Integration of ICTs in the Teaching and Learning of Mathematics at Primary School Level

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ABSTRACT

This study investigated the integration of Information Communication Technology (ICT) in the teaching and learning of primary Mathematics. In particular, the objectives of the study were to identify ICT teaching and learning materials available for teaching and learning Mathematics in Pemba, how these ICTs were being utilized in Mathematics instruction and what challenges teachers faced in integrating ICT in the teaching of Mathematics to improve the delivery of lessons. The research utilized a case study design. Purposive sampling was used to select participants, including headteachers, deputy headteachers, senior teachers, and 24 teachers. Interview guides, one-on-one questionnaires and lesson observations were used to collect data. Thematic analysis was used to analyse the data. Transcripts were coded to identify recurring themes and patterns, elucidating the experiences and challenges faced by participants. The study findings showed that apart from IRI radios and Let's Read tablets, there was low availability of ICT and its integration in teaching and learning Mathematics. Among others, the study recommended that the Ministry of Education should train primary school teachers in integrating ICT and provide suitable teaching and learning materials such as interactive boards, maths-related games and software applications with Mathematics content and ensure effective support and maintenance of the ICT infrastructure.

Keywords: ICT, Mathematics Education, Learning and Teaching, Primary Schools, Integration

INTRODUCTION

Integrating Information and Communication Technologies (ICTs) in education has become increasingly important in today's digital age. Integration of ICT in education refers to the use of computer-based communication (Rachmawati, 2019; Viberg, Gronlund & Aderson, 2020). This is particularly true in Mathematics Education at the primary level. Primary education is the largest sub-sector of the education system in Zambia. It offers a unique opportunity to contribute to the transformation of societies through the education of the young by engaging in technological activities at this tender age. Using ICTs in teaching and learning Mathematics can enhance students' understanding, engagement and achievement in this critical subject (Pierson, 2021).

The integration of ICTs in the teaching and learning of Mathematics at the primary level has been the subject of several studies. Viberg, Gronlund & Aderson, (2020) conducted a case study in Singapore to investigate the integration of ICT in teaching English and Mathematics at the primary level. The study found that teachers' beliefs in the potential of ICT and their personal ICT conceptions influenced the frequency of ICT usage in the classroom. English teachers were reported to have a higher frequency of ICT use than Mathematics teachers. The study also revealed differences in the pedagogical approaches adopted by English and Mathematics teachers, with English teachers more likely to adopt learning "from" the ICT approach (Tay et al., 2012).

To create efficient systems and policies that will benefit learners and learning outcomes, the Ministry of Education has invested significant resources and experience in this area (National ICT Policy, 2023). Zambia's overall development is governed by Vision 2030, which is a long-term development blueprint aiming to transform the country into a prosperous middle-income nation by the year 2030 (SNDP, 2016). Developing a society based on information is one of its main objectives. "Accelerating development efforts towards Vision

2030, without leaving anyone behind," reads the document. Vision 2030 also calls for a flexible curriculum considering innovative teaching approaches and a solid general education foundation in science and technology. ICT is essential to this aspect of national development.

Through the Ministry of Education, the government has made pronouncements to enhance the integration of ICT in teaching and learning. To this end, the government intends to effectively ensure that teachers and learners use ICT through the existing ICT policy from primary to tertiary education (Nyambe, 2020). The move saw the introduction of ICT lessons in schools by the Ministry of Education following the revision of the school curriculum in 2013 (MOE, 2014). This has resulted in the need to embrace change to reflect the changing social, political and economic landscape. In this case, the classroom becomes the first port of call to realize this dynamism. The appropriate infusion of technology into teaching and learning is critical for this change.

The implementation of the National ICT Policy marked a significant development in the field of education. The Zambian National ICT Policy views the adoption of ICTs in education as a strategic issue for national development, and this is reflected in the goal of the education sector during the 2012–2015 National Implementation Framework III in support of the Strategic National Development Plan (SNDP) (National ICT Policy, 2023). Both plans sought to increase equitable access to high-quality education and skill-building programme to improve human capacity for sustainable national development. In the context of this goal, the strategic focus of the education and skills sector, as specified in the SNDP, is to put ICT at the centre of all learning.

To fulfil the plan for curriculum review at the primary level, the government integrated ICTs into the primary education curriculum in 2014. The government's move to incorporate ICTs in primary schools is a realization of ICTs as a tool for effective teaching and learning in schools (National ICT Policy, 2023). Indeed, one cannot refute that ICT can play an essential role in the educational sector by improving access to information (one of the significant problems in Zambian education), the quality of education and its management.

According to the National ICT Policy (2023), a very pertinent tool in realizing the educational needs of every nation is the curriculum. However, the Zambian primary education system curriculum did not support ICTs at the primary level until 2014. Therefore, adopting and integrating ICTs into the primary school curriculum can offer high-quality education that will enable Zambia as a country to realize the objectives of Vision 2030 (Comber, Fisher, & Lewin, 2022). In support, MOE's report on ICTs pointed out that "our society is being transformed by continuously evolving technologies that are changing the way we do things at the most fundamental levels. ICT can help foster the Ministry of Education's goal of encouraging learner-centred teaching methods" (MoGE, 2016)

ICT integration in Mathematics is not like any other subject matter that can be taught under a tree or anywhere else using a computer. It needs special knowledge because of the nature of the materials that are involved in math-related teaching and learning. In short, central to all is the government's will and directives. Therefore, both governments and educators all around the world have recognized the exceptional promise of ICT integration in the teaching and learning of Mathematics to foster teaching and learning in primary schools. However, it is important to note that for ICT integration to enhance teaching and learning, it needs to be supported by education and school policies and effective professional development for teachers.

While ICT is necessary for Zambian Education, effective integration is another issue because of several challenges met in the due course. If not correctly integrated, consequent to lack of equipment and inadequate capacity by teachers, the whole purpose of the programme would not be achieved. From this premise, this research was undertaken, and it helped to ascertain the integration of ICTs in the teaching and learning of Mathematics at the primary level. Merely integrating technology into the curriculum will not improve learners' performance, but a thoughtful and appropriate selection of how and where technology should be integrated is essential.

Statement of the Problem

Researchers have been highlighting the potential of ICTs to support mathematics learning when used together

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with good pedagogy for a few decades now. Research has shown that students utilize ICT tools less frequently in classroom settings than in non-academic ones (Tangney, 2017). The use of tablets, calculators, projectors and other technologies in teaching Mathematics makes it more fun and engaging for learners. The learners construct knowledge and engage in collaborative learning experiences facilitated by ICT tools (Simina & Hamel, 2015). Additionally, the ICTs promote active learning, problem-solving and critical thinking in Mathematics Education (LEONG, 2022).

The Ministry of Education recognizes the role of ICT in education through its policies. ICT in education is recognized as the natural platform for equipping citizens with skills for dynamic and sustainable economic growth (Nyemba, 2020). If the country fails to integrate ICT in the teaching and learning of mathematics at the primary level, it risks severe global marginalization. Despite the knowledge of the potential benefits of integrating ICTs in mathematics education, there is little research regarding ICT integration in teaching and learning Mathematics at the primary level in Pemba district. Little, if any, is known about how ICTs are integrated into the teaching and learning of Mathematics at the primary level.

This study was conducted to investigate the integration of ICT tools available to primary schools in Pemba district and enhance the teaching and learning of Mathematics. In this regard, studying the role of the ICT tools used in teaching and learning Mathematics is crucial because this research could guide ways to encourage greater technology use in Mathematics lessons.

Purpose of the Study

This study was purposed to investigate the integration of ICTs in the Teaching and Learning of Mathematics at the Primary Level in selected schools of Pemba District in Southern Province.

Main Research Question

How are ICTs integrated into the teaching and learning of Mathematics at the primary education level in Pemba district?

Research Questions

- What ICT devices are available for teaching and learning Mathematics in Pemba district schools?
- How are ICTs used in teaching and learning Mathematics in primary schools?
- What challenges do teachers face in integrating ICT in the teaching of Mathematics in Pemba district schools?

Research Hypothesis

The integration of Information and Communication Technology (ICT) in mathematics education offers numerous benefits. It enables differentiated instruction, catering to diverse learning needs and leading to improved student outcomes. ICT also enhances student engagement and motivation, surpassing traditional teaching methods. Furthermore, primary mathematics teachers with advanced ICT skills are more effective in boosting learner performance. Ultimately, the strategic use of ICT in mathematics education can significantly elevate learner achievement.

METHODOLOGY

The study was carried out in Pemba District of Zambia. A qualitative research approach was adopted to capture the rich experiences and perspectives of both practising teachers and administrators regarding ICT integration in mathematics education. It employed a single-method approach using a case study design (Creswell and Creswell, 2023).

A single case study design was used to investigate the specific detailed gadgets available, challenges, and

strategies related to ICT integration in Mathematics education at the primary level. It provides an in-depth understanding of tools availability, teachers' pedagogical approaches, learners' engagement and learning experiences, and the contextual factors that influence the effective integration of ICTs (Creswell, 2014). Through the use of this research design, the researcher was able to provide insights into the why and how of the study and also because the study focused on the way primary school teachers interpret and make sense of their experiences with ICTs in the teaching of Mathematics at primary level (Creswell and Creswell, 2018).

The instruments that were used in collecting data were the interview guide for the one-to-one discussion with the Administrators (Headteachers or Deputy Headteachers) and an open-ended questionnaire for the teachers, respectively. To ensure the reliability and validity of the data collected, the interview instrument underwent rigorous validation. A pilot study involving 2 primary school teachers was conducted to test the interview instrument's face validity. was assessed using the test-retest method. A subset of 3 teachers was re-interviewed after a 2-week interval, and their responses were compared to the initial interview. The results showed a high degree of consistency, with a reliability coefficient of 0.85. The validity coefficient was calculated using the content validity index (CVI). The CVI score was 0.92, indicating a high level of content validity.

A digital video camera was used to capture sample videos and pictures, which was used during analysis, and the phone to record some conversations with Headteachers. The data were transcribed and coded. The transcribed and coded data were presented and described under four major themes.

Limitation of the study

Some barriers confront teachers personally when they become agents of ICT-driven innovations in the teaching of Mathematics. Fear of technology grows from the fear of the unknown, the unknowable, and ultimately from not being in charge of the unfamiliar. Fear of technology therefore reflects an unfamiliarity with technology, a low level of confidence in its use, and an unseen, mystic power that technology is purported to hold (Hamlaoui, 2021)

FINDINGS AND DISCUSSION

Demographic representation of participants

Characteristics	**Participants**	**n=33**
Gender	Male	18
	Female	15
Residential distribution	Peri-urban	11
	urban	1
	Rural	21
Profile demographic	Administrators	8
	Teachers	24
	DEBO representation	1
Teaching Experience	<5 years	8
	5-10 years	10
	>10 years	15

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Out of the 33 teachers interviewed 18 were male and 15 were female. The distribution of participants by their residential area indicated that, of the 33 participants, 11 were from the 3 peril-urban schools and the District Education Board Officer resided in a high-density residential area, 22 indicated coming from the low-density residential areas.

The longest-serving teachers were 10 in number accounting for 10. However, it was found that 8 participants had worked for less than 5 years which was significantly lower than the number of teachers who had worked between 5 years up to 10 years which in this case were 15.

Availability of ICT Materials for Teaching and Learning

This question aimed to understand the availability of ICTs in schools. The researchers looked at the availability of teaching and learning materials in primary schools as it was necessary to ascertain whether there were enough ICTs for effective implementation in primary schools. The teachers were asked if ICTs were available to teach Mathematics in their respective schools. From the data collection checklist and one-on-one interviews conducted with the 20 teachers, it was found that the common ICT materials used were radios and tablets.

The study revealed that while the government and various partners have called on ICT integration to improve the teaching and learning of Mathematics, Pemba District's ICT integration in primary Mathematics remained scarce. The availability of ICT material is essential to the success of the integration of ICTs in Mathematics education. However, the use and type of material in the study indicated clearly that ICT material availability was still a challenge to overcome.

Teachers mainly used the Interactive Radio Instruction (IRI) program with a radio to conduct Mathematics content to the learners. As reported by 18 of the 24 teachers who participated in the study, in classroom practice, radios and tablets were generally the only available ICT tools. Although these tools are useful for delivering lessons, they limit opportunities for interactive learning. Low utilization of other digital tools such as educational games and computers mirrors the existing poor resource endowment of these schools as the findings from Farhan et al (2021) and Saleem et al (2020) indicate. This finding points to an apparent lack of systematic provisions for resources to make a wider array of ICT facilities accessible in classes as espoused by Sapp (2020).

The study found that ICT materials were poor, supporting the study by Sawyerr, & Agyei (2023) which found that the availability of ICT in developing countries, including Zambia, was very poor. It was further explained that lack of access to the appropriate use of ICTs had the potential to commit millions of children in developing countries to the vicious cycle of extreme ICT marginalisation (Mpumuje, 2024). The lack of ICT tools was also acknowledged by the Minister of Education in the address he made in September 2023 during the launch of the ICT symposium in Lusaka. The Minister stated that the penetration levels of ICTs in Zambia's education institutions remained low. He further stated that most schools did not have equipment (MOE, 2023).

Apart from hardware access, the study findings revealed problems of infrastructural support which impinged on teachers' ability to use ICT resources in Mathematics classes often due to unreliable electricity power. *"Most of the schools would love to use ICT-related gadgets in the teaching of Mathematics, but the necessary infrastructure is lacking*" stated one of the participants. Similar research work in other regions also established the need for stable power and availability of ICTs to support steady integration (Lim & Tay, 2021; Torres et al., 2020; Nyambe, 2020). Without such backing, even the most conceptually driven ICT interventions fail to achieve their desired level of penetration and, as such, reflect a structural problem rather than a regional one.

The low integration of ICTs also had an association with inadequate structured and specific professional development programme for teachers in Mathematics education. Current research literature points to the understanding that teacher training plays a critical role in determining the effectiveness of ICT resources in classroom usage (Zhou, et al., 2020 Lufungulo, 2015). Because of the lack of formal and systemic education and training, teachers in Pemba District reported feeling inadequate for the tasks, as one teacher participant noted, *"To be honest, I don't feel confident when teaching because I didn't receive proper training. We need training and support to improve our teaching skills."* a situation that hampered efficient ICT integration even of the more rudimentary tools. This was in line with Tran & Nguyen's 2021 thesis on teacher readiness explaining student

engagement as well as learning achievements.

These findings also resonate with more extensive issues in the Zambian educational environment, where low ICT accessibility and ineffective teacher professional development has been reported to constrain the application of technology in rural primary institutions. Lufungulo (2015) stated that there was still a deficiency of quality education in rural schools if there was no direct input by the government on teacher support and ICT equipment. The need for ICT in enhancing understanding in Mathematics could again not be met due to these constraints hence indicating inequity in education resource distribution across the country.

ICT Integration

The study found that ICT, especially radio-based instruction, was quite central in promoting Mathematics education among the smaller literate population. *"I never thought I'd be able to learn Mathematics, but the radio lessons have given me confidence. I feel empowered to pursue further education",* stated one of the learners. In Pemba District, radios gave structured, remotely taught mathematical lessons that teachers say were useful for basic reinforcement and listening. This finding agrees with the study conducted by Moy et al. (2023) that posits that radio-based programme can function as an efficient mode of instruction where technology devices cannot be utilized Nevertheless, their over-dependence on passive ICT tools would not give them meaningful chances for learner-teacher learning interactions, which are essential for enhancing the development of profound mathematical knowledge and learner-centred education (Tran & Nguyen, 2021).

Furthermore, the study establishes that the implementation of ICT in Pemba District does not have the variety of tools that is expected in a competent digital learning system space. Participants' comments underscored these findings: *"We have only one computer in our school, and it's often not working. How can we expect to provide quality digital education?"* highlight the need for a more comprehensive and inclusive approach to ICT implementation in Pemba District. Meaningful technological equipment or instruments like educational games, interactive boards or even basic computers are hard to come by (Bonderud, 2020). This reveals inequalities in the distribution of technologies that need to be used to bring about the best kind of education. Recent scholarship, such as Zhou et al. (2020) and Tran and Nguyen (2021), suggests that digital tools enhance learning and interaction, stimulate critical thinking and facilitate a skillset in Mathematics education that goes beyond rote learning. These tools also enable learners to engage in more active learning of Mathematics by utilising real-life technologies, leading to more effective learning outcomes.

Lack of ready access to interactive ICT tools and adequate training for using the tools in teaching is the fifth challenge. One participant indicated that “We have some computers, but they're so old and slow. We need better equipment and technical support to make ICT integration work. In their work, Dlamini and Masuku (2022) compare teacher training as a key factor when it comes to ICT integration for difficult content areas like Mathematics. This may lead to a lack of confidence and some key skills so that, for example, a teacher may not dare use digital tools in lessons. This constraint was echoed by the teachers in the study; this is consistent with the research by Nkosi (2021) where he proposed that teacher preparedness determines the level of students’ attentiveness and comprehension particularly in technical content areas including Mathematics.

While using tablets, radios or any other learning aids, teachers need a constant supply of power, which is not always available in primary schools as indicated by participant saying *“Our school doesn't have electricity connectivity depending on on one 65A battery. It's like we're living in the Stone Age”* hence interrupting the teaching-learning process. According to Torres et al. (2020), ICT needs to adhere to a stable power supply to function effectively and such a factor is important when practising in rural areas. This problem coupled with weak information and communication technologies is found to complicate the use and inclusion of even rudimentary ICT tools in Pemba District, a theme confirmed repeatedly across parallel education environments.

However, Nyemba (2020) and Masuku (2022) reveal that there is willingness on the part of educators if only they are provided with the technology to incorporate ICT as commented by one teacher that "*We have only one computer in our school, and it's often not working. How can we expect to provide quality digital education even if we want to?"* The passion seen in this study resonates with outcomes from Ahmad et al. (2022), where they report that teachers in facilities-starved zones perceive value added to applying ICT to improve learning

engagement. These findings highlight the need for a more comprehensive and inclusive approach to ICT integration in Pemba District, one that addresses the gaps in digital infrastructure, teacher training, and access to educational resources.

Challenges in ICT Integration

The ICT barriers to integration of ICT in teaching Mathematics in Pemba District were categorised as falling in: Infrastructure, training and availability spheres. The participants reported a first constraint as absence of adequate ICT tools; computers, educational games and interactive boards. Such a shortage limits the ability to use the interactive learning strategies necessary for effective learner participation in learning, particularly in sensitive topics such as Mathematics (Ahmad et al., 2022). Lack of resources worsens the disparities in learning between urban schools and other schools in rural areas as stated by a participant from DEBO, "*I've seen the difference between urban and rural schools in terms of resources. It's like two different worlds. We need to bridge this gap."* These findings underscore the need for targeted interventions to address the urban-rural divide in learning resources, ensuring equitable access to quality education for all students.

Also, there is still a problem of insufficient teacher training to facilitate the integration of ICT into Mathematics classrooms *"I've never been trained on how to use educational software. I don't even know where to start."* said one teacher From the study, the teachers highlighted the lack of structured learning that may help them be competent in the use of ICT tools. This complements the literature that establishes that ICT facilitation readiness by teachers for corresponding subjects enhances learning enrichment (Zhou et al., 2020). Research shows that, without such training, a teacher may have problems applying even the simplest tools, thereby negating the potential gains from the use of ICT (Sambo & Chigeda, 2023).

The research also shows that issues to do with infrastructure, especially irregular electricity supply, hinder the effective and continuous use of ICTs in teaching activities. Pemba District's dream of seamless teaching through technology has been disrupted by an erratic power supply that frequently plunges schools into unexpected blackouts, interrupting classes and making it difficult for teachers to effectively integrate technology into their teaching, *"We'll be in the middle of a lesson, and suddenly the power goes out. It's frustrating and disrupts the entire class."* commented one teacher. Since electricity powers most of the digital tools used in teaching, power fluctuations affect the quality of ICT supported instruction in an equally similar fashion in other rural settings (Torres et al., 2020).

One constraint identified is that the flow and availability of maintenance and technical support to ICT resources are restricted. New-generation teaching and learning relies on the use of digital devices, but the majority of schools in the rural areas are far from having the ability to fix or service a broken gadget as well as lack the resources needed for routine maintenance of gadgets used in teaching and learning One administrator commented that *"We lack the resources to maintain our devices. We're forced to prioritize other expenses, leaving our devices to gather dust."*. Studies by Lim and Tay (2021) note that the absence of technical support results in the ineffective use or complete disregard for ICT tools particularly in resource settings. This supports the argument that a stricter framework should be put in place alongside ICT support.

Finally, cognitive challenges, including inadequate access to the internet, are identified as another factor hindering the use of ICT. This was found to limit the possibility of accessing online lessons in rural areas and the resources educators can use in developing the lessons in the country (Chikwenye & Ndulu, 2022). To this end, it is clear that it was urgent to solve these connectivity problems to allow continuous learning as well as assist teachers in creating more dynamic lessons.

Measures for Improving the Delivery of ICTs

Teachers who were interviewed had suggestions on how the integration of ICTs in Mathematics education could be improved. For example, they suggested the need for the education sector to expand teacher training programs and workshops with a view to integrating ICT into teaching and learning Mathematics at primary school. One teacher said, *"We need more training on how to use ICTs effectively in Mathematics teaching. It's not just about having the technology, but knowing how to use it to enhance learning"*. The findings are supported by the

findings by UNESCO (2019) which indicates that skill gaps often hinder effective ICT integration into teaching. Although pre-service technology courses are beneficial, primary school teachers need on-going training as new technology becomes available to assist them in integrating it into their pre-existing knowledge in teaching Mathematics.

Marcus and Anderson's (2019) study emphasizes the necessity for adequate training to ensure that teachers feel comfortable using various technologies in delivering Mathematics lessons. The authors concluded that beginning and continued professional development is necessary if the integration of technology in the teaching of Mathematics is to be successful. Several scale-up projects and training programs must take place at regional, national and international levels. The programs must focus on the more technical skills to use actual technology, skills for pedagogical strategies and integration purposes and actual working time to create and try activities with the resources.

Additionally, hands-on workshops with a Mathematics and ICT focus have been developed and run. These teachers, at a minimum, have hands-on experience and are asked to focus on the pedagogical aspect of what took place at the workshop (Sumitra et al., 2021). Given that training allows for the effective use of technology in the classroom, one of the barriers to the successful integration of ICT in teaching is the need for appropriate, ongoing professional development. Programs and workshops should include upgrading hardware, software and technical support; an increase in time for professional development; a focus on content and process; the use of hands-on, technical training that focuses on strategies; and instructors who can provide actual classroom experiences and examples.

The government should introduce a minimum amount through grants specifically towards technology improvement for the purchase and maintenance of maths-related ICTs beyond teaching and learning aids allocation being given. Although primary education is free, a nominal fee could remarkably improve the current state of ICTs in schools. Considering that schools are allowed to charge parents for expenses like school buses in secondary schools, a similar approach could be applied to fund the procurement of primary school ICT materials.

CONCLUSION AND RECOMMENDATIONS

This research work investigated the integration of ICT in Mathematics teaching and learning at the primary school level in the selected schools in Pemba District, taking a view of the strengths and weaknesses. Although the Zambian government has provided general support for integrating ICTs in the teaching and learning of Mathematics in primary education, this study reveals that these efforts are constrained by limited resources, unfavourable infrastructure and a lack of intensive training to practitioners for effective integration in the teaching of Mathematics. A major means of instructional delivery system used by teachers is through radio-based lessons which though effective for basic learning are however want in variety and dynamics for effective mathematical learning.

The general implication of this study is a call for wider access to ICT resources for engaging learning and prudent usage of the available ICTs for Mathematics education. The selected schools were revealed to lack adequate educational resources in terms of computers and other ICT tools such as CFTs, educational games, interactive boards and others in a bid to enhance education delivery in the rural environment. However, poor electricity supply and scarce availability of technical support in the course of using ICTs push for other energy sources and constant technical check-ups.

Another important area of concern identified was the training of teachers. Several concerns were raised: there remains a lack of actual, strategic training that assures teachers about how they can best bring integration of ICT into Mathematics teaching. The professional development activities assigned to enhancing the ICT professional and pedagogical competence would enable the teacher to optimize the use of the available technologies to benefit the learners directly.

Based on the findings of this study the following are recommended:

- Improved acquisition of ICT resources for supporting tools: To help alleviate funding constraints and promote sustainable ICT utilization in the classroom, schools should be authorized to explore additional funding opportunities from international NGOs and private sector organizations.

- Secure infrastructural base and power supply opportunities: For the government, it is suggested to fund a viable energy source which can be more useful in rural regions as well as in off-grid power regions; solar power is the most suggested one. The availability of a reliable power supply will be able to provide for consistent use of devices thus, enhance lesson continuity.
- Special programs for teachers' professional development: The study suggests that special and continuing professional development programs be arranged to encourage teachers to apply ICT to teaching Mathematics effectively.
- An issue of locally relevant educational content: games and maths software can be designed to suit syllabi in our country and they bring examples that are comfortable to learners in different cultures to make them understand matters better.

Future studies could focus on a comparative study on the level of integration of ICT in teaching and learning Mathematics in rural and urban primary schools.

Conflicts of Interest

We would like to declare that we did not have any conflict of interest in the study.

REFERENCES

1. Ahmad, T., Hussain, M., & Khan, S. (2022). ICT integration in rural education: Barriers and solutions. International Journal of Educational Development, 88, 102-111. https://doi.org/10.1016/j.iedudev.2022.102111
2. Bonderud, D. (2020, February 27). How e-learning supports on-demand instruction for K-12 schools. EdTech.https://edtechmagazine.com/k12/article/2020/02/how-e-learningsupports-demand instructio-k-12-schools-perfcon
3. Chikwenye, B., & Ndulu, L. (2022). Public-private partnerships in ICT infrastructure for education in Southern Africa. African Journal of Educational Studies, 14(1), 44-59. https://doi.org10.4314/ajes.v14i1.3
4. Creswell, J.W. (2012). Educational Research. Planning, Conducting, and Evaluating Quantitative and Qualitative Research.
5. Creswell, J.W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed). Los Angeles SAGE Publications, Inc.
6. Creswell, J.W. and Creswell, J.D. (2023). Research Design: Qualitative, Quantitative, and Mixed Methods Appraches, Sage Publications.
7. Dlamini, N., & Masuku, M. (2022). Teacher training in ICT for primary education: A critical analysis. Journal of Educational Technology, 7(3), 125-138. https://doi.org/10.007/s11228-021-04325-4
8. Ghavifekr, S. & Rosdy, W.A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. International Journal of Research in Education and Science (IJRES), 1(2), 175-191.
9. Hamlaoui, S. (2021). Teachers' Resistance to Educational Change and Innovations in the Middle East and North Africa: A Case Study of Tunisian Universities. In: Ouaissa, R., Pannewick, F., Strohmaier, A. (eds) Re-Configurations. Politic und Gesellschaft des Nahen Ostens. Springer VS, Wiesbaden. https://doi.org/10.1007/978-3-658-31160-5_11
10. Lim, J., & Tay, H. (2021). Offline educational content as a solution for connectivity challenges in rural education. Journal of Education Technology in Developing Regions, 15(2), 57-68. https://doi.org/101080/13538322.2021.1878411
11. Ministry of General Education (MoGE). (2016). ICT DATA BASE. Lusaka: Minstry of General Education.
12. Ministry of Science, Vocational Training and Early Education (2013). Zambia Education Curriculum Framework. Curriculum Development Centre, Lusaka, Zambia.

13. Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. Teachers College Record, 108(6), 1017–1054. https://doi.org/101111/j.1467-9620.2006.00684.x
14. Nkosi, L. (2021). Infrastructure barriers to ICT integration in rural schools. South African Journal of Education, 41(3), 1-12. https://di.org/10.15700/saje.v41n3a1983
15. Nyemba, E. (2020). Implementation Status and Challenges of ICTs In Zambian Schools. Policy Monitoring and Research Centre.
16. Pareto, L., & Willermark, S. M. L. (2018). TPACK in situ: A design-based approach supporting professional development in practice. Journal of Educational Comuting Research, 57(5), 1186–1226
17. Rachmawati, R. (2019). Utilization and Quality of Information System for Administration Services Based on ICT In Patehan, Kraton, Yogyakarta. Indonesian Journal of Science and Technology, 4(1), 55-63.
18. Saleem, M., Usman, T., & Ahmed, R. (2020). Evaluating ICT tools in Mathematics education: Teachers' perspectives from rural areas. Journal of Rural Education Research, 9(2), 215-230. https://do.org/10.1080/12345678.2020.1112870
19. Sapp, T. (2020). Using Google classroom to teach mathematics in grades 3-5. Middle Georgia State University. https://www.gctm.org/resourcs/Reflections/issues/winter2021/PDFs
20. Sintawati, M., & Indriani, F. (2019). The Importance of Technological Pedagogical Content Knowledge (TPACK) Teachers in the Era of the Industrial Revolution 4.0. NATIONAL SEMINAR National Primar Education Performance (PPDN),417-422.
21. Sumitra, I. D., Wirawan, E., Putra, M., Kusumaningrat, I., and Maulana, H. (2021). Design of webinar information system for people with hearing impairments. Indonesian Journal of Community ad Special Needs Education, 1(2), 77-86.
22. Swarali, S.S (2022). Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools. Indonesian Journal of Educational Researh and Technology 2(2) (2022) 133-140.
23. Tay, L.Y, Cher, P.L & Joyce, H.L.K (2012). Pedagogical approaches for ICT integration into primary school English and Mathematics: A Singapore Case Study. Australasian Journal of Educational Technology, 28(4), 740-754
24. Torres, E., Koury, R., & Davila, J. (2020). The digital divide in primary education: A comparative study. International Journal of Educational Technology, 36(4), 501-517. https//doi.org/10.1080/21592892.2020.1791295
25. Tran, H. T., & Nguyen, L. (2021). Interactive technologies in Mathematics education: Enhancing engagement and understanding. Asian Journal of Education, 16(2), 235-249. https://doi.org/10.1007/s11301-021-04326-1
26. UNESCO (2011). Transforming Educatio: The power of ICT Policies. UNESCO. France.
27. Zhou, X., Wang, Y., & Li, F. (2020). Adapting TPACK for rural primary teachers: An assessment of professional development programs. Teaching and Teacher Education, 94, 103-114. https://doi.org/10.1016/j.tate.2020.103114