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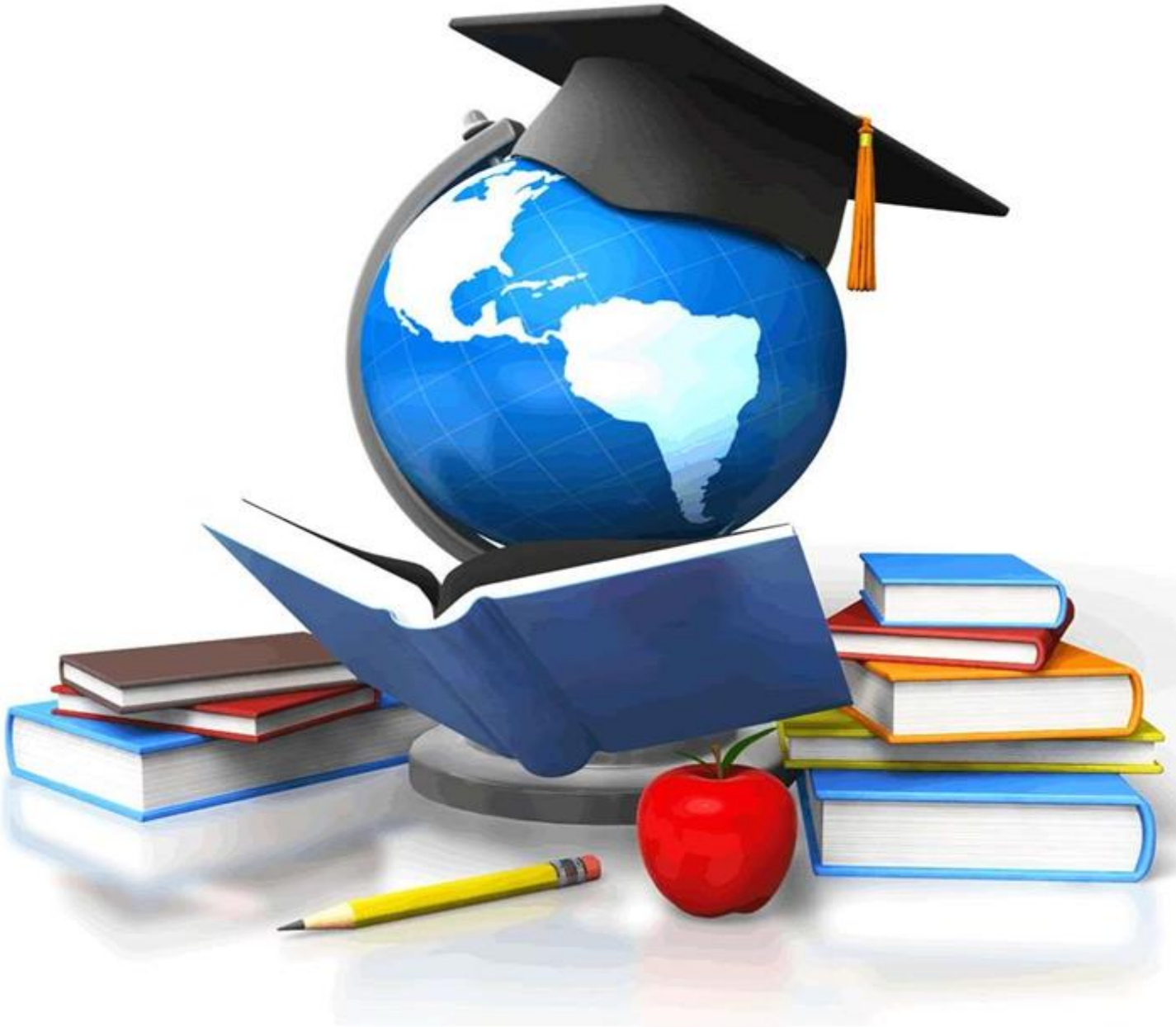

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Exploring Effective ICT Integration Strategies in Education: A Case of Two Public Primary Schools in Mombasa, Kenya

[1*]Juma R. Haji, [2]Rose J. Shiyo, [3]Nipael E. Mrutu

https://orcid.org/0000-0002-0620-7964

[1,2,3]The Aga Khan University

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Abstract

Purpose: The contemporary education landscape is undergoing a significant transformation, largely driven by the integration of Information and Communication Technologies (ICT). This paper explores the experiences of educators as they incorporate ICT into teaching and learning.

Methodology: The study was conducted in Mombasa City, Kenya, and utilized qualitative research methods, including in-depth interviews, focus group discussions, and classroom observations, in a case study design involving two urban primary schools. The research meticulously documented the experiences of 16 participants.

Findings: The findings of the study highlight several advantages of using ICT in teaching and learning, including easy access to information, interactive and personalized learning opportunities, as well as collaboration. However, the data also revealed significant challenges faced by educators, such as unstable electricity, inadequate ICT gadgets, internet fluctuation, and a lack of skills to integrate ICT into teaching.

Unique Contribution to Theory, Policy, and Practice: Educators consistently stressed the importance of continuous support and professional development to enhance their ICT integration skills. Furthermore, the research emphasized several promising recommendations, including the installation of alternative sources of electricity, sourcing for additional ICT devices, supervising learners while using ICT gadgets, and conducting professional development initiatives tailored to the creation of a collaborative community of practice (COP), which have the potential to effectively address these challenges. To fully leverage the potential of ICT for enriching the learning experience, equipping students with essential digital skills, and preparing them for a digital-centric world, educational institutions, and policymakers must prioritize investments in technological infrastructure and foster a culture of innovation and collaboration among educators.

Keywords: *ICT, ICT Integration, Computer, Teaching, Learning*

Introduction

Background of the Study

In today's rapidly changing digital landscape, the integration of Information and Communication Technology (ICT) in education has become a crucial element of teaching and learning. As technology continues to reshape our daily lives, work, and communication, its role in education has become indispensable (Greenhow et al., 2022). The effective incorporation of ICT tools and resources has the potential to revolutionize the educational experience by increasing student engagement, expanding learning opportunities, and preparing students for the challenges of the 21st century.

ICT integration in education refers to the incorporation of digital tools, such as computers, tablets, software applications, and the Internet, into the teaching and learning process (Saal & Graham, 2023). It encompasses a wide range of practices, from the basic use of technology for administrative purposes to innovative approaches that redefine pedagogical paradigms. The significance of ICT integration lies in its potential to enhance educational outcomes by facilitating personalized learning, collaboration, and critical thinking (Farrokhnia et al., 2023): (Bruneau et al., 2023).

Greenhow et al. (2022) highlighted the responsibility of teachers to provide students with a strong foundation in modern technological knowledge, encompassing computer technology and various media forms. Hafifah (2019) also argues that integrating information and technology in the classroom can enhance students' understanding of the material and their ability to retain information. Additionally, Mamolo (2022) asserts that, when ICT is integrated into lessons, students become more engaged in their work due to the diverse opportunities for interactive and enjoyable teaching methods.

However, despite the potential benefits, the successful integration of ICT in education remains a complex and multifaceted challenge. Bhuiyan and Mollik (2023) from Bangladesh contend that educators worldwide face various obstacles that hinder their ability to fully harness the potential of ICT in their classrooms. This paper highlights challenges that educators encounter when attempting to integrate ICT tools and resources into their teaching methods.

This paper aims to answer the following research questions:

(1) How do teachers perceive the integration of ICT in teaching and learning?
(2) What strategies do teachers use for integrating ICT in teaching and learning?
(3) What challenges do teachers encounter when integrating ICT in teaching and learning?

Literature Review

Information and Communication Technology (ICT) has now become an indispensable component of contemporary education, holding the promise of enriching the teaching and learning processes, stimulating student involvement, and equipping learners for the digital era (Das, 2019):

(Naluwooza et al., 2023). Despite the widely acknowledged advantages of incorporating ICT in education, educators confront a multitude of obstacles when endeavoring to use these technologies to their fullest potential within the classroom setting. This literature review seeks to delve into the present state of research concerning the integration of ICT in education, with a particular focus on elucidating the difficulties encountered by educators and presenting potential solutions to overcome these challenges.

The TPACK (Technological Pedagogical Content Knowledge) model, a theoretical framework that directs the successful integration of technology into instructional practices, serves as the foundation for this study. TPACK highlights the complex interactions among three fundamental categories of knowledge that educators possess (Swallow & Olofson, 2017). Content knowledge, pedagogical knowledge, and technical knowledge. The model acknowledges that a sophisticated grasp of the intersections between these three knowledge domains is necessary for effective technology integration in the classroom. This study aims to offer useful insights on methods for employing technology to improve students' overall learning experiences by applying the TPACK framework. As a guiding concept, TPACK provides educators with an organized method to traverse the intricate relationships between technology, pedagogy, and subject matter expertise, with the ultimate goal of enhancing the effectiveness of technology integration in the classroom.

Benefits of ICT Integration

Numerous studies have underscored the advantages of integrating Information and Communication Technology (ICT) into education. For teachers, ICT can streamline administrative tasks, grant access to a wide range of educational resources, and provide opportunities for professional growth (Asrin & Utami, 2023): (Fernández-Batanero et al., 2022). A study conducted in Indonesia by Azizan et al. (2022) elucidated that students can reap the rewards of heightened engagement and improved digital literacy. Indah et al. (2022) supported this by noting that ICT enhances learning experiences through multimedia content and interactive tools.

A recent study conducted in South Africa by Nwosu et al. (2023) highlighted the advantages of using information and communication technology (ICT) in education. The research emphasized its application in academic settings and how support staff utilize various tools related to the Fourth Industrial Revolution (4IR). This utilization encompasses virtual or hybrid classrooms, artificial intelligence, feedback mechanisms, and access to educational materials. These findings were substantiated by a study carried out by Rodríguez-Jiménez et al., (2023), which demonstrated improvements in students' performance, motivation, and problem-solving skills when ICT was integrated into the classroom.

In Tanzania, Pima (2019) uncovered that teachers are motivated and willing to integrate ICT into their teaching methods. This willingness has the potential to lead to enhanced teaching practices and ultimately result in positive learning outcomes. Additionally, Macharia (2022)

reported that the integration of ICT into primary education in Kenya has facilitated convenient access to information for both educators and students. Furthermore, it has fostered learner-centered teaching methodologies, making a substantial contribution to improved learning outcomes.

Generally, scholars posit that Integrating ICT into teaching and learning offers numerous benefits. However, it seems ICT integration in teaching and learning primarily benefits students whose teachers have access to ICT tools and resources. This leads to situations where some teachers can incorporate ICT in teaching and learning and thus benefit their students, while other teachers in an ICT-scarce context fail to do so and therefore disadvantaging their students.

Perception of teachers toward ICT integration

A study conducted in Mombasa-Kenya by Nabangi (2021) states that utilizing gamification represents a highly effective method for instructing grammar. While the use of a gamification strategy prioritizes the needs of students and effectively maintains their focus, it is primarily feasible within affluent private schools that possess advanced Information and Communication Technology resources. Public primary schools face significant obstacles, as not all students can actively participate due to the absence of sufficient devices suitable for gamified teaching methods. However, the success of ICT integration in teaching and learning does not only depend on the availability of ICT infrastructure such as computer labs, but it also calls for teachers with positive perceptions on ICT integration in education (Mwendwa, 2017).

It is evident that most teachers hold a favorable outlook on the integration of ICT into their teaching methods for instance a study conducted by Bakari and his colleague in Tanzania pointed out that 80% of teachers had positive attitude towards ICT integration in teaching and learning (Bakari & Ali 2023). Nonetheless, there exists a notable contingent of teachers who harbor a pessimistic view regarding ICT integration, perceiving it as an inefficient use of time within the teaching and learning process. This skepticism may stem from a fear of technology (technophobia) or the desire to adhere to a strict curriculum schedule.

Common Challenges in ICT Integration

Despite the potential advantages, educators face several challenges when integrating ICT into their teaching practices. These challenges are categorized into three main areas:

Technical Challenges in Education

Teachers frequently face a lack of the necessary technical skills and confidence required for proficiently utilizing ICT tools (Boonmoh et al., 2022). Additionally, issues related to compatibility, software glitches, and a shortage of adequate technical support pose significant barriers to the seamless incorporation of technology into the classroom setting (Aithal & Aithal, 2023). A study conducted in Uganda by Habibu (2012) revealed that teachers often lacked the essential ICT competencies essential for integrating technology into their teaching approaches, and they also experienced inadequate administrative support.

Despite the Kenyan government's proactive efforts to promote the integration of Information and Communication Technology (ICT) in the education sector, educators in the country encounter a multitude of challenges hindering their ability to meet this mandate. These obstacles encompass deficiencies in essential ICT training, the presence of unfavorable attitudes among teachers regarding ICT integration, and a lack of electrical infrastructure, particularly in rural primary schools, leading to difficulties in charging government-provided tablets (Mutisya, 2020).

Regardless of the technical challenges highlighted in the relevant literature, challenges differ from one school to another. Some schools possess ICT facilities but lack the required expertise, while others have well-trained teachers but lack essential ICT devices. It seems therefore that achieving effective ICT integration in the classroom necessitates the availability of both ICT resources and teacher training.

Pedagogical Challenges

In their recent study Lasito and colleagues highlighted pedagogical challenges as barriers in integrating ICT in teaching and learning (T/L) Lasito et al. (2023). Similarly, the research conducted in Tanzania by Ngao et al. (2022) underscores that teacher educators often lack the essential professional training required for seamless technology integration, leading to difficulties in incorporating technology effectively.

Barasa (2021) noted shortage of training is a significant barrier to the successful integration of ICT into teaching practices. When educators are not adequately equipped with the requisite ICT skills and knowledge, their confidence in utilizing technology in the classroom tends to be low. Consequently, they often refrain from integrating ICT tools and techniques into their teaching methods, thereby thwarting the potential educational benefits that ICT could offer.

Resource-Related Challenges

A study conducted in Rwanda by Harerimana and Mthali (2018) highlights that educators, especially in resource-limited settings, face substantial challenges due to inadequate access to ICT resources, including hardware, software, and internet connectivity. Additionally, the implementation of effective ICT strategies is impeded by funding limitations and budget constraints, as noted by (Gupta et al., 2022). In Kenya, research conducted by Lysenko et al. (2022) focused on the use of interactive technology for teaching mathematics in grade-one classes.

Generally, literature seems to indicate that there are various benefits in integrating ICT in teaching and learning, however, challenges also persist. The challenges seem to differ from one context to the next, and it seems these challenges may lead to discrepancies in the type and even the quality of education offered in the same country even though a similar curriculum is used. This paper will focus on the Kenyan context as a way of building on the existing body of literature on ICT integration in teaching and learning. The Kenyan context seems to indicate that integration of ICT in teaching and learning goes beyond the dichotomy of teachers having ICT skills or not, it

encompasses systemic challenges which should not be brushed aside in the quest for effective ICT integration in teaching and learning.

Methodology

This study employed a qualitative research approach to investigate social and human issues within their specific contexts (Kyngäs, 2020). Specifically, a case design approach was utilized, offering researchers the invaluable opportunity to engage with respondents in authentic, real-world settings within selected schools (Gray, 2021). The study was conducted in Mombasa County, Kenya, specifically in the Mvita sub-county, with two public primary schools.

Within the scope of this study, the research population comprised a total of 16 participants, encompassing 10 teachers and 6 administrators. The selection process involved the utilization of convenience sampling for the schools' selection and purposive sampling to identify the administrators and teachers. The latter category consisted of teachers who actively integrated ICT into their teaching methodologies.

To gather data effectively, the researchers employed three primary methods namely observations, interviews, and focus group discussions. The observational approach, facilitated by an observation checklist, was instrumental in collecting information concerning the presence and utilization of ICT devices and facilities in the selected schools. One-on-one interviews were conducted to extract insights from the six administrators, three from each of the chosen schools. To complement this, one focus group discussion per selected school comprising of five teachers each was initiated to capture the lived experiences of a total of ten teachers who shared their perspectives on the experiences of teachers while integrating ICT into their teaching methodologies.

The ensuing data from one-on-one interviews and Focus Group Discussions were meticulously transcribed, aligning with the predefined research questions and the findings from the existing literature review. Subsequently, these transcripts were systematically organized in conjunction with the data obtained from the observation guides. The data were methodically categorized and grouped, giving rise to discernible patterns and overarching themes. This comprehensive data analysis process culminated in a comprehensive and detailed description of the challenges encountered by teachers when integrating ICT into their teaching practices.

Findings and discussion

Benefits of Integration of ICT in Teaching

Enhances interactive learning, fosters critical thinking and retention of knowledge

Interactive learning methods, including hands-on experiments, simulations, and interactive technology, are effective in capturing the attention and interest of young learners. When students are engaged in such activities, they tend to be more attentive and enthusiastic about learning,

which, in turn, promotes critical thinking. During an interview with teacher 5 school Y, integration benefits were highlighted.

> "*Interactive learning encourages students to actively participate in the learning process. They become involved in experiments, discussions, and problem-solving activities, which fosters a deeper understanding of scientific concepts*".

Teacher 1 of school X had the following to say about advantage of ICT in classroom setting:

> "*... you know, ICT plays a pivotal role in improving collaboration and communication among students...this is achieved through its inherent nature of promoting group or pair work, which nurtures and enhances collaborative and communicative abilities".*

Also, during the interview teacher 4 school Y was quoted narrating:

> "*Students can have high knowledge retention when they can see information instead of just hearing it*."

Simplified, Personalized and Collaborated Learning.

ICT simplifies and personalizes the learning process by providing tailored resources and interactive tools. During a one-on-one interview, teacher 5 of school X also shared his though by saying that:

> "*ICT in teaching simplifies learning by offering easy access to a wealth of information and resources online, making it easier for students to find relevant content and study materials. Additionally, it allows for self-paced learning, enabling students to progress at their own speed and revisit challenging topics as needed*".

The deputy headteacher from the same school expressed their preference for using computer software material in simple teaching. He stated:

> "*Using projectors or computers in the classroom helps students learn more easily by providing them with a clear picture of what the teacher teaches. This reduces the need for teachers to expend excessive energy to ensure students understand the material*".

During the interview with the senior teacher from school X, he also stressed the importance of integrating ICT into teaching and learning.

> "*I think there are some topics that you cannot teach theoretically, such as the topic of reproduction in science. Some teachers find that they are unable to teach about this subject, but if you use an ICT tool and the students see the lesson with their own eyes, their understanding will improve*".

The concept of personalized learning is supported by educational research as noted by Kallick and colleagues that the recent movement toward personalized learning needs students to become more active in understanding and charting their learning pathways (Kallick & Zmuda,

2017). Also, the study of Dukuzumuremyi (2014) shows that the use of technology promotes collaborative learning. All the teachers sampled for this study, speak to the afore cited scholarly work. They were able to explain the benefits of integrating ICT in teaching and learning. Thus, whether they effectively integrated ICT in teaching and learning or not is due to other factors but not because they do not know or see the significance of integrating ICT in teaching and learning.

Strategies teachers use when integrating ICT in teaching and learning

Projecting lessons using PowerPoint

The study reveals that among the techniques employed by teachers in ICT integration, one common strategy is the projection of their lessons. This method proves superior to the conventional teaching approach. Nevertheless, teachers still tend to be the focal point unless the lesson is prepared with a more interactive design. The statements below highlight the ICT integration techniques used in teaching and learning.

"I create my instructional materials using PowerPoint slides, which I subsequently display in the classroom using a projector..." (Teacher 2 from school X, who teaches grade 3 science).

A similar sentiment was shared by the senior teacher from school Y, who teaches grade 4 mathematics.

> *"Typically, when I have lessons that necessitate the use of ICT devices, I bring my students to the computer lab where I show video clips related to the topic I teach. While this approach makes the lesson more engaging, there is an issue with the size of the ICT lab, which is smaller than our regular classrooms, leading to overcrowding".*

The use of animation

According to interviews with teachers, animation was used to explain topics like reproduction. Teacher 4 from school X expressed satisfaction when students grasp science concepts with the help of animations, as they make lessons enjoyable and enhance understanding. Teacher 1 from school X emphasized how animations visually present abstract concepts for better comprehension. Additionally, in a focus group discussion, teacher 3 from school Y highlighted that animations facilitate the understanding of complex concepts and processes while also aiding in information retention.

The use of computer

Finding from Focus Group Discussion (FGD) about how teachers integrate ICT during teaching math's in the classroom, teacher 3 from school Y noted:

> "*I display the table of math by using computer to explain the concepts of numbers. I also use video from You-Tube to show my learners how students from other schools can do math".*

Moreover, teacher 1 from school Y was asked about how she feels when she uses a projector in the class, she had the following to say:

> "*I hope my students understand better when I use a computer in the classroom. The computer makes it easier for me to teach … for instance teaching I do not use a lot of effort to make the students grasp the contents".*

The finding shows that projectors and computers are the gadgets that are mostly used in integrating ICT in teaching and learning. Mostly it is the teachers who engage with these gadgets and not learners limiting the acquisition of digital literacy skills for learners. What seems to be going on in these contexts is the use of ICT in teaching and learning and not ICT integration in teaching and learning. However, there are few teachers who engage learners and offer opportunities for learners to manipulate electronic gadgets. For instance, teacher in school X noted that:

"*I use Whiteboards to teach basic math concepts like addition and subtraction. Students could physically interact with the board, dragging and grouping virtual objects to solve problems. This hands-on approach made learning more engaging and helped young learners grasp mathematical concepts more effectively*".

Challenges faced by teachers in integrating ICT

Unstable electricity

The incorporation of ICT integration within educational settings necessitates the utilization of electronic devices that rely on a consistent and stable supply of electricity. Nevertheless, there are occasions when the reliability of electricity is compromised, posing a potential disruption to the seamless integration of ICT tools within the classroom environment. This issue was brought to light during a recent focus group discussion by teacher 2 school X.

> *"There have been numerous instances where I have diligently prepared my lessons, intending to deliver them using ICT tools to engage the students effectively. However, this plan is often thwarted by sudden power outages."*

A challenge related to the availability of reliable electricity. Electricity. This was also shared by teacher 5 school Y who reported:

> *"My school uses pre-paid electricity. Sometimes the token is exhausted before the lesson ends disrupting the class. This is very embarrassing as the lesson is cut short".*

Electricity outages are a critical problem that significantly hinders ICT integration, according to the replies that were gathered. Teachers cannot effectively employ ICT in their teaching practices when there is no electricity or when it is unstable. This aligns with the study by Sahoo (2020) and Shrestha et al. (2022) who cited lack of electricity as an impediment to online learning which is part of the use of ICT in educational settings.

Inadequate ICT gadgets

The research findings notably highlighted the deficiency of sufficient ICT devices as an additional impediment hindering teachers' efforts to effectively integrate ICT into their teaching practices. The researchers observed that in both schools there were some unused ICT devices in the computer laboratories while others were faulty. Additionally, during an interview with the head teacher at School X, she offered the following insights on this matter.

> *"Our school currently faces a significant limitation in terms of ICT resources. To put it into perspective, an average classroom at our school accommodates around 30 to 40 students. However, we possess only four tablets." for ICT use, which proves to be quite inadequate, especially when it comes to sharing these devices among larger groups of students".*

The senior teacher from school Y added:

> *"During a lesson that incorporates ICT integration, students have access to a limited number of gadgets. Unfortunately, most of the tablets provided by the government are non-functional, leaving teachers with no choice but to rely on a single laptop and a projector for instructional purposes".*

It seems despite the government's efforts to provide ICT gadgets, find facilities, and build ICT infrastructures in schools the challenge of limited, factional ICT devices persists, and unreliable electricity adds fuel to the flame.

Internet fluctuation

ICT integration and internet connectivity are inherently intertwined. However, the absence or interruption of internet access can disrupt the seamless utilization of ICT in the teaching and learning process. This concern was voiced by the headteacher from School Y during his statement.

> *"Frequently, we rely on data bundles or Wi-Fi for internet connectivity. Nevertheless, occasional occurrences of internet delays or outages can disrupt teaching activities".*

This sentiment was also shared by teacher 5 from school X:

> *"I have noticed that occasionally, when I am streaming a video during my lessons, there is buffering, and it causes delays. It can be frustrating when this issue continues, as it results in an incomplete lesson, with the next one starting before you've finished teaching what you intended to cover".*

This research discovered that a sluggish internet connection has an adverse impact on teaching, which corresponds with the findings of Flack et al. (2020). However, it is important to note that the latter study primarily concentrated on online learning.

Lack of Skills

The study has revealed that a deficiency in digital literacy skills poses a hindrance to the successful incorporation of ICT in the classroom, particularly among older educators. While these older teachers do incorporate ICT in their teaching practices, they often rely on the expertise of younger colleagues who are more proficient in ICT integration. In response to this issue, the deputy head teacher at school Y attributed it partly to age, although it can be ultimately attributed to insufficient training. Here is her perspective:

> *"Age presents a significant challenge when it comes to teaching ICT effectively. Personally, I find that my age hinders me from working with computers as swiftly as my younger colleagues. It often takes me a longer time to set up and connect the devices due to this factor".*

The headteacher from school X during a one-on-one interview also pointed out that the lack of continuous professional development courses in using ICT to teach is a challenge that affects employing it in the classroom.

> *"The teachers received training on utilizing laptops and computers for teaching some time ago. However, technology is evolving rapidly, and some of our students are already well-versed in the latest advancements. Teaching effectively with ICT would be challenging without attending refresher courses to keep up with these technological changes".*

The responses clearly show that a deficiency in essential skills has a detrimental effect on the integration of ICT in classrooms. Limited digital literacy skills pose challenges to the integration of ICT in teaching and learning. Li and colleagues noted that successful ICT integration necessitates that educators participate in Continuous Professional Development programs to stay updated on the latest trends in utilizing ICT for teaching and learning (Li et al, 2019).

Moreover, Murithi and Yoo (2021) argue that, even though many educators have undergone training in incorporating ICT into their teaching methods, there remains a necessity for ongoing professional development since a significant portion of them continue to struggle with ICT integration in their teaching practices. What is of concern is when teachers view ICT as a "thing" for the younger generation teachers. This kind of perception might lead to "withdrawal" where teachers give up trying or making efforts toward improving their technological pedagogical skills. Thus, we argue that negative views on ICT integration should not be ignored but rather they should be addressed.

Conclusion and recommendations

The findings of the research were quite remarkable. It revealed that teachers actively incorporate ICT into their teaching methods and acknowledge the numerous benefits it brings to the educational process. However, they also candidly highlighted certain challenges they face when integrating ICT into their instructional approaches.

One notable discovery from the study is that despite having received training on the incorporation of ICT in teaching and learning, teachers expressed a persistent need for additional training to enable them to effectively integrate ICT within the classroom setting. Data seems to indicate that one may have the knowledge but applying that knowledge to improve practice depends on the existence of a conducive teaching and learning environment. Thus, we argue that effective integration of ICT in teaching and learning calls for a multifaced approach which brings on board different educational stakeholders from parents, government, national and international organizations.

Based on these findings, the study proposes several recommendations to mitigate these challenges effectively. Firstly, to address the issue of unstable electricity, we suggest that school leadership, in collaboration with the Board of Management (BOM), should engage various stakeholders to install alternative power sources such as solar panels and backup generators. This proactive step will ensure that lessons are not disrupted due to electricity outages, promoting uninterrupted teaching and learning.

Furthermore, addressing the scarcity of ICT devices necessitates the acquisition of additional devices from government sources, corporate entities, and philanthropic individuals. Schools can also encourage parents to permit students to bring their personal digital devices from home, implementing a Bring Your Own Device (BYOD) strategy. By doing so, even when students share devices, it will prevent overcrowding on a single gadget, enhancing accessibility.

Moreover, to tackle the issue of internet instability, schools should consider investing in Wi-Fi infrastructure or partnering with reliable internet service providers to ensure consistent and uninterrupted internet access. Achieving this objective may require collaborative efforts involving school administrators, parents, and local community leaders.

Finally, to address the issue of insufficient skills for effective ICT integration, teachers should consider enhancing their expertise by actively participating in Continuous Professional Development (CPD) programs. While the government occasionally organizes such refresher courses, teachers should not rely solely on government initiatives. Instead, they should take the initiative to acquire additional skills by sharing experiences, engaging in peer teaching, and seeking mentorship within a Community of Practice (COP).

In conclusion, by implementing these recommendations, we believe that teachers will achieve effective ICT integration, which will have a positive impact on teaching and learning. This, in turn, will contribute to learners acquiring digital literacy, one of the essential 21st-century skills advocated by the competency-based curriculum (CBC).

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