computers, projectors, and smartphones to display maps and diagrams to better help explain complex geographical concepts. This finding corroborates the earlier studies by Otieno (2022) and Mkilamwe (2023) who established that integration of ICT in Geography enhances the learning of the subject through improved visualization and analysis of spatial data in real time.

The study also found that digital devices fostered collaboration, creativity, and inquiry-based learning-tGetMapping for the Constructivist Learning Theory (Piaget, 1936; Vygotsky, 1978). Constructivism postulates that learners construct knowledge through interaction and experience. The observed improvements in students' participation and motivation, therefore, align with the notion that technology fosters active learning by enabling students to explore, analyze, and interpret geographical data within authentic contexts.

3.2 Role of Online Resources in Enhancing Learning

The study established that online tools, especially YouTube, Google Earth, and educational websites, are increasingly being used to support learning in Geography. These offer students a wide array of global resources to visualize landforms, climatic conditions, and interactions between humans and the environment. Similar findings have been reported by Rigdel et al. (2023). However, it also highlighted a number of barriers to equitable utilization-particularly a lack of access to the internet and digital devices. Schools with better ICT infrastructures proved to utilize more technology integration than those schools without connectivity and electricity, relying on traditional teaching methods. This corroborates the infrastructural inequalities put forward by Abedi, 2024. He reports that poorly resourced Tanzanian schools are unable to sustain ICT-based teaching despite policy initiatives like the Digital Tanzania Program.

3.3 Technology as a Catalyst for Student Engagement and Performance

These results indicated that the presence of computers and tablets in classrooms enhances students' engagement and achievement. Students taught with the use of digital tools were more enthusiastic, focused, and understanding compared to those students who were taught by using traditional textbooks. This finding agrees with Lestari & Suryani (2023), who found a positive correlation between access to ICT and students' motivation to learn, especially in subjects requiring visualization such as Geography. Also, the usage of interactive technologies, like multimedia maps and simulation software, transforms learning from being passively received to actively explored. This transformation embodies the principle of knowledge co-construction in Constructivist Learning Theory, wherein students engage with the teacher and their peers in solving problems, interpreting spatial data, and reflecting on real-world phenomena (Huang, 2021; Sasan & Rabillas, 2022).

3.4 Comparison of Technology-Based and Textbook-Based Learning

Respondents strongly agreed that the use of technology facilitates a better understanding of Geography than textbooks. Digital media, including videos, animations, and virtual field trips, were noted to transform rather abstract concepts into more tangible, accessible ideas. This simply coincides with the study conducted by Ntawigaya and Kinwiko (2024), which found that technology-based learning enhances the comprehension of and retention in Tanzanian secondary

students. Further, Mkilamwe (2023) has illustrated that real-time visualization tools enable learners to analyze geographical data more critically than static materials can. According to the teachers, when lessons are embellished with videos and interactive software, learners become even more curious about the subject matter and confident in their learning. This suggests that digital tools not only help improve cognitive understanding but also affective and behavioral engagement—these are three core dimensions of student engagement identified by Wong et al. (2024).

3.5 Challenges Affecting Technology Integration

While the advantages of technology integration in Geography education are clear, a set of barriers still hinders the complete realization of technology. The most critical constraints identified are insufficient ICT facilities, unreliable power supply, poor internet connectivity, and inadequate teacher training. These findings align with previous studies by Minga and Ghosh (2024), who emphasized that infrastructure and capacity-building continue to be one of the biggest challenges facing the public education sector in sub-Saharan Africa.

At the same time, interview data showed that even in schools with technological tools, the absence of in-service training programs restricts teacher capacity to effectively integrate technology into their pedagogy. Further, large class sizes and general lack of technical support have often made continued use of the digital tool unfeasible. Such persistent challenges clearly indicate a comprehensive policy and investment approach that supports equitable access and utilization.

4. CONCLUSIONS OF THE STUDY

In sum, the present study illustrated that inclusion of such technological tools as computers, tablets, smartphones, projectors, and internet-based tools like YouTube and Google Earth significantly improves the teaching and learning of Geography in public secondary schools in Morogoro Municipality, Tanzania. These tools make lessons of Geography more interactive and engaging; this subject becomes more effective in developing students' comprehension of complex geographical concepts, as well as their motivation and active participation. However, despite these benefits, challenges such as inadequate ICT infrastructure, limited internet connectivity, and insufficient teacher training hinder full implementation. Therefore, the findings indicate that technology can transform Geography education when effectively supported with infrastructure investment, relevant professional development for educators, and supportive policies to increase the potential for the sustainable integration of digital tools within educational contexts.

5. RECOMMENDATION OF THE STUDY

5.1 Recommendations for Policy Formulation

MoEST should give priority to expanding and maintaining ICT infrastructure in all public secondary schools by providing adequate funds that can ensure reliable electricity supply, stable internet connectivity, and necessary digital tools like computers, tablets, and projectors. Regarding this, the government should issue a clear national policy that supports the use of technology in Geography and other subjects' teaching, in line with the Tanzania Education Sector Development Plan and the SDG 4 on quality education.

Strengthening partnerships with non-governmental organizations, international agencies, and the private sector is needed to mobilize resources, provide professional development, and ensure the sustainability of technological initiatives in schools.

5.2 Recommendations at the School Level

The school administrations should provide functional digital resource centers accessible to both teachers and students, equipped with devices and digital learning materials relevant to Geography. Administrators should also encourage the use of online learning platforms such as Google Earth, YouTube, and open-access geography websites to supplement classroom instruction and promote self-directed learning. Continuous professional development programs focusing on digital pedagogy should be instituted at the school and district levels to enhance teachers' technological competence and confidence in integrating ICT into their teaching practices.

5.3 Recommendations for Curriculum and Pedagogical Development

The geography curriculum needs revision so as to include technology-based activities such as virtual field trips, GIS-based analysis exercises, and multimedia assignments that encourage experiential or inquiry-driven learning. Teaching-learning materials should also be updated in relation to current digital contexts so that their relevance may be ensured for educators and learners alike. Educators should be encouraged to adopt learner-centered, technology-enhanced teaching approaches that foster collaboration, creativity, and problem-solving among students.

5.4 Recommendations for Future Research

Further research is needed to establish long-term impacts on students' academic performance and retention within Geography. In fact, comparative studies between rural and urban schools concerning issues of access, use, and impacts of instructional technologies should be undertaken to reveal contextual differences. Future studies are also needed to expand the scope beyond geography and explore how engagement with technology tools impacts learning outcomes in other secondary school subjects.

CONSENT

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The author (s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES.

Abedi, E. A. (2024). Tensions between technology integration practices of teachers and ICT in education policy expectations: implications for change in teacher knowledge, beliefs and teaching practices. *Journal of computers in education*, 11(4), 1215-1234.

- Demeuov, A., Tilekova, Z., Tokpanov, Y., Hanchuk, O., Panteleeva, N., & Varfolomyeyeva, I. (2021). Use of GIS technology in geographical education.
- Huang, Y. C. (2021, May). Comparison and contrast of Piaget and Vygotsky's Theories. In *7th International Conference on Humanities and Social Science Research (ICHSSR 2021)* (pp. 28-32). Atlantis Press.
- Kerski, J. J. (2023). Teaching and learning geography with a web GIS approach. In *Re-visioning Geography: Supporting the SDGs in the post-COVID era* (pp. 113-135). Cham: Springer International Publishing.
- Lestari, S. D., Ahmad, A., & Suryani, N. (2022). Exploring students' motivation in geography online learning. In *Teacher Education and Teacher Professional Development in the COVID-19 Turn* (pp. 112-119). Routledge.
- Liao, X., & Cao, P. (2025). Digital media entertainment technology based on artificial intelligence robot in art teaching simulation. *Entertainment Computing*, 52, 100792.
- McKenzie, P., Cook, S., & Roulston, S. (2022). Learners as teachers—Teachers as learners: A collaborative approach to develop skills in GIS education. *The Geography Teacher*, 19(1), 4-11.
- Minga, C., & Ghosh, S. (2024). Student Perceptions on ICT Use in Teaching and Learning in Public Secondary Schools in Mbeya District, Tanzania. *Journal of Education, Society and Behavioural Science*, 37(6), 26-39
- Mirsharapovna, S. Z., Shadjalilovna, S. M., Kakhramonovich, A. A., & Malikovna, K. R. N. (2022). Pros and Cons of Computer Technologies in Education. *Texas Journal of Multidisciplinary Studies*, 14, 26-29.
- Mkilamwe, P. (2023). *Assessing The Role of Information Communication Technology (ICT) on Secondary School Students' Academic Performance in Tanzania* (Doctoral dissertation, IAA).
- Obidovna, D. Z. (2024). Advancing pedagogical approaches: leveraging artificial intelligence technologies to enhance the integration of english and latin language instructional methods. *Central Asian Journal of Multidisciplinary Research and Management Studies*, 1(2), 19-23.
- Otieno, F. (2022). *Factors Influencing Integration of Information Communication Technology in Teaching Geography in Secondary Schools in Rachuonyo South Sub-county, Kenya* (Doctoral dissertation, University of Nairobi).
- Rigdel, K. S., Dorji, S., & Rai, D. M. (2023). Effectiveness of YouTube as a supplementary material to enhance the students' learning achievement in geography. *Asian Journal of Education and Social Studies*, 47(3), 53-72.
- Sasan, J. M., & Rabillas, A. R. (2022). Enhancing English proficiency for Filipinos through a multimedia approach based on constructivist learning theory: a review. *Science and Education*, 3(8), 45-58.
- Tuma, F. (2021). The use of educational technology for interactive teaching in lectures. *Annals of Medicine and Surgery*, 62, 231-235.
- Wong, F., Zheng, E. J., Valeri, J. A., Donghia, N. M., Anahtar, M. N., Omori, S., ... & Collins, J. J. (2024). Discovery of a structural class of antibiotics with explainable deep learning. *Nature*, 626(7997), 177-185.

