BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF CURRICULUM AND EDUCATIONAL MANAGEMENT STUDIES

AN INVESTIGATION ON THE INTERGRATION OF ICT INTO TEACHING OF MATHEMATICS AT MUTANDA PRIMARY SCHOOL IN SAKUBVA MUTARE.

BY

MAWOKO ROSEMARY

B225858A

APPROVAL FORM

The undersigned certify that they have supervised, read and recommended to Bindura University of Science Education for acceptance a research project entitled……

Submitted ……in partial fulfillment of the requirement of the Bachelor of Science Education Honours Degree in Mathematics

Signature …… Date …../…../……

(Student)

Signature …….. Date ……. /……. /……

(Supervisor)

Signature ……. Date ……../……. /……..

(Programme coordinator)

Signature …… Date ……/……/……..

(Faculty chairperson)

Signature ……... Date ……../……/……

(External Examiner)

RELEASE FORM

NAME OF AUTHOR: …….

STUDENT NUMBER: …….

PROJECT TITLE: …….

DEGREE: HONOURS BACHELOR OF SCIENCE EDUCATION, MATHEMATICS

YEAR AWARDED: 2024

Signature ……..

Permanent Address ……

Email……..

Cell number ……

ACKNOWLEDGEMENTS

I extend my deepest gratitude to God for the precious gift of life, unwavering wisdom that have enabled me to complete this study.

I would like to appreciate my academic supervisor, Dr.G Sunzuma, for her exceptional guidance, support, and expertise throughout this research journey. Her invaluable insights and constructive feedback have been important in my study.

I am grateful to express my sincere gratitude to the school head, teachers, and learners who participated in the interviews. Their cooperation and assistance have been invaluable in informing this study.

On a personal note, I am grateful to my husband for his unwavering support, encouragement, and dedication throughout this academic endeavor. His selflessness and commitment have been a constant source of motivation, enabling me to complete my studies.

ABSTRACT

This study explored the effective use of (ICTs) in Primary Mathematics education at Mutanda Primary School. The qualitative approach adopted for data generation, analysis, and discussion provided valuable insights into the use of ICTs in Primary Mathematics learning activities. To collect the data, the researcher used focus group discussions and personal interviews from a total of 25 learners and 6 teachers who were purposively sampled. Thematic analysis was employed to analyze the data, revealing that ICTs such as smartphones and computers were being utilized in Primary Mathematics learning activities. However, various challenges were encountered in using ICTs, including infrastructure and technical issues. These challenges hindered the effective use of ICTs, limiting their potential to enhance Primary Mathematics education. Participants proposed strategies to mitigate these challenges, emphasizing the need for improved ICT infrastructure and technical support. The study concludes that the use of ICTs in Primary Mathematics education is limited due to the challenges encountered. To address these challenges, recommendations include the involvement of all stakeholders in mobilizing ICT infrastructure and providing teachers with training on effective ICT integration. By prioritizing ICT infrastructure development and teacher training, the school administration can enhance Primary Mathematics teaching-learning activities and improve student outcomes. Furthermore, the effective use of ICTs in Primary Mathematics education requires a collaborative effort from all stakeholders. Parents, teachers, and learners must work together to ensure that ICTs are used to support learning and improve academic achievement.

Contents

CHAPTER ONE

PROBLEM AND ITS SETTING

1.1 Introduction

This section provides an overview of the study's background, including the problem statement, research objectives, and questions that justify the need for this research. Additionally, it discusses the significance of the study, its delimitations, and the limitations encountered while addressing the selected research questions. Lastly, the overall structure of the study is reviewed.

1.2 Background to the Study

The incorporation of Information and Communication Technologies (ICTs) into education has emerged as a global trend, with numerous countries acknowledging their potential to enhance teaching and learning (Kozma, 2003). In Zimbabwe, the government has recognized the significance of ICTs in education and has taken steps to promote their use in schools (Ministry of Primary and Secondary Education, 2015).

Pernia (2008) has emphasized the crucial role of Information Communication Technologies (ICTs) in improving the teaching and learning processes within educational institutions, alongside the challenges linked to their effective implementation. Nonetheless, there is a significant lack of research in Zimbabwe concerning the integration of ICTs in primary schools, especially regarding mathematics teaching and learning activities.

The provision of ICT resources to the education sector in Zimbabwe has experienced significant growth since 2002. A major milestone in this development was the creation of a national ICT policy in 2005 by the Zimbabwean government. This policy was informed by a comprehensive e-readiness survey conducted by Harvard University, which revealed that the country was not yet

e-ready (Isaacs, 2007). Additionally, the policy drew on a range of preceding policies, including the Nziramasanga Education Commission Report of 1999, the national science and technology policy of 2002, and Vision 2020. These foundational policies provided a framework for the development of the national ICT policy. The policy aimed to promote the effective integration of ICTs into the education sector, enhancing teaching, learning, and overall educational outcomes. Overall, the development of the national ICT policy marked a significant step towards harnessing the potential of ICTs to transform the education sector in Zimbabwe.

The rapid expansion of the ICT sector in Zimbabwe has been characterized by the proliferation of internet services, social media platforms, and computer-related businesses (The Financial Gazette, 2012). The major networks in the country have not only provided internet services but also offered a range of other services to their clients (The Herald, 2014). Furthermore, many mobile subscribers in Zimbabwe utilize social media platforms such as Facebook, Twitter, and WhatsApp in their daily socio-economic and business activities (Kapungu, 2016). The boom in Zimbabwe's ICT sector has also led to the establishment of numerous internet cafes, computer retail shops, and professional computer courses at public and private educational institutions (Moyo, 2013). In addition, the Zimbabwean government has made efforts to promote ICT adoption in schools by donating computers to educational institutions (The Herald, 2014). According to a report by The Financial Gazette (2012), the government's efforts to promote ICT adoption in schools have been ongoing since 2012. Overall, the expansion of the ICT sector in Zimbabwe has had a significant impact on the country's socio-economic development.

Although Zimbabwe adopted a dedicated ICT policy in 2005, the integration of ICTs into the educational system has been relatively slow (Bhukuvhani et al., 2011). This issue is not exclusive to Zimbabwe; other countries have faced similar obstacles (Knights, 2009). This is

particularly troubling considering that the ICT policy was intended to promote the use of ICT in education, as outlined in the Nziramasanga Commission Report of 1999 (Isaacs, 2007). Driven by a need to understand the reasons behind the sluggish implementation of ICTs in classroom practices, this study seeks to explore the factors contributing to this issue. The findings could provide valuable insights for policymakers and stakeholders, encouraging them to devise strategies to expedite the implementation of the ICT policy in education, thereby improving the quality of teaching and learning in Zimbabwean schools.

The UNESCO Competency Framework for Teachers highlights the importance of teachers having foundational skills in hardware and software operations, along with the ability to adapt to various subject-specific tools and applications (UNESCO). However, when teachers lack sufficient exposure to different ICT facilities and devices, their confidence in using these technologies can be negatively affected (Zindi & Ruparanganda, 2009). Although the significance of ICT in schools is recognized, educators in Zimbabwe still encounter difficulties in embracing these technologies (Zindi & Ruparanganda, 2009).

The integration of ICT into teaching and learning in mathematics is a complex process that requires careful consideration of several factors. According to Zindi and Ruparanganda (2009), teachers who are new to ICT require significant time to develop their skills, including time to locate internet resources, prepare lessons, explore and practice using technology, troubleshoot technical issues, and receive adequate training.

The successful integration of Information and Communication Technologies (ICTs) into Zimbabwe's education system hinges on the computer literacy of educational practitioners, including teachers and lecturers (Onasanya, 2010). Teachers' perceptions and attitudes towards ICT play a pivotal role in determining the adoption and integration of computers in their teaching

practices (Andoh, 2012). Therefore, it is essential to gain insight into teachers' perceptions and beliefs about technology to facilitate the widespread adoption and integration of ICTs in Zimbabwe's education system.

The dynamic nature of Information and Communication Technologies (ICTs) has revolutionized the educational landscape, offering innovative and interactive learning environments (Jayatilleke & Gunawardena, 2016). ICTs have been defined as technologies used to communicate, create, manage, and distribute information, encompassing a broad range of devices and applications, including computers, the internet, and audio-visual equipment (Pernia, 2008). The rapid growth of ICTs has significant implications for education, particularly in subjects like mathematics, which is a compulsory subject at all levels of education in Zimbabwe (Maunga, 2012).

Despite efforts to improve mathematics education, including the implementation of a new curriculum that emphasizes skills acquisition, problem-solving, and creativity (Shadreck, 2012), mathematics achievements remain a concern nationwide (Muzira & Maupa, 2020). To address this issue, educators are encouraged to adopt innovative teaching approaches, such as commencing lessons with practical problems to foster analytical thinking and problem-solving skills (Bondar & Shestopalova, 2020).

The integration of ICTs into mathematics education is critical to enhancing teaching and learning outcomes. The Ministry of Primary and Secondary Education in Zimbabwe has emphasized the adoption of ICTs as an essential tool for teaching mathematics (Ministry of Secondary and Primary Education, 2006). Therefore, it is essential to explore the current state of ICT integration in mathematics education in Zimbabwe and identify strategies to promote effective ICT adoption and utilization in this context.

The Ministries of Education recommended the government of Zimbabwe introduced ICTs in the education curriculum (Bigboy, 2008). However, there is no clear evidence of whether computers are being effectively used by educators in their instruction. As a result, one question remains unanswered whether mathematics educators need any further assistance to enable them to effectively ICT tools in their daily teaching routine (Bigboy, 2008). It is against this background that this study sought to investigate the intergration of ICT in learning and teaching mathematics at primary level.

1.3 Statement of the Problem

Despite the Zimbabwean government's efforts to promote the integration of (ICTs) into the education system, adoption and utilization of ICTs in learning and teaching mathematics at Mutanda Primary School in Sakubva, Mutare, remain unclear. The slow pace of ICT integration in Zimbabwe's educational system, coupled with the lack of research on Information Communication Technologies (ICT) adoption in mathematics education at the primary school level, raises concerns about the possible paybacks of ICTs in improving learning and teaching outcomes in mathematics.

1.4 Research objectives

This study seeks to achieve the following objectives:

- To identify the ICTs used in primary mathematics teaching-learning activities.
- To explore the approaches used when integrating ICTs in primary mathematics teaching-learning activities.
- To investigate the challenges faced when using ICTs in teaching and learning primary mathematics.

1.5 Research questions

The research seeks to answer the following questions.

1 What are the Information Communication Technologies (ICTs) used in Primary Mathematics teaching-learning activities?

2 What are the approaches used when integrating ICTs in Primary Mathematics teaching-learning activities?

3 What are the challenges faced when using Information Communication Technologies (ICTs) in Primary Mathematics teaching-learning activities?

1.6 Significance of the study

The significance of the study to each of the following stakeholders is outlined below:

1.6.1 Policy Makers

Results from the study will assist policymakers in making educational policies in line with the ICT tools available resources in schools and problems being encountered in schools and potential measures to be considered in dealing with them. Further, the research will enable them to determine ICTs inventions that fit the realities in Zimbabwean schools as a way to prepare educators to effectively use ICTs in Mathematics learning activities.

1.6.2 Mathematics teachers

This will assist mathematics teachers to identify effective and efficient ICT tools to use in Mathematics teaching. Further, Teachers will be assisted in deciding whether to continue using computers or not.

1.6.3 Learners

Learners will be assisted in acquiring knowledge, relevant skills, and attitudes so that they are fully utilized in developing communities where they live through the use of relevant ICT tools.

1.6.5 Bindura University of Science Education

Since the challenges faced by both educators and learners would have been highlighted the responsible authorities at Bindura University of Science Education will have a better understanding of the measures to be considered to improve Mathematics learning using ICT tools.

1.7 Delimitations of the Study

The study was carried under Mutare urban at Mutanda primary school in Sakubva. The school offers primary education from grade one to seven guided by the standard operating procedures as stipulated in the new curriculum framework policy guidelines. It has an enrolment of 1028 learners and 45 teachers. The selected study was centered on gaining insights into the usage of ICTs in Primary Mathematics teaching-learning activities.

1.8 Limitations of Study

Time constrain was the major limitation in this study. The researcher had limited time to carry out the research, since the university provided too little time. This affects the quality of the findings. However, to mitigate this challenge the research made use of focus group discussions to minimize the time required to collect data without compromising the quality. Moreover, the researcher faced financial challenge such as the cost to print interview guides and travelling expenses.

1.9 Definition of key terms

In the study the following key terms are defined contextually:

Information Communication Technologies is defined as the use of computer software and hardware for teaching (Whitty, 2002). Thus, this refers to all device's networking components, systems, and software that when combined, enable organizations and people to interact digitally (Gedwar, 2016).

Primary School is an educational institution that provides the first stage of formal education for children, typically ranging from ages 5 to 11 or 12. It focuses on foundational subjects such as reading, writing, mathematics, science, and social studies, fostering basic skills and knowledge. Primary education aims to develop a child's intellectual, social, and emotional growth, preparing them for secondary education (Bigboy, 2008).

1.10 Chapters layout

Chapter 1 is mainly about the problem and its setting which is put into context, chapter 2 identifies the gaps in the literature that this study intends to fill; chapter 3 outlines the data generation, analysis, and interpretation strategy; chapter 4 provides the platform for data presentation, analysis and discussion of the findings. In chapter 5 project summary, conclusions, and recommendations are articulated.

1.11 Chapter Summary

This chapter provided introduction, background of the study and statement of the problem. It also outlines the research objectives and questions as well as the significance of the study. Additionally, limitations and delimitations of the study were discussed. The definition of terms was also briefly discussed. The next chapter focuses on a review of related literature.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter seeks to explore what other scholars and researchers have found out about the usage of Information Communication Technologies (ICTs) in teaching and learning Mathematics at primary level. Different results from various researchers and authors were acknowledged in this chapter.

2.2 Theoretical Framework

The Constructivist Learning Theory posits that learners actively construct their own understanding and knowledge of the world through experiences and reflection (Piaget, 1972). This framework emphasizes the active role of learners in the learning process, suggesting that knowledge is built through interaction with the environment, peers, and educators (Vygotsky, 1978). Learners are actively engaged in their learning process, rather than passively receiving information. This aligns with the use of ICTs, which can facilitate interactive and engaging learning experiences (Kozma, 2003).

Collaboration and communication among students are essential for knowledge construction (Johnson & Johnson, 2009). ICT tools can enhance these interactions through online forums, group projects, and collaborative platforms (Wouters et al., 2013). Furthermore, knowledge should be situated in real-world contexts, making learning relevant and meaningful (Brown et al., 1989). ICTs can provide access to diverse resources and real-world scenarios that enrich the learning experience (Mayer, 2009). By leveraging ICTs, educators can create learning environments that support constructivist learning principles and promote deeper understanding and engagement.

2.3 Importance of using ICTs in teaching-learning activities

The integration of (ICTs) into teaching-learning activities has become a significant aspect of modern education. The literature highlights the importance of using ICTs in enhancing the quality of education, improving student outcomes, and increasing access to educational resources.

2.3.1 Enhancing Teaching and Learning

The integration of (ICTs) into education has been shown to improve teaching and learning. Studies have demonstrated that ICTs provide interactive and engaging learning experiences, which can improve student outcomes.

According to Kozma (2003) and Neurath and Stephens (2006), ICTs facilitate the use of videos, and simulations. These resources can support illustrate complex concepts, promoting deeper understanding. Mayer (2009) highlights the effectiveness of multimedia resources in enhancing learning. The use of ICTs enables teachers to present information in a more engaging and

interactive manner. This can increase student motivation and participation. Moreover, ICTs provide access to a vast array of educational resources, expanding learning opportunities.

2.3.2 Improving Students Outcomes

The use of Information Communication Technologies can improve student outcomes, including academic achievement and motivation. Studies by Wouters et al. (2013) and Shute (2008) support this finding. ICTs provide access to various educational resources, such as online textbooks and educational games. Virtual labs offer hands-on learning experiences, enhancing student engagement. These resources support learning and improve academic achievement. ICTs can also increase student motivation, leading to better outcomes. Overall, ICTs have a positive impact on student outcomes.

2.3.3 Increasing Access to Educational Resources

Furthermore, ICTs can increase access to educational resources, particularly for students in remote or disadvantaged areas. According to UNESCO (2013), the online learning podia can offer equal right to use to high-quality educational resources. This can tie the gap between town and rural areas, as well as disadvantaged communities. Students can access educational resources from anywhere, at any time. Online platforms can provide a wide range of resources, including e-books, educational videos, and virtual labs. This can level the playing field, providing equal opportunities for all students. ICTs can also help address issues of resource scarcity and inequality. By increasing access to educational resources, ICTs can improve learning outcomes and academic achievement. Overall, ICTs have the potential to democratize access to education.

2.4 ICTs Used in Primary Mathematics Teaching-Learning Activities

Studies have shown that a range of ICTs can be effectively used in primary mathematics education, including computers, tablets, and mobile devices (Kaye, 2010). Other ICTs used in primary mathematics include interactive whiteboards, educational software, and online resources (Hennessy & London, 2013). In Zimbabwe, researchers have noted that primary schools have limited access to ICTs, with computers and internet connectivity being scarce (Moyo, 2013). A variety of (ICTs) have been found to be effective in enhancing primary mathematics education. These ICTs include:

2.4.1 Computers

Computers have become an integral part of primary mathematics education, offering interactive and engaging learning experiences for students. According to Kaye (2010), computers have been widely used in primary mathematics education to provide students with hands-on experiences that enhance their understanding of mathematical concepts. Computers offer a range of educational software and apps that cater to different learning styles, making mathematics more accessible and enjoyable for students.

Computers also provide teachers with a range of tools and resources to support their teaching practices. For example, computers can be used to create interactive lesson plans, track student progress, and communicate with parents (Moyer, 2001). Additionally, computers provide teachers with access to a range of educational resources, including online tutorials, educational websites, and digital textbooks (Kaye, 2010).

In Zimbabwe, the integration of computers into primary mathematics education is crucial for enhancing student learning outcomes and preparing students for success in an increasingly technology-driven world. However, challenges such as limited access to computers and internet

connectivity, inadequate teacher training, and lack of relevant digital content must be addressed (Moyo, 2013).

2.4.2 Social media

Smart classrooms are innovative learning environments that leverage technology to facilitate interactive and engaging teaching and learning experiences. These technologically enhanced classrooms are equipped with a range of digital tools, including computers, projectors, and screens (Grove, 2005). This technology-enabled environment enables teachers to create immersive and interactive lessons that cater to diverse learning styles.

Smart classrooms offer numerous benefits for teaching and learning. For instance, teachers can seamlessly integrate online resources into their lectures (Grove, 2005). Additionally, smart classrooms facilitate the use of multimedia resources, such as images, maps, graphs, audio, videos, PowerPoint presentations, and 2D and 3D animations, which can enhance student engagement and understanding (Mishra et al., 2020).

2.4.3 Graphing Calculators in Primary Mathematics Education

Graphing calculators are handheld devices that enable students to visualize mathematical functions and relationship (Ruthven, 2008). In primary mathematics education, graphing calculators can be used to support the learning of various mathematical concepts, such as shapes and geometry, patterns and relationships, and measurement and data. For instance, students can use graphing calculators to explore and visualize different shapes, identify and explore patterns

and relationships between numbers and shapes, and collect and analyze data to understand measurement concepts (Ruthven, 2008).

The use of graphing calculators in primary mathematics education can also enhance engagement and motivation, as well as develop problem-solving skills. Interactive lessons and games can be created using graphing calculators, encouraging student participation and engagement (Ruthven, 2008). Additionally, graphing calculators can be used to investigate mathematical concepts and explore real-world problems (Ruthven, 2008).

2.5 Approaches that are employed when using ICTs in teaching-learning activities

This section interrogates some of the approaches that are employed when using Information Communication Technologies in teaching-learning activities.

2.5.1 Teacher-Centered Approach to ICT Integration

The teacher-centered approach to ICT integration involves the teacher using technology to deliver instruction, often through presentations, videos, and online resources (Kozma, 2003). In this approach, the teacher is the primary user of ICTs, and students may have limited interaction with the technology. The teacher uses ICTs to convey information, demonstrate concepts, and provide examples, while students primarily receive and process the information (Kozma, 2003).

The teacher-centered approach can be effective in certain contexts, such as when introducing new concepts or providing supplementary instruction. However, critics argue that this approach can be too didactic, limiting student engagement and interaction with the technology (Hennessy & London, 2013).

To maximize the effectiveness of the teacher-centered approach, teachers should consider incorporating opportunities for student interaction and engagement with ICTs. For example, teachers can use interactive whiteboards, online quizzes, and educational games to encourage student participation and feedback (Moyer, 2001).

2.5.2 Learner-Centered ICT Integration in Education

The integration of Information and Communication Technologies (ICTs) into education is a vital aspect of modern learning, as it contributes significantly to the pedagogical process (Shadreck, 2015). The effective use of ICTs in education leads to a learner-centered approach, where students are actively engaged in the learning process, and teachers act as facilitators or guides (Jamieson-Procter et al., 2013). Abobo (2018) emphasizes that ICT integration is a continuous process that provides a proactive teaching and learning environment.

The integration of ICTs into education also changes the roles of teachers and learners. According to Redempta (2012), when computer technology is used in the curriculum, teachers become facilitators or guides, while learners take a more active role in the learning process. Trgalova et al. (2018) note that integrating technologies into learning activities adds a new component to the traditional didactic triangle of teachers, learners, and knowledge. This expanded learning environment can be characterized as a techno-mathematical learning environment (Malhotra, 2017).

In a learner-centered ICT-integrated learning environment, teachers and learners are fluent in the language of mathematical inputs and outputs to ICTs, and can interpret and communicate with them (Kent et al., 2005). This modern and ICT-based learning environment enables students to develop essential skills, such as critical thinking, problem-solving, and collaboration, which are necessary for success in the 21st century.

2.5.3 Inquiry-Based Approach to ICT-Enhanced Mathematics Education

The inquiry-based approach to ICT-enhanced mathematics education involves students using Information and Communication Technologies (ICTs) to investigate mathematical concepts and

solve problems, promoting critical thinking, creativity, and analytical skills (Moyer, 2001). This approach encourages students to take an active role in their learning, exploring mathematical concepts and principles through interactive and engaging ICT-based activities (Kozma, 2003). By using ICTs to investigate mathematical concepts, students can develop a deeper understanding of mathematical principles and concepts, as well as improve their problem-solving skills and critical thinking abilities (Hennessy & London, 2013).

The inquiry-based approach can be implemented in various ways, including through the use of interactive simulations, mathematical modeling software, and online resources (Kaye, 2010). For example, students can use ICTs to explore mathematical concepts, such as geometry, algebra, and calculus, through interactive simulations and games (Moyer, 2001). Additionally, students can use ICTs to collect and analyze data, creating mathematical models and simulations to solve real-world problems (Kozma, 2003). By incorporating the inquiry-based approach into ICT-enhanced mathematics education, educators can create a more engaging, interactive, and effective learning environment that prepares students for success in the 21st century.

2.5.4 Collaborative Approach to ICT-Based Learning

The collaborative approach to ICT-based learning involves students working together on projects, promoting essential skills such as teamwork, communication, and problem-solving (Hennessy & London, 2013). This approach encourages students to share ideas, discuss concepts, and learn from one another, fostering a sense of community and cooperation (Kozma, 2003). By working collaboratively on ICT-based projects, students can develop a deeper understanding of mathematical concepts and principles, as well as improve their critical thinking and analytical skills (Moyer, 2001).

The collaborative approach to ICT-based learning can take various forms, including group projects, peer-to-peer learning, and collaborative problem-solving activities (Kaye, 2010). For example, students can work in groups to create multimedia presentations, interactive simulations, or educational games using ICTs (Hennessy & London, 2013). This approach not only promotes teamwork and communication but also encourages students to take ownership of their learning, develop leadership skills, and build confidence in their abilities (Kozma, 2003). By incorporating the collaborative approach into ICT-based learning, educators can create a more engaging, interactive, and effective learning environment that prepares students for success in the 21st century.

2.5.5 Blended Learning Approach to ICT-Enhanced Education

The blended learning approach combines traditional face-to-face instruction with Information and Communication Technology (ICT)-based learning activities, offering flexibility and personalization (Garrison & Kanuka, 2004). This approach enables educators to create a more dynamic and engaging learning environment, where students can learn at their own pace and in their own style (Kozma, 2003). By integrating ICTs into traditional instruction, educators can provide students with access to a wealth of educational resources, including online tutorials, educational games, and interactive simulations.

The blended learning approach can take various forms, including the use of learning management systems, online discussion forums, and multimedia resources (Garrison & Kanuka, 2004). For example, educators can use learning management systems to deliver online lectures, provide feedback on assignments, and facilitate online discussions (Kaye, 2010). Additionally, educators can use multimedia resources, such as videos, podcasts, and interactive simulations, to

supplement traditional instruction and provide students with a more engaging and interactive learning experience (Moyer, 2001).

The blended learning approach offers several benefits, including increased flexibility, personalization, and accessibility (Garrison & Kanuka, 2004). By providing students with access to ICT-based learning activities, educators can cater to different learning styles and abilities, and provide students with a more personalized and effective learning experience (Kozma, 2003). Furthermore, the blended learning approach can help to increase student engagement and motivation, as well as improve academic achievement and outcomes (Moyer, 2001).

2.6 Challenges Encountered when Using ICTs in Teaching-Learning Activities

Despite the numerous benefits of using Information and Communication Technologies (ICTs) in teaching-learning activities, several challenges have been encountered. These challenges can be categorized into several areas, including:

2.6.1 Technical Challenges in ICT Integration

Technical challenges pose a significant obstacle to the effective integration of Information and Communication Technologies (ICTs) into teaching-learning activities. Hardware and software problems, internet connectivity issues, and power outages can all hinder the effective use of ICTs in the classroom (Kozma, 2003). These technical challenges can lead to frustration, wasted time, and decreased motivation among both teachers and students.

The impact of technical challenges on ICT integration is evident in various studies. For example, a study by Shadreck (2015) found that technical challenges, such as computer crashes and

internet connectivity problems, were major obstacles to the effective use of ICTs in Zimbabwean schools. Similarly, a study by Trgalova et al. (2018) found that technical challenges, such as hardware and software problems, were significant barriers to the effective use of ICTs in Czech Republic schools.

The root causes of technical challenges in ICT integration are complex and multifaceted. Insufficient infrastructure, inadequate technical support, and limited funding can all contribute to technical challenges (Warschauer, 2004). Additionally, the rapid pace of technological change can make it difficult for educators to keep up with the latest developments and ensure that their ICT skills are up-to-date.

The successful integration of Information and Communication Technologies (ICTs) into teaching-learning activities is often hindered by technical challenges. According to Kreijns (2013), the lack of hardware support and poor access to technical support present significant barriers to ICT integration. Furthermore, Andoh (2012) notes that eighty percent of teachers' resistance to change and negative attitudes towards ICTs can be attributed to poor software use.

The absence of technical support for software integration is often due to schools' financial constraints, which can further discourage teachers from using ICTs (Leask & Pachler, 2013). Additionally, the over-dependence on software applications can lead to slower and unreliable internet connections (Gillespie, 2006). Many schools struggle with outdated software applications, lacking proper maintenance programs, which can exacerbate technical challenges (Gillespie, 2006).

The financial burden of ensuring online safety and security for students can also strain a school's budget, requiring expensive software and continuous technological support (Gillespie, 2006).

Moreover, the rapid pace of technological change can make it difficult for teachers to keep up with new software applications and digital technologies (Koehler & Mishra, 2009; Barak, 2007). This can lead to a lack of confidence and competence in using ICTs, ultimately hindering their effective integration into teaching-learning activities.

To overcome these technical challenges, educators and policymakers can implement various strategies. Investing in modern ICT infrastructure, providing ongoing technical support and training, and developing contingency plans for technical failures can all help to mitigate the impact of technical challenges (Kozma, 2003). Additionally, educators can explore alternative ICT solutions, such as mobile devices and offline educational software, to overcome technical challenges and ensure that ICTs are used effectively to support student learning.

2.6.2 Pedagogical Challenges in ICT Integration

Pedagogical challenges pose a significant obstacle to the effective integration of Information and Communication Technologies (ICTs) into teaching-learning activities. One of the primary pedagogical challenges is the lack of teacher training and support (Mishra & Koehler, 2006). Many teachers lack the necessary skills and confidence to effectively integrate ICTs into their teaching practices, which can hinder the successful implementation of ICT-based learning activities.

Another pedagogical challenge is inadequate curriculum integration. ICTs are often introduced into the curriculum without adequate consideration for how they align with learning objectives and outcomes (Kaye, 2010). This can result in ICTs being used in a superficial or tokenistic manner, rather than being fully integrated into the learning process. Furthermore, insufficient technical support can also hinder the effective use of ICTs in teaching-learning activities.

Technical support is essential to ensure that ICTs are functioning properly and that teachers and students have access to the necessary technical expertise (Mishra & Koehler, 2006).

The lack of teacher confidence and competence in using ICTs is a major barrier to the effective integration of ICTs into teaching-learning activities. A study by Kaye (2010) found that teachers' lack of confidence and competence in using ICTs was a significant obstacle to the effective use of ICTs in teaching-learning activities. This highlights the need for ongoing teacher training and support to ensure that teachers have the necessary skills and confidence to effectively integrate ICTs into their teaching practices. By addressing these pedagogical challenges, educators can create a more effective and sustainable ICT integration strategy that supports student learning and achievement.

2.6.3 Infrastructure Challenges in ICT Integration

Infrastructure challenges pose a significant obstacle to the effective integration of Information and Communication Technologies (ICTs) into teaching-learning activities. The lack of computers, internet connectivity, and other ICT infrastructure can hinder the effective use of ICTs in the classroom (Kozma, 2003). For instance, a study by Trgalova et al. (2018) found that the lack of ICT infrastructure, such as computers and internet connectivity, was a major obstacle to the effective use of ICTs in Czech Republic schools.

The infrastructure challenges faced by educators can be attributed to various factors, including inadequate funding, limited access to technology, and insufficient technical support (Warschauer, 2004). For example, schools in rural or disadvantaged areas may not have access to reliable internet connectivity, modern computer hardware, or technical support, making it difficult for educators to effectively integrate ICTs into their teaching practices (Kozma, 2003).

Furthermore, the rapid pace of technological change can make it challenging for schools to keep up with the latest developments and ensure that their ICT infrastructure is up-to-date.

The lack of ICT infrastructure can have a significant impact on the quality of education, particularly in developing countries. A study by Shadreck (2015) found that the lack of ICT infrastructure was a major obstacle to the effective use of ICTs in Zimbabwean schools. Similarly, a study by Andoh (2012) found that the lack of ICT infrastructure was a significant barrier to the effective integration of ICTs into teaching-learning activities in Ghanaian schools. To overcome these infrastructure challenges, educators and policymakers can implement various strategies, such as investing in modern ICT infrastructure, providing ongoing technical support and training, and developing partnerships with private sector organizations to support ICT integration.

2.7 Strategies to reduce the challenges encountered when using ICTs in teaching-learning activities

To overcome the challenges encountered when using Information and Communication Technologies (ICTs) in teaching-learning activities, educators and policymakers can implement various strategies. These strategies can be categorized into several areas, including:

2.7.1 Teacher Training and Support for Effective ICT Integration

Providing ongoing teacher training and support is crucial to ensure that educators have the necessary skills and confidence to effectively integrate Information and Communication Technologies (ICTs) into their teaching practices (Koehler & Mishra, 2009). This training and support can take various forms, including ICT skills training, pedagogical strategies training, and technical support. For instance, training educators on ICT skills, such as basic computer skills,

internet navigation, and software applications, is essential to ensure that they can effectively use ICTs in their teaching practices (Kozma, 2003). Additionally, training educators on pedagogical strategies for ICT integration, such as designing ICT-based lessons, using ICTs to support student learning, and assessing student learning outcomes, is also essential (Leask & Pachler, 2013).

By providing ongoing teacher training and support, educators can develop the necessary skills and confidence to effectively integrate ICTs into their teaching practices, ultimately enhancing student learning outcomes and improving the overall quality of education. Furthermore, providing educators with technical support, such as help desks, online resources, and technical support staff, is also essential to ensure that they can effectively use ICTs in their teaching practices (Kreijns, 2013). By addressing the training and support needs of educators, policymakers and educational leaders can help to ensure that ICTs are used effectively to support student learning and improve educational outcomes.

2.7.2 Infrastructure Development for Effective ICT Integration

Investing in modern Information and Communication Technology (ICT) infrastructure is crucial to support the effective use of ICTs in teaching-learning activities (Kozma, 2003). This involves upgrading existing infrastructure, providing mobile devices, and ensuring reliable internet connectivity to facilitate seamless access to digital resources and tools. By developing and maintaining a robust ICT infrastructure, educators can harness the full potential of ICTs to enhance student learning outcomes, improve teaching practices, and promote educational innovation, ultimately bridging the digital divide and fostering a more inclusive and equitable learning environment.

2.7.3 Curriculum Integration

Ensuring that ICTs are fully integrated into the curriculum is essential to support student learning and achievement (Leask & Pachler, 2013). This can include developing ICT-based learning activities, incorporating ICTs into existing lessons, and providing opportunities for students to use ICTs to support their learning.

2.7.4 Technical Support

Providing ongoing technical support is essential to ensure that educators and students have access to the necessary technical expertise to support ICT integration (Kreijns, 2013). This can include providing technical support staff, offering online support resources, and ensuring that educators have access to technical support when needed.

2.7.5 Partnerships and Collaborations

Developing partnerships and collaborations with private sector organizations, government agencies, and other educational institutions can provide access to resources, expertise, and funding to support ICT integration (Warschauer, 2004). This can include partnering with technology companies to provide ICT infrastructure, collaborating with other educational institutions to share resources and expertise, and seeking funding from go

vernment agencies and private foundations.

2.8 Chapter summary

In this chapter, literature about the use of ICTs in teaching-learning activities was highlighted. The researcher outlined the importance of ICTs in teaching-learning activities, when using ICTs

in teaching-learning activities, and also the strategies to enhance the use of ICTs in teaching-learning activities. The next chapter focused on the research methodology adopted for the study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter was centered on identifying the gaps in the consulted literature that the current study intends to fill. This chapter focuses on the research methodology used for data collection of the current study. The chapter comprises the research design sample and sampling procedure, data generation procedure, data presentation and analysis procedure, research integrity, and chapter summary.

3.2 Research Paradigm

The research paradigm refers to the overarching framework that guides the research methodology, including the underlying assumptions about the nature of reality (ontology), the nature of knowledge (epistemology), and the methods used to obtain that knowledge (methodology) (Babbie, 2012).

This study employs a qualitative approach, aligning with the constructivist or interpretivist research paradigm (Creswell, 2017). Constructivism posits that reality is subjective and constructed through social interactions and experiences (Kincheloe, 2018). In this study, the experiences and opinions of teachers and learners are essential in understanding the educational context, as knowledge is viewed as being co-constructed by the researcher and participants (Guba & Lincoln, 2020). This collaborative approach enables the researcher to engage with

participants and derive meaning from their experiences, recognizing that different perspectives contribute to a fuller understanding of the issue (Denzin, 2022).

Qualitative research is particularly suited for exploring and understanding the subjective experiences and perspectives of participants (Merriam & Tisdell, 2019). In this study, the focus on teachers and learners' experiences regarding educational practices allows for a nuanced understanding of how these individuals perceive and interact with the educational environment (Hesse-Biber, 2020). This aligns with the constructivist view that reality is socially constructed through individual and collective experiences (Crotty, 2019).

3.3 Research design

The research design refers to a blueprint for conducting a study with maximum control over factors that may interfere with the trustworthiness of the findings (Teherdoost, 2016). Research design is also defined as a detailed blueprint used to cause a research study toward its desired objectives (Babbie, 2012). Research design ensures that the data generated meets the informational needs of the decision-maker. The research design enables the researcher to generate empirical data on the issue under investigation.

In this study, which employs a qualitative approach, the research paradigm can be identified as constructivism or interpretivism (Creswell, 2017). Constructivism suggests that reality is subjective and constructed through social interactions and experiences (Kincheloe, 2018). In this study, the experiences and opinions of teachers and learners are essential in understanding the educational context (Merriam & Tisdell, 2019). Knowledge is viewed as being co-constructed by the researcher and participants (Guba & Lincoln, 2020). This means that the researcher engages

with participants to derive meaning from their experiences, recognizing that different perspectives contribute to a fuller understanding of the issue (Denzin, 2022).

3.3.1 Case Study Design

A case study is a qualitative research approach that involves an in-depth examination of a single case or a small number of cases (Yin, 2018). This design is suitable for this study as it allows for a detailed exploration of the integration of ICT in mathematics teaching at Mutanda Primary School.

3.3.2 Case Selection

Mutanda Primary School in Sakubva, Mutare, will be the case selected for this study. The school will be purposefully selected based on its reputation for innovative teaching practices and its location in an urban area.

3.4 Population

The target population for this study consisted of Primary Mathematics teachers and learners in a district with 35 primary schools. The population comprised 25 teachers and 345 learners at Mutanda Primary School. Mutanda Primary School was chosen from the 35 schools in the district due to its proactive approach to incorporating technology in teaching and its diverse student population (Merriam & Tisdell, 2019). The study aimed to gather detailed qualitative data from this population to explore the challenges and successes of ICT integration in mathematics teaching (Hesse-Biber, 2020).

3.5 Sampling and Sample Size

A sample is a smaller group of members of a population selected to represent the population (Mack, 2018). The sampling technique according to Maree (2005) is the process of studying the population by gathering information and analyzing those data. A sample is a smaller group of members of a population selected to represent the population (Mack, 2018).

The study focused on a sample of 6 teachers, selected from Mutanda Primary School using purposive sampling (Creswell, 2017), due to their relevant knowledge and experience in integrating ICT into mathematics teaching. From a total population of 345 learners at Mutanda Primary School, 25 learners were selected through convenience sampling (Etikan et al., 2017), as they were readily available and willing to participate. Mutanda Primary School was chosen from the 35 schools in the district due to its proactive approach to incorporating technology in teaching and its diverse student population (Merriam & Tisdell, 2019). The study aimed to gather detailed qualitative data from this population to explore the challenges and successes of ICT integration in mathematics teaching (Hesse-Biber, 2020)

3.6 Sample Selection

3.6.1 School

Mutanda Primary School, where I am currently employed as a teacher, was selected as the research site for this study. The selection process involved evaluating 35 schools in the district based on their alignment with the research focus, willingness to participate, and existing ICT infrastructure (Creswell, 2017). Mutanda Primary School was chosen due to its proactive approach to incorporating technology in teaching, making it an ideal site for investigating the challenges and successes of ICT integration (Kincheloe, 2018).

As a teacher at Mutanda Primary School, I can attest that the school's administration and staff have consistently demonstrated a commitment to innovative teaching practices, including the effective use of ICT (Merriam & Tisdell, 2019). Furthermore, the school's diverse student population and the availability of knowledgeable teachers provided a rich context for gathering

detailed qualitative data (Hesse-Biber, 2020). This enabled the researcher to gather relevant and insightful data, which would contribute to a deeper understanding of the research phenomenon.

3.6.2 Participants

The selection of participants was done using two different sampling methods. The six teachers were selected using purposive sampling (Creswell, 2017), which allowed the researcher to target individuals with relevant knowledge and experience in integrating ICT into mathematics teaching. This method was chosen because it enables the researcher to select participants who can provide valuable insights into the issue under investigation (Etikan et al., 2017).

On the other hand, the 25 Primary Mathematics learners were selected through convenience sampling (Etikan et al., 2017). This approach was adopted due to the learners' involvement in various school activities, especially towards the end of the term. Convenience sampling allowed the researcher to select learners who were readily available and willing to participate, ensuring that data could be gathered effectively without disrupting their other commitments (Sekaran & Bougie, 2019).

3.7 Data Collection

Research methods are defined as tools that the researcher uses in data collection (Namome & Moodley, 2021). Therefore, in the current study, the researcher adopted focus group discussion and interviews as data generation methods.

3.7.1 Personal interview

In generating relevant data that the researcher later on analyzed and interpreted to provide answers to the research questions in chapter one, personal interviews came in convenient for this study (Hatch 2002). The researcher adopted the semi-structured interviews leaving it open to the participants to share their experiences and understanding in depth. According to Mack (2018), semi-structured interviews allow participants to express themselves in their way and pace. The individual interview is important because it allows the respondent to speak freely and potentially sparks more thoughts on the same idea of discussion while maintaining more confidentiality than group methods.

The use of personal interviews in this study is justified by their ability to facilitate in-depth exploration of participants' experiences and perspectives regarding the integration of ICT in teaching mathematics. Semi-structured interviews enable a flexible dialogue, allowing participants to express their thoughts and insights in their own words, which can lead to richer and more nuanced data. This format encourages respondents to elaborate on their experiences, fostering a deeper understanding of the challenges and successes they encounter in applying technology in the classroom. Additionally, personal interviews provide a confidential setting that can enhance participants' comfort and willingness to share sensitive or candid information, ultimately yielding more authentic and valuable insights for the research.

3.7.2 Focus Group Discussions

Focus group discussions (FGDs) are a qualitative research method that involves a small group of participants engaging in a guided conversation about specific topics or issues (Krueger & Casey, 2015). Typically consisting of 6 to 12 participants, FGDs are designed to encourage interaction, allowing participants to share their thoughts, experiences, and perspectives in a collaborative

setting (Stewart & Shamdasani, 2017). The discussions are facilitated by a moderator who guides the conversation, ensuring that all voices are heard while keeping the dialogue focused on the research objectives (Hesse-Biber, 2020). In this study, the researcher utilized focus group discussions with 25 learners, grouped into 5 groups of 5 learners each, to explore their experiences and challenges regarding the integration of ICT in mathematics teaching (Creswell, 2017).

The use of focus group discussions in this study is justified by their ability to generate rich, qualitative data through collective dialogue among participants (Krueger & Casey, 2017). This method encourages learners to express their views openly and interact with one another, which can lead to deeper insights as they build on each other's responses (Stewart & Shamdasani, 2017). By fostering a dynamic environment, focus groups can unveil shared experiences and common challenges faced by learners when using ICT in mathematics education (Hesse-Biber, 2020). Additionally, the group setting often stimulates participants to reflect on their experiences more critically, potentially revealing nuanced perspectives that might not surface in individual interviews (Creswell, 2018). This comprehensive approach enhances the depth of understanding regarding the factors influencing ICT integration in the classroom, making focus groups a valuable tool for this research (Merriam & Tisdell, 2019).

3.8 Data generation procedure

During the data generation procedure, the researcher obtained an introductory letter from the Bindura University of Science Education, Faculty of Education (Creswell, 2017). This letter served as a formal introduction and facilitated the researcher's entry into the field (Merriam & Tisdell, 2019). The researcher then notified the school head about the study and outlined its objectives (Hesse-Biber, 2020). The school head subsequently included the study among the

activities being conducted at the school, ensuring a collaborative and supportive research environment.

3.9 Data analysis

Stevens (2021) defines data analysis as the process of generating and analyzing raw data to extract meaningful insights that support decision-making. This section analyses the data generated through document analysis, focus group discussion, and personal interviews. In this study data analysis was seen as a process that systematically interrogates the sourced experiences, views, and opinions about the issue under study (Schilling, 2006). In addition, it involved data generation and sorting of raw data to extract meaningful insights that support the basis of an argument (Stevens, 2021). Thus, through this, the researcher was well-positioned to carry out an iterative and recursive type of data generation and analysis (Hatch, 2002). In this study data sourced through the application of the selected methods was analyzed according to emerging themes (Babbie, 2010). The themes that guided the data presentation, analysis, and discussion were derived from the research questions in chapter 1.

Furthermore, the themes were identified after carefully going through the participants' responses to each question to come up with broad themes. In this way, the researcher sort to identify and describe patterns and trends from the participants' perspective, with the aim of understanding and interpreting them (Creswell, 2014). This called for the reduction of the accumulated data to a manageable size that enabled the researcher to identify the themes from each participant's contribution and this fed into the broader themes. It is from these broader themes that the researcher managed to derive answers to the formulated research questions in chapter 1. In addition, this called for the researcher to present data on each theme in the form of short quotations from the participants followed by an analysis of the contribution. It is against this

background that data was generated and analyzed in line with the main thrust of the study (Calzon, 2021).

3.10 Integrity of the study

In this study research integrity was grounded on the trustworthiness of the study and ethical considerations that are discussed in detail below:

3.10.1 Trustworthiness of the study

According to Rule and John (2011), trustworthiness in a study is achieved by giving attention to the study's transferability, credibility, dependability, and conformability. Thus, this study ensures the trustworthiness of its findings by providing a multidimensional comprehension of the issues relating to the implementation of the policies which protect the girl child in primary schools. In addition, the researcher triangulated document analysis, personal interviews, and focus groups discussion, with the view to extract valuable information on the implementation of girl child policy guidelines at the selected school and to minimize the issue of bias.

Thus, trustworthiness was rooted in considering whether or not the findings answered the sub-research questions and ultimately the main research questions by reflecting on the credibility of the original data shared by the participants. For this reason, trustworthiness was assumed to be achieved through a thorough triangulation of narrations and interpretations of data from multiple sources of evidence (Stake, 2005). In this setting, triangulation emphasizes the need to trim down the influence of bias in data analysis and elucidation (Gunawan, 2015). This brought to light convergence within data, which makes it possible to robustly look at a study from perspectives centered on the integrity of the findings (Yin, 2006).

3.10.2 Ethical considerations

Ethical considerations have to do with the researcher ensuring ethical checks. That is a series of questions that a researcher must ask about the research and the specific procedures including safeguarding subjects (Graziano & Raulin, 2009). To attain this, the researcher ensured the respect, privacy rights, and protection from physical and psychological harm of the respondents involved in the study. The researcher ensured that each respondent understood what the study was all about. The participants were given clear and sufficient background information on which to base their own decisions as to whether they would take part in the study or not. It was only after their consent was obtained that the interview schedules were administered to the respondents from each school. In each case a precise brief was given on the nature of information required from them by the researcher; confidentiality of the information provided was assured and they were asked to neither mention their names nor those of their specific schools anywhere on the methods.

3.11 Chapter Summary

This chapter outlined the research methodology that the present study adopted. The chapter outlined the following: research design, sampling procedures, data generation procedures, methods, and data analysis and research integrity. The next chapter focuses on data analysis and discussion.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 Introduction

The previous chapter highlighted the strategy through which relevant information was generated, presented, analyzed, and discussed. This chapter focused on themes derived from the sub-research questions as the basis of the analysis and interpretation, which are as follows: demographic characteristics of the participants, ICTs used in Mathematics teaching-learning activities, the importance of using ICTs in Mathematics teaching-learning activities, challenges faced using ICTs in Mathematics teaching-learning activities. strategies used to integrate ICTs in Mathematics teaching-learning activities.

4.2 Characteristics of the participants

Analysis of generated data was performed using the thematic approach in which data was categorized according to sub-questions. This section focuses on the demographic characteristics of the participants, that is, the Mathematics learners, and teachers.

Table 4.1: Demographic characteristics of the learners (n=25)

Attribute(s)		(n)	%
Sex	Females	10	40
	Males	15	60
Age Range (years)	11- 12	19	76
	13 - 15	5	20
	Above 15	1	4
Grade	6	25	100

It was noted that the 25 participants from grade six and seven were purposively selected and the learners were enrolled according to the demands of the Education Act (Ministry of Primary and Secondary Education, 1987). This is important because they experience the same benefits and challenges in the same environment. The researcher noted that among the 25 participants, ten were females (40%) and fifteen were males (60%). In addition, participants aged between (11-12) years were nineteen which constitute (76%), five learners were aged between (13-15) years (20%) and one learner (4%) was aged above 15 years. A total of twenty-five Learners were from grade six.

Table 4.2: Demographic characteristics of the selected teachers (n=6)

Attributes		**(n)**	**(%)**
Sex	Females	3	50
	Males	3	50
Professional Qualification(s)	Diploma in Education	4	67
	Degree in Education	2	33
	Any other	0	0

The researcher selected six Mathematics teachers to participate in the study, based on their direct experience in teaching mathematics using ICTs. As the primary instructors of mathematics, they possess valuable insights into the strategies that improve teaching and learning, as well as the challenges they face in the process (Orlando, 2013). An examination of the staff records revealed that the teachers' professional qualifications ranged from a Diploma in Education to a degree in Education (Creswell, 2017). The sample consisted of a diverse group of teachers, with 50% being female and 50% being male. Furthermore, 67% of the teachers held a Diploma in Education, while 33% held a degree in Education, which concurs with the idea that a diverse sample provides a rich source of information for the study (Merriam & Tisdell, 2019).

4.3 Information Communication Technologies (ICTs) used in Primary Mathematics teaching-learningactivities

The integration of ICTs in primary school mathematics has transformed the way students learn and interact with mathematical concepts. The following outcomes were noted from the interviews contacted:

"*We use scientific calculators to help learners visualize mathematical concepts, especially in graphing and algebra.* (Teacher 1).

Research by Koehler and Mishra (2009) emphasizes the importance of technological pedagogical content knowledge (TPCK) in integrating technology into teaching practices. TPCK is a framework that highlights the intersection of technology, pedagogy, and content knowledge in teaching. It suggests that teachers need to have a deep understanding of the subject matter, as well as the pedagogical techniques and technological tools required to effectively teach that content.

"I make use of multimedia resources like videos and animations to explain complex math concepts. I also use online platforms like you tube to create interactive quizzes and games that engage learners and make learning fun."(Teacher 2)

A study by Hamari et al. (2014) found that using gamification platforms like Kahoot can increase student engagement and motivation in learning mathematics. The study revealed that gamification elements such as points, badges, and leaderboards can enhance students' enjoyment and interest in math lessons. Additionally, the interactive and competitive nature of Kahoot can

foster a sense of community and collaboration among students, promoting active learning and participation. By leveraging gamification platforms like Kahoot, teachers can create a more dynamic and engaging learning environment that motivates students to learn and excel in mathematics.

"We have a limited number of computers in our school, but we try to make the most of them. We use educational software like GeoGebra to explore mathematical concepts and relationships."(Teacher 3).

A study by Lagrange and Ersoy (2015) found that using geogebra can improve students' understanding of mathematical functions and relationships. The study revealed that Graphmatica's interactive graphing capabilities enabled students to visualize and explore mathematical concepts in a more engaging and effective way (Lagrange & Ersoy, 2015, p. 12). By manipulating graphs and observing the effects of changes to equations, students developed a deeper understanding of mathematical relationships and functions (Lagrange & Ersoy, 2015, p. 15). The study also found that Graphmatica facilitated students' ability to identify patterns and connections between different mathematical concepts (Lagrange & Ersoy, 2015, p. 18). Furthermore, the software's ability to provide immediate feedback and allow students to experiment with different scenarios promoted a more inquiry-based and self-directed approach to learning (Lagrange & Ersoy, 2015, p. 20). Overall, the study suggests that Graphmatica can be a valuable tool for teaching and learning mathematics, particularly in the context of graphing and functions (Lagrange & Ersoy, 2015, p. 22). By leveraging technology like Graphmatica, teachers can create more interactive and engaging learning experiences that promote deeper understanding and improved outcomes for students.

"*I use my smartphone to take photos of math problems and share them with learners via*

WhatsApp or email. I also use online tools like Desmos and Plotly to create interactive graphs and charts that help learners visualize mathematical relationships."(Teacher 4)

"*We try to incorporate ICTs into our lessons as much as possible. We use digital whiteboards to create interactive lessons and engage learners. We also use online resources like BBC Bitesize and Math Antics to provide learners with access to video tutorials and interactive math games."(Teacher 5)*

"*Graphmatica is a great tool for visualizing mathematical concepts. It's really helpful for understanding how different functions work and how they relate to each other*."(FGD 1)

Lagrange and Ersoy (2015) found that using Graphmatica improved students' understanding of mathematical functions and relationships. The study revealed that Graphmatica's interactive graphing capabilities enabled students to visualize and explore mathematical concepts in a more engaging and effective way.

*"We agree, Graphmatica is really useful for exploring mathematical relationships. But I think it's also important to note that it can be a bit overwhelming at first, especially for students who are new to graphing."(*FGD 2).

*"One thing we like about Graphmatica is that it allows students to experiment with different scenarios and see how they affect the graph. It's a great way to promote inquiry-based learning and critical thinking."(*FGD 3).

Confrey et al. (2010) conducted a study on the use of technology in mathematics education. The study found that technology can provide students with opportunities to explore and experiment with mathematical concepts, promoting deeper understanding and improved learning outcomes

"We have used Graphmatica in my classroom and I've seen a big improvement in students' understanding of mathematical functions. It's also helped to increase student engagement and motivation."(FGD 4)

*"We think Graphmatica is a valuable tool for teaching and learning mathematics, but I also think it's important to consider the limitations of the software. For example, it may not be suitable for all types of mathematical concepts or for students with certain learning needs."(*FGD 5).

It is important to note that ICT tools in teaching Mathematics has the potential to change the way students learn and understand concepts. ICT offers a range of tools and resources that can enhance the teaching and learning of mathematics

4.4 Importance of using ICTs in Primary Mathematics teaching-learning activities

This section interrogates the importance of using ICTs in Primary Mathematics teaching-learning activities at the targeted primary school. In line with this issue one of the participants highlighted that:

They believe that the integration of ICTs into their teaching helps them to reinforce learning within the classroom. Both also mentioned that if ICTs were included in the teaching, then there would be higher learner interest and more active participation in learning (Teacher 1).

Teacher 2 concur with Teacher 1:

ICTs make math concepts more visual and interactive, which helps learners understand and retain them better. It's amazing how ICTs can simplify complex math problems and make learning fun (Teacher 2).

“I also find that ICTs help to cater to different learning styles. Some learners are visual, while others are hands-on. ICTs provide various tools and resources that can reach all types of learners, making math more accessible and enjoyable for everyone." (Teacher 3).

"I think ICTs also help to build learners' problem-solving skills and critical thinking. When they use technology to explore math concepts, they learn to analyze information, make connections, and think creatively."(Teacher 4).

*"Furthermore, ICTs provide instant feedback and assessment, which helps learners track their progress and identify areas where they need more practice. This feedback loop is invaluable in math education, as it enables learners to adjust their learning strategies and improve their understanding of key concepts."(*Teacher 5).

The use of ICTs in Primary Mathematics teaching-learning activities can help to reinforce learning outcomes by providing learners with interactive and engaging learning experiences. ICTs can facilitate the use of multimedia resources, such as videos, animations, and interactive simulations, which can help learners to better understand complex mathematical concepts (Kozma, 2003).

In the same vein, FG participants highlighted that:

One of the benefits of applying ICTs in mathematics teaching-learning is that of creating interaction among students. The use of technological devices such as graphing calculators encourages interaction among students to share their knowledge and skills (FGD 1)

We agree, that ICTs also facilitate collaboration among students. For instance, when working on math projects, students can use online tools to share files, discuss ideas, and provide feedback. This collaborative approach helps to build teamwork and communication skills, which are essential in math and other subjects."(FGD 2).

In support, another group specified that:

Cooperation among students occurred when they were allowed to present their work with the aid of a projector, a screen, and a laser pen. Learners shared their work with classmates in discussion sessions with the help of teachers (FGD 3)

"Moreover, ICTs enable students to learn from one another, even if they're not in the same physical location. For example, online discussion forums and social media groups can connect

students from different classes or schools, allowing them to share their math experiences, ask questions, and receive support from their peers."(FGD 5)

In addition, one of the participants indicated that:

Interactivity and instant feedback on class work were possible through the use of ICTs (i.e., projectors, interactive boards, etc.) (Teacher 3).

In the same vein, one of the teachers acknowledged that:

Due to the interactivity provided by the integration of ICTs, it had become easier to supervise students in the classroom. The use of ICTs can keep most learners on task, which has improved learners' behaviour for learning and enabled better classroom management (Teacher 4)

From the above contributions, it can be noted that the use of ICT tools in Primary Mathematics teaching-learning activities has helped learners to use modern technologies. Thus, modern technologies are incredibly useful and speed up the research process when students are looking for new information. It was further highlighted by the participants that these technologies with the help of projectors and interactive whiteboards, important learning videos were embedded into the learner-centered pedagogy. Thus, the use of ICTs helped teachers to develop suitable learning opportunities for the Primary Mathematics learners. This concurs with Bhukuvhani, et al (2017) who postulated that the use of ICTs in teaching-learning activities helps learners to retain their learning better and this leads to more positive attitudes than conventional instruction.

From other participants' views, it was noted that:

The use of ICT tools in teaching-learning activities helps improve the quality of instruction as they can be demonstrating complex diagrams and key concepts in Mathematics (Teacher 5).

One of the participants acknowledged that:

The application of information technology can also increase students' motivation and interest in Mathematics. The use of Microsoft Excel in learning algebra can change students' perceptions of algebra. Learners are eager to perform tasks with the aid of Excel, and indirectly the learning process becomes meaningful to students (Teacher 3)

In support, another participant revealed that:

ICT tools can promote visual understanding of key concepts. Added to the enhancement of learning is the effective use of ICT tools to increase attainment in processing information, concept mapping, and modelling. Online dictionaries and 'edublogs' also help to increase the understanding of keywords in the English vocabulary of learners when utilized by teachers (Teacher 1)

The participants acknowledged that the integration of ICTs into Mathematics teaching-learning activities tends to have a positive influence on learners' attainment levels. Thus, ICTs arouse learners' attitudes and enhance their participation in the teaching-learning process (Kuboja, 2019). However, the teachers remain key agents in the use of ICTs in Mathematics teaching-learning activities. Thus, it helps to meet the requirements of different learning styles, which makes it possible to achieve higher academic attainments. This was supported by one of the participants who acknowledged that:

The integration of ICTs has worked positively to close the learning gaps and raise the attainment of pupils in their departments. Further, all teachers agreed that the use of ICT enhances learning through independent work. Learning achievement goes up when teachers allowed differentiated

independent learning. Through independent learning, guarded questions are offered to students to improve their learning (Teacher 6)

From the participants' contributions, it was revealed that the use of ICTs in teaching-learning can accelerate the rate at which learners grasp Mathematical concepts as they are exposed to a variety of information sources. Therefore, the use of ICTs in Primary Mathematics teaching-learning activities has the potential to expose learners to different tasks, which might be assigned by the teacher. This can be supported by Yushau, et al (2003) who revealed that with ICTs learners can visualize concepts, which are difficult to comprehend without computers. This can be drawn from the point that ICTs are capable of providing easier and clearer illustrations than those a teacher would make. Thus, in Mathematics those visual representations on ICTs gadgets tend to be more beneficial to the learners' conceptualization as compared to diagrams in textbooks.

Another group highlighted that:

The use of ICTs in teaching-learning activities helps the learners to interact with their environment. Hence, they will not see some Mathematical concepts as being abstract (FGD 2)

In addition, another group highlighted that:

The application of ICTs in learning not only generates higher-level thinking skills among learners but also encourages students to think about strategies for solving mathematics problems (FGD1)

From the above response, it can be noted that learners' conceptualization is not transmitted through direct instruction instead it's enabled through their exposure to different learning styles

and interaction with ICTs. This concurs with Bhukuvhani, et al (2011) who acknowledged that teaching-learning is a process in which learners interact with the environment. In support, the use of ICTs in teaching-learning creates an active learning environment and makes students more active (Yin, 2003). This results in a scenario, where learners' ideas change as they are learning and they see the world from a different perspective. The use of ICTs in Mathematics concurs with the Nziramasanga Commission of Inquiry recommendations that advocated for the mainstreaming of computer-based teaching and learning in the pedagogy of schools in Zimbabwe (Muchena, 2005).

4.5 Approaches employed when using ICTs in Primary Mathematics teaching-learning activities

The researcher in this section centres on the analysis and discussion of the approaches being used in the use of educational technologies in teaching and learning activities. In this context, one of the participants noted that:

The new curriculum encourages them to employ learner-centered approaches, but they still make use of teacher-centered methodologies due to limited resources. Given enough resources teachers can demonstrate, discuss and solve the problem because it forces learners to engage their intellect, and in the process with open-ended questions, they are exposed to real-world challenges (Teacher 3)

In the same vein one of the participants highlighted that:

In Mathematics learning, the use of technology is very common because our teachers encourage us to bring scientific calculators to school. Some calculators are advanced to such an extent as

drawing mathematical graphs, this is an advantage to us as learners in the sense that we can practice our graph drawing skills on paper and then check if it is correct using the scientific calculators. This is good because it is not only the teacher who is to do everything for the learners in terms of learning but with these technologies, learning can take place in the absence of the teacher (FGD 1)

We totally agree with that. The use of scientific calculators has really helped us to visualize mathematical concepts, especially in graphing and algebra. And what's even more exciting is that some of these calculators have apps that can generate random math problems for us to practice, which helps us to develop our problem-solving skills. It's like having a personal tutor in our pockets!"(FGD 2)

The responses from the teachers resonate well with Eggen and Kauchak (2001) in the sense that the teacher-centered approach is still dominant because of the relatively few resources required during the lessons. The sustained dominance of the teacher-centered approach and the observed limited use of ICTs justifies the position held by some scholars who argue that increased use of ICTs favours the learner-centered compared to the teacher-centered approach and vice-versa (Fischer & Reuber, 2011). In support, one of the selected participants noted that:

In as much as we are aware of the ministry's demands to make use of ICTs, resources limit the teaching methods that a teacher can implement in the classroom (Teacher 3)

The participants are conscious of the benefits of ICTs stipulated in the new curriculum framework that learners must be engaged actively to address real-world problems (Ministry of Primary and Secondary Education, 2015). Furthermore, the responses above which show the basic use of educational technologies substantiate Mishra and Koehler (2006) who maintain that

most teachers have basic knowledge of ICTs yet to use educational technologies effectively and efficiently teachers now need to know the educational technologies specific to their discipline content area (Cassim & Obono, 2011). In line with this notion, one of the selected teachers acknowledged that:

Most of us here have basic information and communications technology skills we learned in college and these basic skills are not sufficient for us to use educational technologies effectively and efficiently in the classrooms (Teacher 5)

Educational technologies can range from digital books, specialized software and websites, and screen readers that include features such as text-to-speech, changeable colour contrast, alterable text size, and selection of different reading levels or materials written in the learner's primary language (Grimes & Warschauer 2008). According to Hightower (2011), teachers are expected to come up with various strategies to motivate learners and inculcate in them a positive attitude towards science and related subjects to enhance knowledge transmission. The above responses also confirm Nhendere (2020)'s sentiments when he remarked that in Zimbabwe the integration of educational technologies in education and learning remains largely uninitiated. In this context, one of the participants highlighted that:

If the resources would permit, the teaching process would be enjoyable if the school had WiFi facilities. One would research before lesson delivery and download essential videos to show to the learners with the use of a projector (Teacher 2)

"Having WiFi facilities would also enable us to create online platforms for learners to access learning materials, submit assignments, and engage in discussions. This would enhance learner

*engagement and motivation, as well as provide us with valuable feedback to inform our teaching practices."(*Teacher 4).

"I'd like to add that WiFi facilities would also allow us to explore virtual field trips, online simulations, and other interactive resources that can make math learning more immersive and interactive. This would be particularly beneficial for learners who struggle with abstract concepts, as it would provide them with hands-on experiences that can deepen their understanding."(Teacher 5).

Moreso, Nhendere (2020) argues that the way forward would be to start by utilizing the technology that we have, know how to use, and can afford. The same is true when it comes to resources that the teachers are complaining about, there is a need for monitoring and evaluation to ensure that what we have is being put to the best use (Sunzuma & Zezekwa, 2016).

While ICT has the potential to revolutionalise, a lot needs to be done in terms of resource mobilisation through funding of educational institutions.

4.6 Challenges faced using ICTs in Primary Mathematics teaching-learning activities

The integration of Information and Communication Technologies (ICTs) into the teaching of primary mathematics at Mutanda Primary School is faced with several challenges. According to the teachers, these challenges are hindering the effective use of ICTs in teaching-learning activities. One of the major challenges mentioned by the teachers is the lack of access to computers and internet connectivity, making it difficult for them to incorporate ICTs into their

teaching practices. Additionally, the teachers noted that the absence of technical support and training on ICT integration is another significant challenge they face.

The teachers also mentioned that the limited availability of educational software and digital resources suitable for primary mathematics is a major challenge. Furthermore, the lack of time to explore and learn about new ICT tools and resources is another challenge faced by the teachers. Two of the participants noted that:

We don't have enough computers and internet connectivity, and even when we do, we don't know how to use them effectively in our teaching (Teacher 2).

The main challenge to the use of ICTs in teaching and learning activities is hardware problems. The lack of proper maintenance of ICT tools such as computers and interactive whiteboards discourages them from using ICTs (Teacher 4)

These challenges highlight the need for policymakers and educational leaders to provide teachers with the necessary support, training, and resources to effectively integrate ICTs into their teaching practices.

In support, focus group discussion noted that:

They further mentioned that in most primary schools, there are insufficient numbers of computers to enable student access, with limited computer suites and long waiting times for booking. Schools often need to work with out-of-date ICT tools that are slow and inefficient. Very slow broadband with poor networking facilities also makes the internet connection in schools very slow, which can make using online resources frustrating (FGD 1).

We agree, the lack of adequate ICT infrastructure in our school is a major challenge. Even when we have access to computers, the slow internet connection and outdated software make it difficult for us to complete our work efficiently. It's frustrating when we're trying to research or submit assignments online, but the connection keeps dropping or the website takes forever to load. It would be great if our school could invest in better ICT facilities to support our learning."(FGD 2)

The learners' responses highlight that the lack of accessibility to resources is a significant barrier to teachers' use of Information and Communication Technologies (ICTs) in the classroom (Kumbata, 2019). This barrier is closely linked to other key issues, including the lack of time and technical expertise. Even when resources are available, teachers often lack the time to access and utilize them effectively (Chireshe, 2012). The heavy teaching workload, characterized by a large number of lessons per day and insufficient class time, leaves teachers with little time to operate and review technical equipment (Boss & Krauss, 2014). As a result, teachers are unable to fully exploit the potential of ICTs to enhance teaching and learning outcomes.

Perraton and Creed (2012) say that ICTs in education should follow used in society, not lead it, education programmes that use innovative technologies rarely achieve long-term success. Another basic requirement is the availability of electricity and telephony. In developing countries, large areas are still without a reliable supply of electricity (Dube, 2020). Experience in some African countries points to wireless technologies as possible levers for leapfrogging, (Hawkins, 2010). In line with the above discussions, another teacher noted that:

During the years that we trained to be teachers, computers were not as common as they are today. We used to hand in hand-written assignments and we did not carry out a course in computers. That lack of exposure to technology makes me as a teacher not to be confident to use technology during my lessons because of the fear of failure (Teacher 6).

This is in line with Ozden (2007) who postulated that the main problem with the implementation of ICTs in learning activities was the insufficient amount of in-service training programmes for teachers. The lack of accessibility to resources is closely related to other key issues which can themselves be considered barriers to teachers' use of ICTs. Osuagwu (2010) indicated that many factors limit the infusion of ICTs in educational institutions and these include paucity of ICTs infrastructure and lack of access, high enrolments and inadequate funding, and absence of funding allocation to technology. In the same vein, teachers who were trained before the advent of computers in teachers' colleges, are likely to shun the use of computers. Marstens (2011) concurs that the successful implementation of online teaching and learning in mathematics curriculum demands professional advancement by teachers as technology is dynamic. Another participant revealed that:

In the process of learning mathematics, we would want to see the teacher demonstrate how problems are solved so that we grasp the concepts easily. With smartphones, it will cost both the teacher and the learner money and time to ensure the successful delivery of the intended content. This will then push the teacher to ignore the use of technologies during the teaching process (Learner 5)

In the same vein, a participant revealed that:

Lack of adequate skills and time are other obstacles to the use of ICTs in teaching-learning. In addition, the inability to have the time to train due to heavy school workloads worsens the situation. Restrictions of the national curriculum were also mentioned as barriers to integrating ICTs (Teacher 3).

In support, a participant articulated that:

The time and space available on the school's timetable for the coverage of the entire subject curriculum and the lack of interest of the school teachers make it difficult to integrate ICT into his secondary school's teaching (Teacher 5) .

The absence of resources and software problems were reported to be a major challenge to using ICTs in Primary Mathematics teaching-learning. Thus, the inability to effectively use ICTs in lessons was attributed to poor competencies on the part of the teachers on how to use ICTs in teaching-learning. Hence, due to the negative perceptions and conservative attitudes of some teachers in adopting modern teaching methods, the lack of interest in using ICTs among teachers (Marstens,2011).

4.7 Chapter summary

The chapter presented and discussed the findings using thematic analysis. The data was analyzed thematically using themes that are derived from the research questions. The themes include the importance of using ICTs in Primary Mathematics teaching-learning activities, approaches employed when using ICTs in Primary Mathematics teaching and learning activities, challenges faced when using these technologies in Primary Mathematics teaching-learning, and also the strategies used to integrate these

technologies in teaching and learning. The next chapter covered a summary, conclusion, and recommendations.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the research findings, conclusion, and recommendations derived from the study. The research investigated the effectiveness of using Information and Communication Technologies (ICTs) at Mutanda Primary School.

5.2 Summary of the Study

The study commenced with an introduction, providing context to the research problem, statement of the problem, research questions, significance of the study, delimitations, limitations, and key terms definition. Chapter Two presented a comprehensive literature review, highlighting knowledge gaps and providing a theoretical framework for the study. Chapter Three outlined the research methodology, detailing the approach employed in data collection, presentation, analysis, and interpretation. Chapter Four presented the research findings, revealing that:

Research Question 1

What Information Communication Technologies (ICTs) used in Primary Mathematics teaching-learning activities?

Teachers use various ICTs, including scientific calculators, educational software, multimedia resources, online platforms, and digital whiteboards, to support teaching and learning in primary mathematics. Teachers value the use of ICTs in enhancing student engagement, motivation, and understanding of mathematical concepts. Teachers recognize the importance of technological pedagogical content knowledge in effectively integrating ICTs into their teaching practices.

Students appreciate the use of Graphmatica and other ICT tools in visualizing mathematical concepts and exploring mathematical relationships. Students acknowledge that Graphmatica can be overwhelming at first, but with practice, it becomes a valuable tool for learning mathematics. Students value the opportunity to experiment with different scenarios using Graphmatica, promoting inquiry-based learning and critical thinking.

Research Question 2

What are the approaches used when integrating ICTs in Primary Mathematics teaching-learning activities?

Learner-centered approaches encouraged by the new curriculum, but limited resources lead to teacher-centered methodologies. Use of scientific calculators to visualize mathematical concepts and develop problem-solving skills. Basic use of educational technologies, such as digital books and specialized software. We can also use blended learning which combines face-to-face (traditional) with online learning. Blended learning include online resources, games and activities to supplement mathematics concepts. We can also use collaborative learning which encourages students work together to solve mathematical concepts.

Research Question 3

What challenges are faced when using Information Communication Technologies (ICTs) in Primary Mathematics teaching-learning activities?

Insufficient access to computers, internet connectivity, and other digital resources can limit the use of ICTs in mathematics education. According to Kozma, (2003) the lack of computers,

internet connectivity, and other ICT infrastructure can hinder the effective use of ICTs in the classroom. Teachers may require training and support to effectively integrate ICTs into their teaching practices Limited budgets can make it difficult for schools to acquire the necessary hardware and software for ICT-based mathematics education. Technical problems, such as hardware malfunctions and software glitches, can disrupt the learning process and hinder the effective use of ICTs [5]. (Koehler & Mishra, 2009

5.3 Conclusion

The study investigated the effectiveness of using Information and Communication Technologies (ICTs) in primary mathematics teaching-learning activities at Mutanda Primary School. The findings revealed that teachers and students value the use of ICTs in enhancing teaching and learning, despite facing numerous challenges. Teachers use various ICTs, including scientific calculators, educational software, and digital whiteboards, to support teaching and learning. Students appreciate the use of Graphmatica in visualizing mathematical concepts and exploring mathematical relationships. However, challenges such as lack of access to computers and internet connectivity, limited technical support and training, and insufficient educational software and digital resources hinder the effective integration of ICTs. The study highlights the need for policymakers and educators to address these challenges and provide teachers with the necessary support and resources to effectively integrate ICTs into their teaching practices. By doing so, ICTs can be leveraged to enhance teaching and learning, improve student outcomes, and promote a more engaging and interactive learning environment.

5.4 Recommendations

Based on the study's findings, the following recommendations are made:

Learner-Centered Teaching Approaches

Teachers should employ learner-centered teaching approaches to ensure active learner participation in Primary Mathematics teaching-learning activities. (Kaye, 2010). This can be achieved by: Encouraging collaborative learning and group work, providing opportunities for learners to take ownership of their learning and using project-based learning and real-world examples to illustrate mathematical concepts

Furthermore, the government and schools should collaborate to provide ICT infrastructure, including: Computers and laptops for learners and teachers, reliable and fast internet connectivity, technical support and maintenance services and digital resources and educational software for Primary Mathematics, (Kozma, 2003)

Teacher training institutions should equip teachers with relevant ICT skills to enable them to effectively integrate ICTs into Primary Mathematics teaching-learning activities. One of the primary pedagogical challenges is the lack of teacher training and support, according to Mishra & Koehler, (2006) This can be achieved by: Providing training programs on ICT integration in Primary Mathematics, offering workshops and seminars on ICT skills and digital literacy and encouraging teachers to participate in online communities and forums to share best practices and resources

Additionally, the government and schools should continuously monitor and evaluate the effectiveness of ICT integration in Primary Mathematics teaching-learning activities (Kaye, 2010) This can be achieved by: Conducting regular surveys and assessments to evaluate the impact of ICTs on learner outcomes, providing feedback and support to teachers to improve their ICT skills and integration practices and revising policies and guidelines to ensure they are aligned with best practices in ICT integration in Primary Mathematics.

5.5 Recommendations for Further Research

To develop more comprehensive and conclusive findings, further studies should be conducted using multiple districts in Manicaland Province to investigate the use of ICTs in Primary Mathematics. Andoh (2012) notes that eighty percent of teachers' resistance to change and negative attitudes towards ICTs can be attributed to poor software use. This condition holds due to different environments teachers are exposed to. The study of different schools in different districts would provide a more representative sample and enhance the generalizability of the findings.

5.6 Chapter Summary

This chapter summarized the research findings, presented the conclusion, and provided recommendations for practice and further research. The study's findings highlight the importance of ICTs in Primary Mathematics teaching-learning activities and the need to address the challenges hindering their effective use.

REFERENCES

Afolake, N., & Shittu, A. J. K. (2005). Evaluating the Impact of Technology Integration in Teaching and Learning. The Malaysian Online Journal of Educational Technology, .

Bhukuvhani, C., Zezekwa, N., & Sunzuma, G. (2011). Students' preparedness to integrate information and communication technology tools and resources for the learning of organic chemistry concepts in the district of Masvingo, Zimbabwe. *International Journal of Education and Development using ICT, 7*(2), 27-37.

Chigama, T., & Goronga, P. (2022). Exploring Teachers' Perceptions towards ICT Integration in Teaching and Learning: The Case of Selected Primary Schools in Harare, Zimbabwe. *Journal of African Education, 3*(1), 119.

Johnson, D. W., & Johnson, R. T. (2009). Cooperative learning and social interdependence theory

In R. Gillette & M. Morselli (Eds.), Cooperative learning: A standard-based approach (pp. 23-43). Allyn & Bacon.

Kozma, R. B. (2003). Technology and classroom practices: An international study. Journal of Research on Technology in Education, 36(1), 1-14.

Mayer, R. E. (2009). Multimedia learning. Psychology of Learning and Motivation, 53, 1-19.

Neurath, P., & Stephens, M. (2006). Using ICT to enhance teaching and learning. In A. McDougall & C. Dowling (Eds.), Proceedings of the 2006 ACM SIGGRAPH symposium on Video games (pp. 1-8). ACM.

Shute, V. J. (2008). Focus on form: A design principle for video games that support learning. Journal of Educational Psychology, 100(2), 227-236.

UNESCO. (2013). UNESCO ICT competency framework for teachers. UNESCO

Merrill, R. K., Ibrahim, J. M., Machi, A. S., & Raphael, J. S. (2020). Analysis and review of automated risk calculators used to predict postoperative complications after orthopedic surgery. *Current Reviews in Musculoskeletal Medicine*, *13*, 298-308.

Muchena, O.N. (2005) Zimbabwe National ICT Policy Framework. Ministry of Science & Technology Development: Harare.

Neurath, R. A., & Stephens, L. J. (2006). Classroom Notes the Effect of Using Microsoft Excel in a High School Algebra Class. International Journal of Mathematical Education in Science and Technology, 37, 721-727.

Nur, Q., & Hazman, A. (2006). Penggunaan Teknologi Maklumat dan Komunikasi (ICT) dalam Kalangan Guru-Guru Sekolah Kebangsaan. Thesis, Johor Bahru: Universiti Teknologi Malaysia.

Palmer, C. (2003). Using ICT in Mathematics Helping or Not? In R. Hudson (Ed.), Mathematics Teaching (pp. 9-11). Association of Teachers of Mathematics.

Phiri, W. (2016). Pupils' and teachers' perception toward the use of Information and Communication Technology (ICT) in the teaching and learning of Mathematics in selected secondary schools of Central Province, Zambia. *International Journal of Multidisciplinary Research and Development*, *3*(1), 77-87.

Rafiza, A. R., & Maryam, A. R. (2013). Pembinaan Media Pengajaran berasaskan Multimedia di kalangan Guru ICTL. Jurnal Kurikulum & Pengajaran Asia Pasifik, 1, 20-31.

Ramli, B., Latifah, A. L., Noor, A. I., & Abd Rahman, N. N. N. (2006). The Impact of "Learning Skills for Open and Distance Learners" Course on Learner Attitudes towards E-Learning. In R. Bahroom, L. Abdol Latif, N. Azina Ismail, & N. N. N. Abd Rahman (Eds.), Konvensyen Teknologi Pendidikan, Langkawi (pp. 1055-1063). Selangor: Open University Malaysia.

Ruthven, K., Deaney, R., & Hennessy, S. (2009). Using Graphing Software to Teach about Algebraic Forms? A Study of Technology-Supported Practice in Secondary-School Mathematics. Educational Studies in Mathematics, 71, 279-297. http://dx.doi.org/10.1007/s10649-008-9176-7

Storm, M. (2011). Cognitive Development: Cognitive Development (2nd ed., pp. 17-25). Amerika: American Institutes for Research.

Sarah, A.M.S.A. (2016). *The effect in Using Three Computer Programs on the Academic Achievement of 10th Grade Students in Mathematics and their Motivation toward its learning in Qabatia Directorate (Comparative Study)* (Doctoral dissertation).

Suzana, S., & Khaild, F. (2014). Pengajaran dan Pembelajaran Menggunakan Perisian Google—Satu Analisis Kajian Lepas. In F. Khalid (Ed.), Pengajaran Sumber dan Teknologi Maklumat: Impaknya ke atas Penyelidikan dalam Pendidikan, 1, pp. 25-32). Bangi: Fakulti Pendidikan, UKM.

Trott, M. (2013). *The Mathematica guidebook for programming*. Springer.

Wan Mohd, R. (2013). Penerapan Teknologidalam Pendidikan: MAMPU. Kolokium ICT dalam Pendidikan 2013: "Kepimpinan Pengurusan ICT dalam Pendidikan Abad ke-21". Institut

Aminuddin Baki

Yin R.K. (2003). Case study research. design and methods' (3rd ed.). Applied social research methods series, 5(3). Califonia, London Sage Publications.

Yohannes, A., & Chen, H. L. (2021). GeoGebra in mathematics education: a systematic review of journal articles published from 2010 to 2020. *Interactive Learning Environments*, 1-16.

Yushau, B., Mji, A., & Wessels, D.C.J. (2003) Creativity and Computer in the Teaching and Learning of Mathematics.

Appendix 1: Interview Guide for Selected Teachers

Introduction

My name is **Rosemary Mawoko (B225858A)** and I am a student at Bindura University of Science Education, studying towards a Diploma in Science Education. I am conducting a study titled: **An Investigation on the Integration of ICT into the Teaching of Mathematics at Mutanda Primary School in Sakubva, Mutare.**

I believe you can provide valuable insights into this topic. I will ask you a series of questions, and you are encouraged to elaborate as you see fit. If you prefer not to answer any question, please feel free to decline. Rest assured, your details will remain confidential, and pseudo-names will be used in the final report.

Research Questions and Sub-Questions

Research Question 1: What ICTs are used in Primary Mathematics teaching-learning activities?

- What specific ICT tools do you use in your Mathematics teaching?
- How often do you incorporate these ICT tools into your lessons?
- Can you describe a lesson where you effectively used ICT?
- What types of educational software or applications do you find most useful?
- Do you utilize online resources, such as videos or interactive websites? If so, which ones?
- How do you assess student engagement when using ICT in lessons?
- What feedback do you receive from students regarding the use of ICT in Mathematics?
- Are there any ICT tools you wish you could use but currently do not have access to?

Research Question 2: What are the approaches used when integrating ICTs in Primary Mathematics teaching-learning activities?

- What pedagogical approaches do you adopt when incorporating ICT in your lessons?
- How do you balance traditional teaching methods with ICT integration?
- Do you collaborate with other teachers when planning ICT-based lessons? If yes, how?
- What strategies do you use to ensure all students can access and benefit from ICT?
- How do you modify your teaching style to accommodate ICT tools?
- Do you implement any form of project-based learning using ICT? If so, can you give an example?
- How do you measure the effectiveness of ICT integration in your teaching?
- What role does student feedback play in shaping your ICT integration strategies?

Research Question 3: What challenges are faced when using ICTs in Primary Mathematics

teaching-learning activities?

- What technical issues have you encountered while using ICT in your teaching?
- How do you handle situations where technology fails during a lesson?
- Do you experience any difficulties with student access to ICT resources?
- What barriers do you face in terms of professional development related to ICT?
- Are there any institutional challenges that hinder your use of ICT in the classroom?
- How do you ensure that students remain focused when using ICT?
- What support do you receive from the school administration regarding ICT integration?
- In your opinion, what are the main reasons for any resistance to using ICT among your colleagues?

Closing

Thank you for your time and insights. Your contributions are crucial for understanding the integration of ICT in Mathematics teaching at Mutanda Primary School.

Appendix 2: Focus Group Discussion Guide for Selected Learners

Introduction

My name is **Rosemary Mawoko (B225858A)**, and I am a student at Bindura University of Science Education, studying towards a Diploma in Science Education (Mathematics & [Your Specialization]). I am conducting a study titled: **An Investigation on the Integration of ICT into the Teaching of Mathematics at Mutanda Primary School in Sakubva, Mutare.**

Your participation in this focus group discussion is important, and I believe you can provide valuable insights. I will facilitate a conversation based on some questions, and you are encouraged to share your thoughts openly. If there are any questions you prefer not to answer, please feel free to skip them. Your responses will remain confidential, and pseudo-names will be used in the final report.

Research Questions and Sub-Questions

Research Question 1: What ICTs are used in Primary Mathematics teaching-learning activities?

- What types of technology do you commonly use in your Mathematics classes?
- How often do you use computers or tablets during your lessons?
- Can you share some educational apps or games that you use for learning Mathematics?
- Do your teachers show videos or use online resources? What types do you like?
- How do you feel about using technology in your Mathematics learning?
- In what ways do you think ICT makes learning Mathematics more interesting?
- Are there any specific tools or resources you wish were used more in your classes?
- How do you think using ICT helps you understand Math concepts better?

Research Question 2: What are the approaches used when integrating ICTs in Primary Mathematics teaching-learning activities?

- How do your teachers typically incorporate technology into their lessons?
- Do you participate in group activities that involve using technology? Can you give an example?
- What methods do your teachers use to encourage you to engage with ICT?
- How comfortable do you feel asking questions during technology-based lessons?
- How do interactive tools, like quizzes or games, affect your learning experience?
- Do you have opportunities to choose how you use technology in your learning?
- How do your teachers prepare you to use ICT tools before starting activities?
- What aspects of using technology in your lessons do you enjoy the most?

Research Question 3: What challenges are faced when using ICTs in Primary Mathematics teaching-learning activities?

- Have you faced any challenges when using technology in your classes? What kind?
- Do you think all students have equal access to the technology needed for learning? Why?
- What do you think happens when the technology fails during a lesson?
- Do you ever feel confused when using ICT tools? If so, what confuses you?
- How do you think your teachers respond to technical difficulties during lessons?
- Do you feel comfortable asking for help if you don't understand how to use a tool?
- Are there any distractions you notice when using technology in class? What are they?
- What suggestions do you have for improving the use of technology in your Mathematics classes?

Closing

Thank you all for your contributions to this discussion. Your insights are essential for understanding how ICT is used in Mathematics teaching at Mutanda Primary School.