

**AN INVESTIGATION INTO THE INTEGRATION OF ICTS IN  
TEACHING AND LEARNING MATHEMATICS AT THE  
PRIMARY SCHOOL LEVEL IN SELECTED SCHOOLS OF  
PEMBA DISTRICT, SOUTHERN PROVINCE**

**By**

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fulfilment of the requirements for the award of the degree of  
Master of Education in Primary Education**

**The University of Zambia**

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### **Certificate of Approval**

This is to certify that the dissertation prepared by Host Mazabuka, entitled “An Investigation into the Integration of ICTs in Teaching and Learning Mathematics at the Primary School Level in Selected Schools of Pemba District, Southern Province” and submitted in partial fulfilment of the requirements for the award of the Master of Primary Education degree complies with the regulations of the university and meets the accepted standards concerning originality and quality.

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## **Dedication**

I dedicate this work solely to my wife Mutinta M. Mazabuka and my three children, Daisy C, Denzel L, and Lubomba J Mazabuka who at the time this research was being done needed my attention most, but they were patient enough to allow me to successfully complete the research.

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## ABSTRACT

The study investigated the integration of Information and Communication Technology (ICT) in the teaching and learning of primary Mathematics in selected schools of Pemba District, Southern Province. Guided by the Technological Pedagogical Content Knowledge (TPACK) framework, the study aimed to identify available ICT teaching and learning materials for Mathematics, examine how ICTs are utilized in Mathematics instruction, and investigate challenges teachers face in integrating ICT into Mathematics teaching. The study employed a qualitative approach using a case study design. Purposive sampling was used to select participants, including one District Education Board Secretary (DEBS) representative, eight administrators (Headteachers, Deputy Headteachers, or Senior Teachers), and 24 Mathematics teachers. Data collection methods included interview guides, one-on-one questionnaires, and lesson observations (8 lessons). Findings revealed that ICT integration in Mathematics instruction was limited due to the low availability of ICT teaching and learning materials. Apart from Interactive Radio Instruction (IRI) radios and Let's Read tablets, schools had inadequate technological resources. Additionally, poor technical and physical infrastructure further constrained ICT adoption. While teachers demonstrated strong Content Knowledge (CK) and Pedagogical Knowledge (PK), their Technological Knowledge (TK) and Technological Content Knowledge (TCK) were insufficient, hindering effective ICT integration in Mathematics teaching. The study recommends that the Ministry of Education should provide continuous professional development training for teachers on ICT integration in Mathematics instruction. Additionally, the government and stakeholders should invest in equipping schools with essential ICT tools such as interactive boards, Mathematics-related educational games, and software applications tailored to Mathematics content. Moreover, sustained technical support and infrastructure maintenance should be prioritized to enhance ICT use in Mathematics education.

## **Abbreviations**

CD	-	Compact Disc
CPD	-	Continuing Professional Development
CTS	-	Creative and Technology Studies
DEBS	-	District Education Board Secretary
DEBO	-	District Education Board Office
ICT	-	Information and Communication Technology
IITE	-	Institute for Information Technologies in Education
LCE	-	Learner-centred Education
LCET	-	Learner-Centred Education and Teaching
MDGs	-	Millennium Development Goals
MOE	-	Ministry of Education
NGOs	-	Non-Governmental Organisations
NICI	-	National Information and Communications Infrastructure
PBL	-	Problem-Based Learning
PCK	-	Pedagogical Content Knowledge
SDGs	-	Sustainable Development Goals
TA	-	Thematic Analysis
TV	-	Television
TGM	-	Teacher Group Meetings
TPACK	-	Technological Pedagogical Content Knowledge
UNDP	-	United Nations Development Programme
ZIC	-	Zonal Insert Coordinator
ZNUT	-	Zambia National Union of Teachers

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 Overview**

The chapter presents an overview of the study. It gives the background of the study, the Statement of the problem, the purpose of the study, specific objectives, specific research questions, Significance of the study, limitations of the study, delimitations, conceptual framework, theoretical framework, Operational Definitions, and ends with the summary.

#### **1.1 Background to the Study**

The integration of Information and Communication Technology (ICT) in education has gained significant attention in recent years as a means to enhance teaching and learning processes. In Mathematics teaching and learning, ICT tools such as interactive software, digital simulations, and online learning platforms have been introduced to improve student engagement, conceptual understanding, and problem-solving skills. Recognizing the potential of ICT, governments and educational institutions worldwide have invested in technology to modernize the learning experience and equip students with the digital competencies required in the 21st century.

In Zambia, Mathematics is a compulsory subject for all primary school learners due to its fundamental role in academic and professional development. To ensure high-quality Mathematics teaching and learning, the government has demonstrated a strong commitment to integrating ICT into the teaching and learning process. The Ministry of Education (MOE) has implemented various initiatives aimed at enhancing Mathematics instruction at the primary school level through the adoption of ICT (MOE, 2014). Additionally, the Ministry has acknowledged the importance of embedding ICT within the national curriculum for both primary and secondary schools as a strategy to improve learning outcomes.

Despite these efforts, the effective implementation of ICT in Mathematics teaching and learning remains a challenge. Many teachers face barriers such as inadequate

infrastructure, limited access to digital resources, lack of training, and resistance to change, all of which hinder the seamless adoption of technology in classrooms. Given these challenges, this study seeks to examine the current status of ICT integration in Mathematics teaching, exploring the extent of its adoption, the challenges encountered, and possible strategies for improvement.

The rapid advancement of Information and Communication Technologies (ICTs) has significantly transformed various sectors, including education. Hattie (2019) defines ICTs as technologies that interlink information technology devices such as personal computers with communication technologies like telephones and telecommunication networks, with the best example being PCs and laptops with email and the Internet. According to UNESCO, information and communications technology (ICT) is an umbrella term that includes any communication or application encompassing radio, television, cellular phones, satellite systems, and computer and network hardware or software. In the current era of globalization and technological change, ICT is rapidly developing in many countries and is widely utilized in various sectors, including education, the economy, politics, and society. Many countries now regard ICT literacy as a fundamental component of education, alongside reading, writing, and literacy.

While definitions of ICTs vary, the United Nations Development Programme (UNDP) defines them as "information-handling tools, a varied set of goods, applications, and services that are used to produce, store, process, distribute, and exchange information." These tools encompass both "old" ICTs such as radio, television, and telephone, and "new" ICTs such as computers, satellite and wireless technology, and the Internet, forming a "networked world" a vast infrastructure of interconnected telephone services, standardized computing hardware, the Internet, radio, and television that reaches every corner of the globe. ICTs not only refer to the latest computer and Internet based technologies but also include simple audiovisual aids such as transparencies, slides, tape and cassette recorders, radio, video cassettes, television, and film. Older technologies fall under "analogue media," while newer computer and Internet-based technologies are categorized as "digital media."

ICT serves as an automatic means of capturing, processing, storing, and communicating information. Its integration into classroom teaching and learning is imperative as it enables teachers and pupils to manipulate, store, operate, and retrieve information; fosters independent and active learning; encourages self-responsibility in learning, including distance education; and motivates both teachers and pupils to extend learning beyond school hours. Additionally, ICT facilitates lesson planning, course content delivery, and the sharing of resources, expertise, and advice. This multipurpose tool not only engages students in instructional activities to enhance their learning but also assists in solving complex problems and improving cognitive skills (Reeves, 2016). The introduction of ICTs into schools is a global phenomenon, affecting both technologically advanced and developing countries. While previously optional for technologically advanced nations, ICT is now a necessity for all schools. It has become an essential tool for teaching and learning and a catalyst for change in schools (Pierson, 2021). Countries that fail to adopt and utilize ICTs risk marginalization and vulnerability in the face of globalization. Consequently, integrating low-income countries into the global knowledge society through ICT is essential. Under suitable conditions, ICT can significantly expand learning opportunities, overcoming cultural barriers and geographical constraints (Zambia National ICT Policy, 2023). Technologies can improve the teaching-learning process through educational reform.

Integrating Information and Communication Technology (ICT) into teaching and learning is not a new phenomenon. Wang and Woo (2007) highlight that ICT integration has existed since the introduction of educational radios and televisions, serving as a means to enhance learning experiences beyond traditional classroom settings. They define integration as achieving a sense of completeness by seamlessly combining all essential elements into a whole. This perspective underscores the idea that ICT should not function as an isolated tool but rather as an integral part of the teaching and learning process.

Mpumuje (2021) builds on this argument, asserting that ICT integration extends beyond the mere placement of hardware in classrooms. He emphasizes that technology must be used in a pedagogically sound manner, meaning that it should

not only facilitate information retrieval but also promote deeper learning through engagement, problem-solving, and critical thinking. Effective ICT integration involves embedding digital tools into instructional strategies in a way that supports curriculum objectives and enhances student understanding. This is particularly relevant in Mathematics teaching and learning, where ICT can provide interactive and visual learning experiences that reinforce abstract concepts and improve student outcomes.

Given the increasing emphasis on digital learning, understanding how ICT is integrated into Mathematics teaching and learning is essential for improving educational quality. Integrating ICTs in education is increasingly important, particularly in Mathematics Teaching and learning at the primary level. Primary education is the largest sub-sector of Zambia's education system, offering a unique opportunity to transform society by engaging young learners in technological activities. The use of ICTs in teaching Mathematics can enhance students' understanding, engagement, and achievement in this critical subject (UNESCO IITE, 2011).

Several studies have examined ICT integration in Mathematics teaching and learning at the primary level. Tay et al. (2021) conducted a case study in Singapore on ICT integration in teaching English and Mathematics. They found that teachers' beliefs in ICT's potential and their personal ICT conceptions influenced the frequency of ICT usage in the classroom. English teachers demonstrated higher ICT usage than Mathematics teachers. Additionally, English teachers were more likely to adopt a learning "from" ICT approach (Tay et al., 2012).

Education partners are actively engaged in redefining educational paradigms to align with societal needs. New approaches emphasize ICT usage, curriculum redrafting, skill development, and training a new generation of teachers. In 2011, the UNESCO Institute for Information Technologies in Education (IITE) launched a project on ICTs in primary education to facilitate policy dialogue and establish a strong foundation for effective ICT integration.

To enhance learning outcomes, the Ministry of Education in Zambia has allocated substantial resources to ICT initiatives. Zambia's Vision 2030 aims to transform the

country into a prosperous middle-income nation, emphasizing the development of an information-based society. The document states, "Accelerating development efforts towards Vision 2030, without leaving anyone behind." Vision 2030 calls for a flexible curriculum that incorporates innovative teaching approaches and a solid foundation in science and technology, recognizing ICT as vital to national development.

Through the Ministry of Education, the government has made pronouncements to promote ICT integration from primary to tertiary education. The 2013 curriculum revision led to the introduction of ICT lessons in schools, reflecting broader social, political, and economic changes. Effective technology infusion in education is critical for adapting to these changes.

The implementation of Zambia's National ICT Policy marked a significant milestone in education. The policy views ICT adoption as a strategic priority for national development. This is evident in the education sector's 2012–2015 National Implementation Framework III, aligned with the Strategic National Development Plan (SNDP). Both plans aim to improve equitable access to quality education and skills development, positioning ICT at the center of learning.

In 2014, the government integrated ICTs into the primary education curriculum, recognizing ICTs as essential tools for teaching and learning. The integration enhances access to information, one of Zambia's key educational challenges while improving education quality and management. The Ministry of Education (MOE, 2023) emphasizes that curriculum design plays a crucial role in national education goals. Before 2014, Zambia's primary education curriculum did not support ICTs, but their integration now offers high-quality education aligned with Vision 2030. The MOE (2023) acknowledges, "Our society is being transformed by continuously evolving technologies that are changing the way we do things at the most fundamental levels. ICT can help foster learner-centered teaching methods."

While ICT is essential in Zambian education, its implementation faces challenges, including inadequate equipment and limited teacher capacity. Without proper implementation, the intended benefits may not be realized. This research sought to investigate the integration of ICTs in teaching and learning Mathematics at the

primary level in Pemba district. Mere technology integration will not automatically improve learners' performance; careful and appropriate selection of how and where to integrate technology is essential for meaningful educational outcomes.

This study was conducted in 8 primary schools in Pemba District, Southern Province of Zambia. Pemba District is a rural area with limited access to ICT resources and infrastructure. The selected schools are a representative of the typical challenges faced by primary schools in rural Zambia. These schools have a total enrollment of approximately 4967 pupils, with a teacher-pupil ratio of 1:65. The schools' infrastructure is basic, with limited access to electricity, internet, and computer facilities.

The 8 selected primary schools (Muzoka, Pemba, Choomba, Kanchomba, Siazwela, Simooya, Cheelo and Maambo) share similar contextual characteristics that reflect the typical challenges faced by rural schools in Zambia. Pemba, the entire district being rural, all the eight schools are located in rural areas. These schools have basic infrastructure, with limited access to electricity, no or limited access to internet connectivity, and limited computer facilities per school (see appendix C). The schools are overcrowded, with inadequate sanitation facilities and a high teacher-pupil ratio. The schools serve communities with high levels of poverty, limited access to basic services, and a predominantly subsistence farming economy. Furthermore, the schools have limited access to ICT resources, including computer labs, ICT centres, and digital educational resources, with few teachers possessing ICT skills.

## **1.2 Statement of the Problem**

The integration of Information and Communication Technology (ICT) in education is increasingly widespread, transforming the learning landscape in primary schools. ICT tools, such as tablets, calculators, math-related games, and projectors, enhance Mathematics instruction by making learning more engaging, interactive, and student-centered (Leong, 2022). These digital resources enable learners to construct knowledge, participate in collaborative learning experiences, and develop critical thinking and problem-solving skills.

Furthermore, ICT supports differentiated instruction, allowing teachers to cater to diverse learning needs and paces among students. Digital platforms and educational applications facilitate self-paced learning, immediate feedback, and greater access to educational resources beyond the traditional classroom setting.

In recognition of the importance of ICT in education, the Ministry of Education has implemented policies that acknowledge its vital role in equipping citizens with skills necessary for sustainable economic growth (MOE, 2014; National ICT Policy, 2023). The failure to integrate ICT in education risks marginalizing the country in the global landscape.

Despite the recognized benefits of ICT in Mathematics instruction, a significant research gap exists. Limited studies have explored the integration of ICT in primary school Mathematics education, particularly in rural settings. This study aims to address this knowledge gap, investigating the challenges and opportunities of ICT integration in primary school Mathematics education in Zambia.

### **1.3 Purpose of the Study**

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

### **1.4 Research Objectives**

The objectives of this study were the following:

- (1) To establish the available ICT devices commonly used in the teaching and learning of Primary Mathematics
- (2) To establish how the integration of ICT in the teaching and learning of Mathematics in primary schools is influenced by teachers' technological, pedagogical, and content knowledge
- (3) To identify the challenges faced by teachers in integrating ICT in the teaching and learning of Mathematics in Pemba district schools.

### **1.5 Main Research Question**

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

## **1.6 Research Questions**

- (1) Identify ICT devices available for teaching and learning Mathematics in Pemba district schools?
- (2) How do teachers' technological, pedagogical, and content knowledge influence the integration of ICT in the teaching and learning of Mathematics in primary schools?
- (3) What challenges do teachers face in integrating ICT in the teaching of Mathematics in Pemba district schools?

## **1.7 Significance of the Study**

This study addressed the challenges faced in integrating ICTs into Mathematics teaching and learning at the primary level, with a particular focus on the TPACK framework. By investigating the interplay between teachers' technological, pedagogical, and content knowledge, the study extended the theoretical understanding of ICT integration in primary school Mathematics teaching and learning. It explored how the three domains of TPACK influenced effective ICT use in the classroom, potentially validating and expanding the framework's application in the Zambian context. This contribution was important for both the theoretical development of ICT integration in education and for practical approaches that could be implemented in local schools.

In addition to theoretical insights, the study provided valuable findings that could specifically address the challenges faced by teachers in Pemba District. By identifying the available ICT tools and understanding how they were integrated into Mathematics instruction in this local context, the study could provide actionable recommendations for policymakers, curriculum developers, and educators. This may contribute to the development of strategies and frameworks that were more relevant to the unique educational and infrastructural challenges of Pemba District.

Furthermore, by understanding how ICT integration impacted the teaching and learning of Mathematics in this region, the study could develop innovative pedagogical practices that were culturally and contextually appropriate, enhancing learners' mathematical understanding and achievement. The findings may also serve as a foundation for future research in other regions, helping to guide the integration

of ICT into different areas of education and offering insights on how ICT could improve teaching and learning experiences across various subjects.

### **1.8 Delimitation of the Study**

The study focused exclusively on primary schools within Pemba District Southern Province of Zambia.

### **1.9 Theoretical Framework**

The Technological Pedagogical Content Knowledge (TPACK) theoretical Framework guided the study.

#### **1.9.1 Technological Pedagogical Content Knowledge (TPACK) theoretical Framework**

The theoretical framework for investigating the integration of ICTs in teaching and learning Mathematics at the primary level is anchored in the Technological Pedagogical Content Knowledge (TPACK) theory (Sintawati & Indriani, 2019). This framework, developed by Mishra and Koehler in 2006, describes the knowledge required by teachers for the successful integration of technology in teaching. It emphasizes the dynamic interplay among three core domains of knowledge: technology, pedagogy, and content, which together form the foundation for effective technology-enhanced teaching.

In recent years, teacher knowledge has been a central focus in educational research, particularly concerning how different knowledge domains integrate to support effective teaching. The TPACK framework asserts that successful integration of ICT in teaching requires teachers to understand the complex relationships among technology, pedagogy, and content. This means that educators must not only possess knowledge of the subject matter but also be skilled in using technological tools to facilitate meaningful learning experiences. Furthermore, they must make informed decisions regarding when and how to integrate specific technologies to enhance pedagogical effectiveness.

To achieve this, the TPACK framework expands traditional pedagogical knowledge to include technology as an essential domain. This integration allows for new representations of content and innovative ways to conduct pedagogy using technological tools. Research supports the assertion that adopting a TPACK

approach can improve instructional practices by promoting deeper engagement with subject content (Sintawati & Indriani, 2019).

The TPACK framework is grounded in two fundamental ideas. Firstly, the use of technology is an integral component of effective teaching, influencing how knowledge is constructed and delivered. Secondly, TPACK is an extendable concept that applies beyond traditional school subjects to diverse educational contexts. Within Mathematics education, the framework provides a structured approach to integrating ICT tools in ways that enhance subject-specific learning. Discussions in the Mathematics education community have continued to reinforce the framework's emphasis on interactions between technology, pedagogy, and content, shaping how knowledge is constructed and applied in the classroom.

Applying the TPACK framework enables educators to critically examine current teaching practices while identifying opportunities for effective ICT integration. By analysing how teachers incorporate ICT tools such as tablets, calculators, and projectors, the framework helps define best practices in using technology to enhance student engagement. Educational games and interactive software further support Mathematics learning by making lessons more engaging and promoting a hands-on, inquiry-based approach. The integration of content knowledge with pedagogical and technological knowledge fosters collaborative learning experiences and enhances student problem-solving and critical-thinking skills (Leong, 2022).

The three types of knowledge technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) interact within the TPACK framework to broaden its application in teaching and learning. Technological pedagogical knowledge (TPK) focuses on the relationship between technological tools and pedagogical strategies, while pedagogical content knowledge (PCK) emphasizes the connection between instructional methods and subject matter. Technological content knowledge (TCK), on the other hand, examines how technological advancements influence the way content is represented and understood (Figg & Burson, 2011). These knowledge domains converge to form the core of TPACK, acknowledging that teachers must navigate this complex interplay when integrating ICT into Mathematics instruction at the primary level.

The interconnection of these knowledge bases results in what can be termed Mathematics Technological Pedagogical Content Knowledge. Content knowledge (CK) reflects a teacher's expertise in mathematical concepts, theories, and procedures. Pedagogical knowledge (PK) encompasses effective teaching strategies and instructional methods, while technological knowledge (TK) involves familiarity with communication, multimedia, and Mathematics-specific digital tools that facilitate learning. TK encompasses the mechanical aspects of technology use, while TPACK represents the effective integration of these tools within Mathematics education.

ICTs provide learners with opportunities to engage with content beyond routine classroom exercises, allowing them to tackle complex problems and develop higher-order thinking skills. Pedagogical knowledge equips teachers with the ability to facilitate meaningful learning experiences, while technology knowledge ensures that educators effectively leverage digital tools to support Mathematics instruction. The synergy among these components determines the overall effectiveness of the learning process.

As such, teachers cannot be expected to integrate ICT effectively without foundational pedagogical knowledge. They must develop a balance between pedagogy and content to innovate their teaching methods. This dynamic and evolving nature of TPACK underscores the humanistic aspect of teaching, emphasizing that technology is a tool rather than a standalone solution. Effective teaching requires a holistic approach that considers pedagogy, content, and technology in tandem. Without adequate pedagogical support, over-reliance on ICTs may fail to address critical instructional needs.

Thus, this study investigated the integration of ICT in the teaching and learning of Mathematics in selected primary schools of Pemba District by finding out whether or not the learning of Mathematics integrating ICT is taking shape through the available equipment and knowledge inadequacy in the teachers, hence responding to the TPACK theory using the hands-on approach and experimentation, which helps learners to make their inferences, discoveries and conclusions.

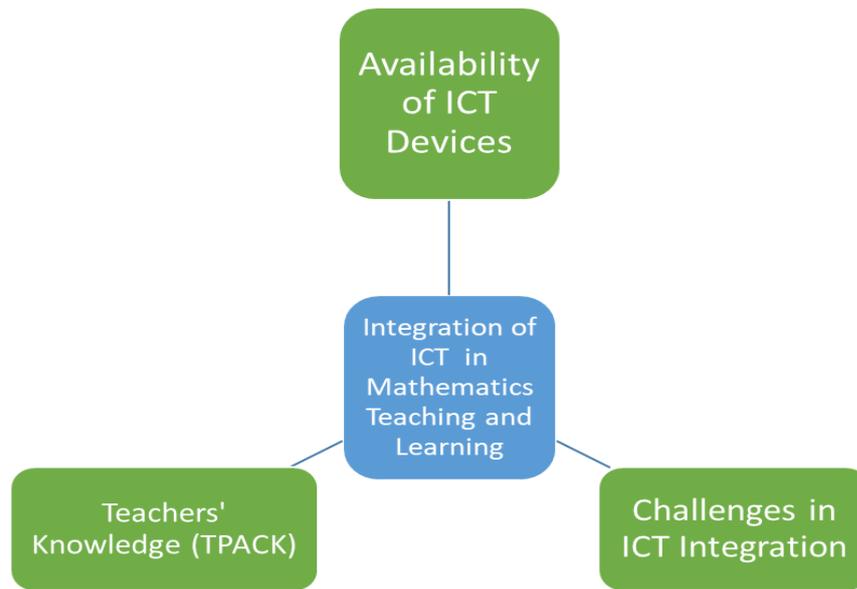
### **1.10. Conceptual Framework**

This study investigates the integration of Information and Communication Technologies (ICTs) in the teaching and learning of Mathematics at the primary level in selected schools of Pemba District. The conceptual framework illustrates how various independent variables influence the extent to which ICTs are effectively integrated into Mathematics instruction. The first independent variable is the availability of ICT devices, which refers to the types, quantity, and accessibility of technological tools used in teaching Mathematics. The presence of functional ICT resources, such as computers, projectors, tablets, and internet access, is a prerequisite for effective integration. If these devices are scarce or outdated, the process of incorporating ICT into Mathematics instruction becomes challenging.

The second independent variable is teachers' knowledge, particularly their technological, pedagogical, and content knowledge (TPACK). The successful integration of ICT in education requires teachers to have adequate knowledge of technology, effective pedagogical strategies, and a deep understanding of mathematical concepts. A teacher's ability to blend these three aspects determines their competence in utilizing ICT tools to enhance students' learning experiences. Without proper training and professional development, teachers may struggle to adopt ICT in their lessons effectively.

The third independent variable focuses on the challenges faced by teachers in integrating ICT into Mathematics instruction. These challenges may include inadequate infrastructure, lack of training, resistance to change, insufficient technical support, and curriculum constraints. Such barriers can hinder the smooth adoption of ICT and limit its potential impact on improving learning outcomes.

The dependent variable in this study is the integration of ICT in Mathematics teaching and learning at the primary school level. Effective ICT integration is characterized by the seamless use of technological tools to enhance student engagement, facilitate interactive learning, and improve mathematical comprehension. When ICT devices are readily available, teachers possess the necessary knowledge, and barriers to implementation are minimized, the likelihood of successful ICT integration increases significantly.



**Figure 1:1 Conceptual framework for the integration of ICTs in teaching and learning Mathematics at primary school**

### 1.11 Operational Definitions

- i. **Digital technology** refers to the use of digital devices, systems, and tools to store, process, and transmit information in binary form (as zeros and ones). It encompasses a wide range of technologies such as computers, mobile phones, software applications, artificial intelligence, internet services, and digital networks, all of which enable the creation, manipulation, and exchange of data.
- ii. **Integration:** Effective and meaningful incorporation of selected media technology into the topic or content taught in Mathematics
- iii. **ICT:** Information-handling tools, a varied set of goods, applications, and services that are used to produce, store, process, distribute, and exchange information
- iv. **ICT Integration:** refers to the process of incorporating Information and Communication Technology (ICT) tools, systems, and resources into various

aspects of society, education, business, and governance to enhance performance and achieve specific objectives.

- v. **Teaching:** Process of facilitation of learning, guiding learners to acquire knowledge, skills and attitude necessary to achieve their full potential
- vi. **Traditional Teaching Methods:** refer to conventional instructional approaches that emphasize direct instruction, often delivered by the teacher, who plays a central role in transmitting knowledge to students.
- vii. **Quality Mathematics Education:** A learner-centered educational experience that fosters mathematical literacy, critical thinking, and problem-solving skills, while promoting equity, inclusivity, and social responsibility with Technology at the centre.
- viii. **Effective ICT use:** Refers to the extent to which the use of ICT enlivens the teaching process, encourages positive attitudes to learning, and increases the pace and depth of learning;

### **1.12 Chapter summary**

This chapter introduced the research study, providing an overview of the research problem, background, and context. It outlined the research questions, objectives, and significance of the study, highlighting the need to investigate the integration of Information and Communication Technology (ICT) in mathematics education in Zambian secondary schools. The chapter also discussed the scope and limitations of the study, as well as the theoretical framework that guided the research. Overall, this chapter sets the stage for the research investigation, providing a clear direction for the study.

This dissertation is divided into six chapters. Chapter one provided an overview of the background of the study, the problem statement, objectives of the study, research questions, significance of the study, limitations and delimitations of the study. The chapter also sets out the theories and conceptual framework. Chapter two provides a review of literature relevant to the study globally, African as well and Zambian contexts. Chapter three explains the research methodology, which includes the research design, data sources, sample selection and size. It also outlines the various

data collection tools. Chapter four presents the research findings, and Chapter five discusses the research findings, analysis and interpretations. Finally, chapter six discusses the conclusions and recommendations.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Overview**

This chapter presents a comprehensive review of literature on the integration of ICT in Mathematics teaching and learning, examining global, African, and Zambian perspectives. The objective is to establish a foundation for understanding the challenges and opportunities associated with ICT adoption, particularly in Pemba District. The review critically analyses existing studies, identifies trends, and evaluates how infrastructure, teacher preparedness, and policy frameworks influence the effectiveness of ICT integration. Furthermore, the literature review highlights the necessity of aligning ICT implementation with local educational needs to maximize its impact on learning outcomes.

Research has shown that ICT has the potential to revolutionize Mathematics teaching and learning by making abstract concepts more tangible, promoting student engagement, and enhancing problem-solving skills (UNESCO, 2020). However, these benefits can only be realized if ICT tools are effectively integrated into teaching practices and supported by adequate resources. Studies by Koehler, Matthew & Mishra (2013) indicate that access to digital resources alone is not enough; teachers must also possess digital pedagogical skills to effectively utilize technology in instruction. In many low-resource settings, the adoption of ICT faces significant barriers such as limited digital infrastructure, lack of teacher training, and insufficient policy enforcement. For Pemba District, these challenges necessitate an in-depth examination within the broader literature to establish practical and context-specific solutions. Furthermore, educational theorists such as Nyambe (2020) emphasize that ICT should not only serve as a delivery mechanism for content but also as an interactive tool that fosters deeper learning through engagement and real-time feedback.

#### **2.2 Global Perspective on ICT Integration**

Globally, ICT has transformed education by providing innovative tools that enhance teaching and learning. The integration of Information and Communication

Technology (ICT) in education has become a global phenomenon, transforming the teaching and learning landscape across the world. In recent years, there has been a significant increase in the availability and use of ICT in schools, including primary schools. Many countries have invested heavily in ICT infrastructure, including computers, tablets, and internet connectivity, to enhance teaching and learning.

### **2.2.1 Availability of ICTs**

At the global level, the availability of ICTs in Mathematics instruction has been examined in various contexts, including primary schools in Singapore (Ghavifekr, 2016). This study aimed to assess ICT integration in primary and secondary education in Singapore. This study highlighted the importance of pedagogical approaches that promote active learning, collaboration and knowledge construction through available ICT tools. Factors such as teachers' knowledge and training in ICT, accessibility to ICT equipment and the use of learning management systems have been identified as influencing the effective integration of ICT in Mathematics Teaching and learning.

The study's findings are significant because they show that it is feasible to incorporate ICTs into the teaching and learning of Mathematics in primary schools. However, this is only possible if the government is willing to address policies and deficiencies regarding infrastructure, equipment and adequately trained teachers. Additionally, it is implied in this study that ICTs may encourage learner involvement and sensible information-seeking. Additionally, the study revealed that the learners who took part in it extensively used ICTs. It was, therefore, vital to investigate and ascertain the integration of ICTs in the teaching and learning of Mathematics in primary schools of Pemba District. The study presented different results due to policy limitations in using gadgets such as phones, underdevelopment in infrastructure and lack of equipment compared to primary schools in Singapore.

The integration of ICT during lower grades in Chinese teaching has been assumed to promote understanding of abstract concepts. According to (Yang & Leung, 2015), using graphic calculators, advanced configured tablets and computerised drawings speeds up the graphing process, freeing learners to analyse and reflect on the relationships between ICT and teaching. The study also found that beliefs about

Mathematics teaching and attitudes toward ICT significantly influenced pre-service teachers' beliefs about ICT use in Mathematics teaching and learning (Yang & Leung, 2015). The findings revealed that the availability of ICT resources, teachers' technological pedagogical content knowledge and support from school leaders were essential factors influencing the integration of ICT in Mathematics teaching (Yang & Leung, 2015). The study also highlighted the importance of professional development for teachers to enhance their TPACK and promote effective integration of ICT in Mathematics instruction (Yang & Leung, 2015).

A study by Upadhyaya (2017) assessed teaching-learning with ICT at the primary level in India and found that although ICT in the classroom is essential for giving learners opportunities to learn to operate in an information era, ICT integration has typically encountered barriers. Lack of self-assurance, a lack of skill and a lack of equipment access were the main obstacles. ICT equipment, including software and hardware, efficient, professional development and technical support need to be given to teachers because it has been discovered that confidence, competence and accessibility are the essential elements of technology integration in schools. In Ahmad (2022) survey of practitioners, the lack of confidence was the area that attracted the most responses from those who took part. Some studies have investigated the reasons for teachers' lack of confidence in using ICT. For example, Paul (2016) asserted that teachers' "fear of failure" caused a lack of confidence.

The other study by James and Al-Hassan (2015) was on Promoting Teaching and Learning in Ghanaian Primary and Basic Schools through ICT. The data was obtained through a cross-sectional survey involving a random sampling of 333 Primary and 295 Junior High Schools across four regions (Northern, Upper East, Upper West, and Volta) in Ghana. Expert interviews on ICT policy implementation were also conducted with ten District and four Regional Directors of Education. ICT technologies are used to educate in primary schools by 69% of female and 50% of male teachers. Due to limited internet connectivity, electricity/power issues, a shortage of computers, and a lack of technical know-how, instructors have difficulty using computers to teach and research. To minimize the issues related to the integration of ICT in the educational system, the study suggests a robust and long-lasting Public and commercial Partnership between the government, the commercial sector, and civil society organizations.

### **2.2.2 ICT integration in teaching and learning**

Hwang et al. (2023) provide a scoping review of research trends in technology use within mathematics education, identifying various technologies that support student engagement and conceptual understanding. Their findings suggest a shift towards collaborative learning environments, where technology plays a pivotal role in enhancing students' mathematical skills.

Similarly, Singapore's Smart Nation initiative emphasizes the integration of AI-based platforms, smartboards, and adaptive learning technologies to personalize Mathematics instruction and track student progress (Ng, 2020). The country has integrated computational thinking and coding into its Mathematics curriculum, ensuring that students develop strong digital literacy skills alongside numeracy competencies.

However, research indicates that the success of ICT integration is not solely dependent on technology availability but also on pedagogical strategies that promote student-centered learning. Studies by Lim & Tay (2021) suggest that ICT is most effective when it is used as a tool to facilitate inquiry-based learning rather than as a substitute for traditional teaching methods.

Additionally, Hennessy et al. (2019) argue that the most successful ICT initiatives are those that align technological tools with teachers' professional development, ensuring that educators are equipped to integrate digital resources effectively. This insight is particularly relevant for Pemba District, where ICT adoption remains in its early stages. Unlike Finland and Singapore, where ICT is a core component of teacher education programs, many educators in Pemba lack adequate training in digital pedagogies, which significantly affects their ability to integrate technology into Mathematics instruction.

The articles cited critically evaluates the current landscape of ICT integration in mathematics education on the global stage, highlighting a persistent focus on literacy skills at the expense of developing robust instructional strategies. This observation raises important questions about the preparedness of educators to utilize technology effectively within their teaching practices. The authors contend that the successful integration of ICT in mathematics instruction hinges on the proficiency of classroom

teachers in employing these tools and the extent to which students are encouraged to utilize them as learning aids.

### **2.2.3 Challenges faced in ICT integration**

Research by Khomo (2018) illustrated the challenges faced by mathematics and science teachers in primary schools, incorporating the Technological Pedagogical Content Knowledge (TPCK) framework in the teaching of mathematics. This framework emphasizes the necessity of intertwining technology, pedagogy, and content knowledge for effective ICT integration. Khomo highlighted that many teachers lack the requisite skills and resources, which hinders their ability to incorporate technology effectively into their teaching practices.

The advancements in technology globally have made it imperative that nations equip teachers with Information Communication Technologies (ICT) to meet the challenges of equipping our young learners with the essential twenty-first century skills. A study by Jackson (2017) indicates that there is a challenge particularly in developing nations due to a number of barriers that include teachers seldom getting the necessary professional development training. Though the study was limited to rural India and focused only on primary school teachers. Over a third of the primary school teachers in the sample believed the policy of integrating ICT in Mathematics is hindered as they and the learners do not have access to technology.

## **2.3 African Perspective on ICT Integration in Teaching Mathematics**

The implementation of ICT in African schools has been uneven, with some countries making significant advancements while others struggle with infrastructural and financial limitations.

### **2.3.1 Availability of ICTs**

South Africa has initiated programs such as the Gauteng Online Schools Programme, which aims to provide learners with digital resources and internet access (Nkosi, 2021). While these efforts have improved access to digital learning, disparities remain between urban and rural schools, with many rural institutions lacking computers, internet connectivity, and stable electricity (Chigona, 2020).

Research by Farhan et al. (2021) suggests that the digital divide in Africa is one of the biggest obstacles to ICT integration, as rural schools often receive fewer resources and lack trained personnel to support ICT-based learning initiatives. In their study of ICT adoption in Tanzania, Sanga et al. (2019) found that while digital tools have the potential to improve Mathematics learning outcomes, their success is often undermined by poor infrastructure and limited technical support.

In East Africa, Kenya and Rwanda have demonstrated promising results in ICT adoption. Kenya's Digital Literacy Programme (DLP) has distributed tablets to primary school learners, helping to integrate ICT into classroom instruction (Wambugu & Mwakuni, 2021). However, studies by Otieno et al. (2020) indicate that while the provision of digital devices has increased, many schools struggle with maintenance and sustainability issues due to inadequate funding. Rwanda's One Laptop per Child initiative has expanded digital literacy in primary schools, significantly improving Mathematics performance (Orieno 2020). However, a study by Tran & Nguyen (2021) found that without structured teacher training, the benefits of ICT in education remain limited. The study emphasizes that digital resources alone are not sufficient, educators must be equipped with the skills to effectively incorporate these tools into their teaching methodologies.

For Pemba District, these African case studies highlight the importance of strong government initiatives, public-private partnerships, and ongoing teacher professional development to foster availability of ICTs in education settings. While Zambia has taken steps towards ICT integration, rural areas like Pemba continue to experience significant challenges, including lack of ICT infrastructure, inadequate teacher training, and limited digital literacy among students. Addressing these barriers requires a strategic approach that incorporates lessons from successful African ICT education models. According to Chigona and Dagada (2021), for ICT initiatives to be sustainable in low-resource settings, they must be supported by policies that ensure equitable distribution of resources, targeted training programs, and ongoing monitoring mechanisms.

### **2.3.2 ICT integration in teaching and learning**

The article "*Opportunities and Challenges: Integration of ICT in Teaching and Learning Mathematics in Secondary Schools, Nairobi, Kenya*" by (Amuko et al., 2017) provides a comprehensive examination of the integration of Information and Communication Technologies (ICT) in mathematics education, particularly within the context of secondary schools in Kenya. The authors highlight a critical gap in the literature concerning the specific challenges faced by teachers in effectively utilizing ICT, which is a pertinent issue that extends into primary education as well.

The article emphasizes that while there have been numerous policy initiatives aimed at enhancing ICT use in mathematics classrooms, the success of these initiatives is largely contingent upon the attitudes and competencies of teachers. This is particularly relevant in primary education, where foundational skills in mathematics are developed. The findings underscore that policy interventions alone are insufficient; the transformation in teaching practices must originate from the teachers themselves. This suggests a need for targeted professional development that not only increases teachers' technical skills but also fosters a positive attitude towards the use of ICT.

Furthermore, the authors highlight that teachers' computer competence as a major predictor of successful ICT integration. This finding calls for a robust framework for ICT training in teacher education programs, particularly for those preparing to teach mathematics at the primary level.

### **2.3.3 Challenges faced in ICT integration**

In the study by Francom (2020), conducted in Rwanda with the title "*Barriers to technology integration: A time-series survey study*", the findings indicate that there are barriers that confront teachers personally when they become agents of the ICT-driven innovations in the teaching of mathematics. Fear of technology grows from the fear of the unknown, the unknowable, and ultimately from not being in charge of the unfamiliar.

The study reveals that fear of technology therefore reflects an unfamiliarity with technology, a low level of confidence in its use, and an unseen, mystic power that

technology is purported to hold. Resistance to change, as ICT technologies find themselves in the classroom environment, is therefore a fundamental factor. Teachers tend to revert to a comfortable, tried-and-tested way of teaching with which they are familiar and have been trained to do. These technologies confront teachers with subtle and not-so-subtle change. The supported change agents who communicate the nature of the power behind change poorly will antagonize these teachers who have lost confidence in the what, the why, the when, and the how of the future. The traditional and comfortable way of teaching and managing discipline becomes the known alternative in the face of the unknown.

The article identifies several key factors that contribute to the challenges faced by teachers, including their comfort level with technology, confidence in using ICT tools, and overall competence in integrating these tools into their teaching. The lack of confidence among teachers, coupled with limited knowledge of ICT, emerges as a significant barrier that obstructs effective technology use in Mathematics instruction. This finding is particularly relevant, as it suggests that professional development and training in ICT are essential for enhancing teachers' skills and confidence in the teaching and learning of mathematics.

## **2.4 The Zambian Situation**

In Zambia, the Ministry of Education has recognized the role of ICT in enhancing education, as reflected in the 2013 curriculum reform that introduced ICT as a subject in schools (MOE, 2014).

### **2.4.1 Availability of ICTs**

Government initiatives such as the Let's Read program and Interactive Radio Instruction (IRI) have sought to improve literacy and numeracy through availability of technological devices such as radios and tablets, particularly in underserved areas. However, research suggests that the impact of these initiatives varies significantly, with rural schools facing greater challenges in ICT adoption due to infrastructure constraints (Lufungulo, 2015).

Despite national ICT policies, many schools in Zambia, particularly in rural districts like Pemba, still lack the resources to fully implement digital learning programs.

Chabalengula & Banda (2023) highlights that while ICT policies exist, their execution is often hindered by inadequate funding, lack of technical support, and inconsistent teacher training programs. Similarly, Nyambe (2020) found that the majority of rural schools still rely on outdated teaching methods due to the absence of basic ICT facilities. According to Banda and Tembo (2022), without a well-structured ICT strategy, rural schools are at risk of falling further behind, exacerbating educational inequalities between urban and rural students.

#### **2.4.2 ICT integration in teaching and learning**

According to a recent study conducted by Moonga and Mwape (2022), a significant proportion of Zambian teachers lack confidence in their ability to effectively integrate Information and Communication Technology (ICT) into their teaching practices. Specifically, the study revealed that less than 30% of the surveyed teachers felt adequately trained in ICT. This finding suggests that the majority of Zambian teachers may not possess the necessary skills and knowledge to effectively harness the potential of ICT in enhancing student learning outcomes.

This is concerning, given the increasingly important role that ICT plays in modern education. The inadequate training of teachers in ICT may hinder the effective implementation of ICT-integrated curricula, ultimately affecting the quality of education provided to Zambian students. Furthermore, this shortage of ICT-trained teachers may exacerbate existing educational inequalities, particularly in rural or disadvantaged areas where access to ICT resources may already be limited.

The study's findings highlight the need for targeted interventions aimed at enhancing the ICT capacity of Zambian teachers. This could involve the provision of ongoing professional development opportunities, mentorship programs, and access to ICT resources and infrastructure. By addressing the ICT training needs of teachers, the Zambian education system can better leverage the potential of ICT to improve teaching and learning outcomes.

#### **2.4.3 Challenges in ICT Integration**

In another study by Hachintu (2021) which focussed on investigating the challenges of ICT adoption in Zambian secondary schools, with a specific focus on Lusaka

District. The findings, published in the *International Journal of Education and Development using ICT*, highlight the significant obstacles that hinder the effective integration of ICT in Zambian secondary schools. Among them, poor internet connectivity, insufficient computer hardware and inadequate electricity supply.

The study underscores the need for targeted interventions to address these challenges and promote the effective adoption of ICT in Zambian primary schools. This could involve investments in infrastructure development, teacher training programs, and technical support services. By addressing these challenges, Zambian primary schools can harness the potential of ICT to enhance teaching and learning outcomes in Mathematics too.

Moreover, studies also show that the education system in Zambia has been greatly affected by the lack of qualified primary school ICT teachers and relevant infrastructure to support ICTs. Nyambe (2020), in a study conducted on *Implementation Status and Challenges of ICTs In Zambian Schools*, found that “various schools lack fully functional computer labs, especially in rural areas to house and support both hardware and software”. This report equally indicated the lack of necessary ICT skills among teachers and the specific training needed to be able to use ICTs appropriately in the classroom. It was found that the most commonly used ICTs by both teachers and learners were a calculator and a phone, despite phones not being allowed in classrooms. The study helps us give a clue of what is happening in the education sector regarding ICT integration.

## **2.5 The Study Gap**

The gap identified here is that despite the vast literature on the role of integrating ICTs in the teaching of Mathematics in primary education from an international perspective, little is known regarding the integration of ICTs in teaching Mathematics at the primary level. The situation has been promulgated by the fact that Zambia, as a developing country, has challenges in ICT resources, infrastructure, and skills to incorporate the technology effectively. While studies touched on ICT integration in general education, there is a need for more research on ICT integration in mathematics education, particularly in primary schools in the context under discussion.

Lufungulo (2015) conducted a comparative study focusing on integrating ICTs in the teaching and learning of Social Studies (SS) in Katete and Lusaka without focusing on the primary sector. Findings were that ICT was advantageous over traditional methods. Hence, the study left a gap in investigating the integration of ICT in teaching Mathematics at the primary level. Thus, since this geographical area (Pemba district) has not been investing through scientific inquiry, it was essential to undertake this study to investigate the current status and prospects of integrating ICTs with all the equipment available in the primary education curriculum. The findings of this study may also add more information to the body of knowledge and identify gaps for future researchers in this area.

## **2.6 Conclusion**

In conclusion, the literature collectively underscores the multifaceted relationship between ICT and Mathematics teaching and learning in primary schools. It highlights the availability of ICT tools, the thoughtful selection of technological tools and the need for supportive learning environments. As the integration of ICT continues to evolve, ongoing research and practical applications will be essential to fully realize its potential in enhancing Mathematics teaching and learning.

The chapter has discussed related literature on the topic and the problem under study using the following headings: Global-related Literature, African perspectives, Zambian Context, and comments on the gap. What has come out clearly in the literature are; the main arguments, deductions, conclusions, and recommendations by various scholars and researchers. The literature has also been linked to my study by way of highlighting similarities, differences, meanings, relationships, and gaps that exist. The next chapter will discuss the methodology of the study.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Overview**

This chapter outlines the methodology used in the study, providing a detailed justification for the research design, sample selection, data collection methods, and analytical techniques. The section also elaborates on the measures taken to ensure the credibility, trustworthiness, and ethical considerations of the research. The study employed a qualitative research approach to explore ICT integration in Mathematics teaching and learning in primary schools in Pemba District, aligning with the study's objectives and the nature of the research problem.

A robust methodology is essential for ensuring that research findings are reliable and valid. This section not only describes the procedures followed but also justifies why specific methods were chosen over others. It ensures that the research process is transparent and can be replicated or adapted for further studies in similar contexts. By providing a detailed account of the methodology, this study enhances its contribution to knowledge in the field of ICT integration in education.

#### **3.2 Research Design**

Different scholars have commented on the research design. In the views of Creswell and Creswell (2023), a research design is a framework for the collection and analysis of data that one employs in a study. This is usually designed according to epistemological and ontological assumptions a researcher might have adopted. Qualitative and quantitative are the two main research paradigms used in social research which Creswell and Creswell refer to as positivism and interpretivism respectively.

A research design is a structured framework that guides the collection, analysis, and interpretation of data (Creswell & Creswell, 2018). This study adopted a qualitative case study design to investigate the availability, challenges, and strategies related to ICT integration in Mathematics teaching. The case study approach was selected

because it enables an in-depth exploration of real-world educational settings, providing rich contextual insights (Yin, 2018).

Qualitative research, rooted in interpretivism, allows for the examination of subjective experiences and contextual factors influencing ICT adoption in schools (Brown, 2008). The case study design was appropriate because it facilitated a detailed investigation into the perspectives of teachers, administrators, and learners regarding ICT use in Mathematics education. Unlike quantitative research, which focuses on numerical analysis, qualitative research allows for a deeper understanding of human experiences and social dynamics. The flexibility of this design enabled the researcher to explore emergent themes and adapt the study as new insights were gained.

Additionally, the case study design was chosen because it provides an opportunity to explore real-life challenges and best practices in a specific context. By focusing on multiple schools within Pemba District, this study aimed to provide a comprehensive understanding of how ICT is integrated into Mathematics teaching and learning at the primary level. This design also allowed the researcher to engage with participants in their natural setting, facilitating a holistic understanding of their experiences.

### **3.3 Study Population**

The study population consisted of school administrators, teachers, and learners from eight primary schools in Pemba District, as well as representatives from the Pemba District Education Board Office (DEBO). Creswell and Creswell (2023) define a study population as all the people you aim to make inference about. The selected participants were those directly involved in Mathematics teaching, school administration, or ICT policy implementation in primary schools.

This population was chosen because these stakeholders play a crucial role in the adoption and implementation of ICT in the education system. School administrators are responsible for decision-making regarding resource allocation, teachers are the primary implementers of ICT in classrooms, and learners are the ultimate beneficiaries of ICT integration. The DEBO representative was included to provide insights into district-level policies and strategies concerning ICT in education. By

including multiple stakeholders, the study ensured that diverse perspectives were captured, leading to a more comprehensive understanding of the research problem.

### **3.4 Sample Size**

The sample size of the study refers to the number of participants or observations included in the study sample. In this regard, the size of the sample should neither be excessively large, nor too small. However, it should be optimum meaning that it should meet the requirements of efficiency, representativeness, reliability and flexibility. Therefore, while deciding the size of the sample, the researcher determined the desired precision as well as an acceptable confidence level for the estimate (Ahmed, 2024).

Sample size determination involves various techniques that can be employed. These include using a census for small populations, imitating a sample size of similar studies, using published tables, and applying formulas to calculate sample size, (Rashwan, 2021). The study used a sample size of 33 participants, consisting of:

- (i) 1 DEBO representative
- (ii) 8 school administrators (1 per school)
- (iii) 24 Mathematics teachers (3 per school, selected from both lower and upper primary levels)

A sample size of 33 was deemed appropriate based on the principle of data saturation, where additional participants were unlikely to provide new insights (Hennink et al, 2021). Secondly, Malterud et al. (2016) introduced the concept of "information power," which suggests that the sample size should be determined by the study's aim, sample specificity, and the desired level of detail. Given the study's focus, 33 participants provided sufficient information power to explore the research questions.

This sample size was selected to ensure that data was collected from a representative group without being overwhelming for analysis. The inclusion of multiple schools allowed for a comparative analysis of ICT integration across different educational settings. By incorporating both lower and upper primary teachers, the study captured variations in ICT usage across different grade levels. The decision to include a DEBO representative ensured that district-level perspectives were considered, providing a broader context for the findings.

**Table 3.1 Categories of the Participants in the Sample**

<b>Category</b>	<b>Total Number</b>
DEBO	1
Administrators	8 (1 x 8 schools)
Teachers	24 (3 x 8 school)
<b>Total</b>	<b>33 participants</b>

### **3.7 Sampling Techniques**

The study employed purposive sampling; a non-probability sampling technique used to select participants who could provide rich, relevant data (Patton, 2015). Specifically, maximum variation sampling was applied to ensure diversity in the sample by selecting participants from different school contexts, grade levels, and administrative roles. This approach was crucial in capturing a broad range of perspectives on ICT integration.

Purposive sampling was selected because it allows the researcher to focus on information-rich cases that provide deeper insights into the research topic. The logic behind maximum variation sampling is that by selecting a diverse group of participants, the study can identify patterns that cut across different contexts, as well as unique challenges faced by specific groups. For instance, ICT integration challenges in lower primary grades may differ from those in upper primary grades, and variations in resource availability between urban and rural schools could impact ICT adoption differently.

### **3.8 Data Collection Instruments**

The instruments that were used in collecting data were as follows: An interview guide for the one-to-one discussion with the Administrators (Headteachers) as per Appendix 1 and an open-ended questionnaire for the teachers, respectively. The data was collected using various tools. A digital video camera was used to capture sample

videos and pictures, which was used during analysis, and the phone to record some conversations with Headteachers.

### **3.8.1 Open-ended questionnaires**

The open-ended questionnaire was more appropriate to encourage complete, meaningful responses using the subject's knowledge and also increase the base of objectivity from the participants, allowing the researcher to better access the participants' actual perception of ICT integration. The researcher opted to use open-ended questions to provide a better understanding of participants' perspectives and experiences. Geoffrey, Mills and Gay (2015, p. 375) indicate, "It gives participants the freedom to bring out their views and opinions and make suggestions that can be significant to the study". By allowing individuals to express themselves freely, the researcher gained insights into the underlying reasons behind their decision-making processes. Eight (8) administrators (head teacher, deputy head teacher, or senior teacher) used this instrument.

### **3.8.2 One on one interview**

Interviews are basically carried out in question form and are asked orally (Creswell and Creswell, 2018). In this study, one-on-one interviews were used to collect data from teachers serving as class teachers teaching in various grades at the primary level. One-to-one interviews were used because qualitative inquiry usually produces in-depth data. From this description, the researcher was able to understand the status of the integration of ICTs in teaching Mathematics at this level of education. Its efficiency is the reason the researcher felt settling for it would bring out quality information and a deeper understanding of teachers' knowledge, practices, and experiences. Twenty-four (24) teachers from across the schools were interviewed, using this instrument.

### **3.8.3 Observations**

The lessons that were observed were given by teachers who had been interviewed. This was to help the researcher understand some of the comments that teachers made in the interview, such as teaching using traditional methods. Coe, Waring, Hedges and Ashley (2021) justify that the information obtained under this method relates to

what is currently happening; it is not complicated by either past behavior or future intentions or attitudes.”

### **3.9 Data collection Procedure and Timeline**

The researcher sought permission from the District Education Board Secretary (DEBS) and Zonal Headteachers before conducting the proposed research in 8 primary schools across the district. The researcher also pursued the consent of the teachers who took center stage in the study and agreed to use any of the instruments outlined. The study was designed to be undertaken in 3 to 4 months. For this reason, the researcher worked within the stipulated period to move to other stages of the research, after it was approved. The researcher used open-ended questionnaires for administrators. Administrators were included in this sample because they play their schools' supervisory, management and administrative roles. Their opinions about their teachers towards the integration of ICTs in the teaching of Mathematics were of great importance to this study. The 24 teachers (3 x 8 schools) were interviewed one-on-one on specified dates, taking videos and recording during the interview.

### **3.11 Data Analysis Procedures**

The study employed thematic analysis, a widely used qualitative method for identifying, analyzing, and reporting patterns within data (Braun & Clarke, 2006). Thematic analysis was chosen because it provides flexibility while allowing for a structured approach to data interpretation. Collingridge and Gantt (2013:76) note that “an understanding of the standards of rigorous qualitative research and familiarity with qualitative approaches has not kept pace with the growing presence of qualitative methods.

The analysis followed Braun and Clarke’s (2006) six-phase framework

- (i) Familiarization with Data – This involved transcribing recorded interviews, reading field notes, and reviewing open-ended questionnaire responses multiple times to ensure deep engagement with the data. This phase helped in identifying initial patterns and recurring ideas within the dataset.
- (ii) Generating Initial Codes – Data was systematically coded by identifying and labeling significant features of the responses. Each segment of data was

assigned a descriptive code that captured key aspects of ICT integration experiences, challenges, and strategies.

- (iii) Searching for Themes – Related codes were grouped into broader themes that represented significant patterns in the data. This phase involved linking various coded extracts to understand commonalities and discrepancies across different participants' experiences.
- (iv) Reviewing Themes – Themes were refined by ensuring they accurately reflected the dataset. This involved iterative checking, merging overlapping themes, and discarding themes that were not strongly supported by data.
- (v) Defining and Naming Themes – Clear definitions were established for each theme to ensure their distinctiveness. Each theme was linked back to the study's objectives and research questions.
- (vi) Producing the Report – The final phase involved synthesizing the themes into a coherent narrative, incorporating direct quotes from participants and cross-referencing with relevant literature to support the findings.

### **3.12 Trustworthiness and Credibility of the Study**

To ensure the trustworthiness of the study outcome, greater care was taken in selecting a research design and data collection instruments. The open-ended questionnaires were first designed and piloted at one school with 4 teachers. After this pilot, modifications were made to several questions to enhance clarity and consistency. In an attempt to investigate the integration of ICTs in Mathematics teaching and learning, the research followed a systematic approach. Firstly, the researcher carried out a pilot study at one of the public schools to test the quality of the interview guide in terms of clarity of questions. This was followed by editing the interview guide and data collection sheets to perfect them.

To enhance the credibility of the findings, Triangulation was done on the pilot study by comparing different kinds of data from different instruments to see whether they collaborate; for example, from the Headteachers and the teachers. To ensure that the findings were credible, the researcher cross-checked the participants' responses with those of other participants that were obtained by different instruments.

### **3.13 Ethical Considerations**

Several ethical codes of conduct guided the researcher's behaviour. These codes discuss many issues that could arise in research and other issues related to professional practice. Creswell and Creswell (2023) state that researchers must "do no harm." In line with the above, this research strived not to cause any harm to the participants. This was arrived at by following the ethical guidelines proposed by Kimmel (2007). The researcher sought permission from the District Education Board Secretary using an introductory letter from the University of Zambia. Further, the researcher explained to the participants what the study was about. He informed the participants that the study was taking approximately 45 minutes for each session.

He assured them that there were going to be no physical risks incurred if they took part in the study and they were free to withdraw from the study if they did not want to participate. At the same time, if they did not want to answer any question, they were free to do so. They were also informed that they were not getting any form of personal benefit by participating in the study.

The researcher ensured that interviews were held at a place and time convenient to participants. The participants were also informed that the information collected was to be used for academic purposes and was confidential.

The implementation of these ethical procedures was highly effective in ensuring participant safety and confidentiality. Participants expressed appreciation for the researcher's transparency and respect for their autonomy. The informed consent process ensured that participants were fully aware of the study's requirements and their rights as participants.

The measures taken to ensure confidentiality and anonymity were also effective. Participants felt comfortable sharing their experiences and opinions, knowing that their identities would be protected.

### **3.14 Summary**

This chapter highlighted the methodological path the researcher used to bring the study area into reality. It has discussed three significant components of the study: research design, research methods, and data analysis. The research methodology and

procedures discussed in Chapter 3 were applied in the collection and analysis of data for chapters four and five.

## CHAPTER FOUR

### PRESENTATION OF FINDINGS

#### 4.0 Overview

This chapter seeks to present the findings of this research. The researcher utilized tables, graphs and descriptive statistics for data interpretation. The structure of the chapter is based on the research questions outlined below:

1. What ICT devices are available for teaching and learning Mathematics in Pemba District schools?
2. To establish how the integration of ICT in the teaching and learning of Mathematics in primary schools is influenced by teachers' technological, pedagogical, and content knowledge?
3. What challenges do teachers face in integrating ICT in the teaching of Mathematics in Pemba District schools?

Looking at the study participants, it is worth mentioning that the researcher interviewed 20 teachers, 8 administrators (Headteachers or deputy head teachers), and 1 standards officer from the District Education Board Secretary's Office (DEBO). The total number of participants was 37. The teachers were coded for ease of analysis and fear of identification. The 20 teachers were coded T1, T2, T3, ... T20, the deputy head teachers were coded as DH1, DH2, DH3 up to DH8 while the head teachers were assigned codes H1, H2, H3 up to H8. The standards officer was given ST1 as a code. Being related to the research objectives, the information gathered from the interviews and observations was useful in achieving the said objectives.

#### **4.1 Respondents' Knowledge of Information and Communications Technologies and Meaning of Integration in Teaching and Learning Mathematics**

This section presents the respondents' understanding of Information and Communication Technologies (ICT) and their perspectives on the integration of ICT in Mathematics education. The study engaged 24 Mathematics teachers, head teachers, and an education official through interviews to assess their knowledge and perceptions regarding ICT integration. Several key themes emerged, highlighting the level of awareness, with ICT integration in Mathematics teaching and learning.

### **(i) Understanding of ICT in Mathematics Teaching and learning**

Most respondents associated ICT with the use of various digital tools to enhance Mathematics teaching and learning. While some demonstrated a broad understanding of ICT, others had a limited grasp of its full potential beyond basic digital tools. Many educators linked ICT to the use of computers, projectors, and online platforms, while others mentioned software applications designed to support mathematical instruction. However, a few respondents viewed ICT as merely supplementary tools rather than integral components of the teaching process.

The varied responses suggest differing levels of exposure to ICT resources. Some teachers, especially those with prior ICT training, highlighted specific technologies such as dynamic geometry software and interactive whiteboards. Conversely, others lacked familiarity with more advanced applications beyond calculators and basic digital content. Below are some of the selected verbatim responses from the respondents;

*“ICT is about using computers, projectors, and digital tools to help explain mathematical concepts more clearly.”* (Teacher T1)

*“I think ICT in mathematics means using technology like calculators, online simulations, and educational apps to solve problems and visualize mathematical ideas.”* (Teacher T5)

The study findings indicate that while there was some awareness of ICT in Mathematics teaching and learning, there is also a need for enhanced professional development to improve educators' competence in using ICT tools effectively. The responses suggested that although many teachers understand the basic functions of ICT, there is still a lack of deeper pedagogical knowledge on how to fully integrate these technologies into lesson planning and instructional delivery. Without adequate training and access to relevant ICT tools, the potential benefits of ICT in Mathematics teaching and learning remain underutilized.

## **(ii) Meaning of ICT Integration in Mathematics Teaching and learning**

Respondents provided varying definitions of ICT integration, with most emphasizing the need for a seamless blend of digital technology and traditional teaching methods. Many participants viewed ICT integration as a means to actively engage learners rather than just providing passive digital content. Others defined integration as the structured incorporation of digital tools into Mathematics instruction, ensuring that students not only access technology but also interact with it meaningfully to enhance problem-solving skills.

Several teachers emphasized that ICT integration should not be limited to sporadic technology use, such as occasional PowerPoint presentations or video tutorials. Instead, they stressed the importance of continuous and structured application of ICT tools, where students engage with software applications, simulations, and real-time data analysis tools. Some educators, however, expressed concerns about the lack of clear guidelines on ICT integration, leading to inconsistent and ineffective implementation in classrooms.

*“It means making ICT part of the daily teaching and learning process, not just using it occasionally, as the case is in most of our schools” (Teacher T7)*

*“In my view I think Integration means combining technology with traditional teaching methods to improve understanding.” (Head Teacher H1)*

These responses suggest that ICT integration is perceived as a tool for enhanced engagement and comprehension in Mathematics teaching and learning. However, participants also highlighted that without proper training and access to resources, successful integration remains a challenge. Many educators recognized the potential of ICT in fostering interactive learning, but the lack of structured implementation plans hinders effective use. Additionally, concerns about inadequate ICT infrastructure in schools, coupled with limited access to reliable internet and electricity, further complicate the integration process.

A key takeaway is that ICT integration should be approached as a structured and ongoing practice rather than an occasional supplement to traditional teaching methods. To ensure meaningful integration, educators require not only access to digital tools but also training on how to utilize these resources effectively to improve student learning outcomes.

#### **4.2. Available ICT Materials for Teaching and Learning Mathematics**

This analysis examines the availability of Information and Communication Technology (ICT) devices and tools for teaching and learning Mathematics in primary schools in Pemba District. The research primarily aimed to investigate the extent to which ICT tools are available and integrated into the teaching of Mathematics. Through interviews with 20 teachers, head teachers, and a DEBO representative, as well as data collection checklists from eight schools, several key themes emerged. These themes reflect the availability of ICT materials, the challenges faced by teachers and students in utilizing these resources, and the general sentiment about the role of ICT in Mathematics teaching and learning.

##### **(i) Limited Availability of ICT Devices for Mathematics Teaching**

The availability of ICT devices for Mathematics teaching in primary schools was severely limited. Currently, the primary schools relied on basic tools such as radios and tablets, which were part of various initiatives, including the Interactive Radio Instruction (IRI) program and the Let's Read program. These tools, while beneficial, did not meet the broader needs of modern Mathematics teaching. Many schools lacked the necessary infrastructure, including more advanced devices such as computers, interactive whiteboards, and digital math tools, which are essential for a more interactive and effective teaching environment. This shortage of ICT devices created barriers to the full integration of technology in Mathematics teaching and learning. Some of the study participants narrated as given below.

*“As of now, the school only has radios provided through the Interactive Radio Instruction (IRI) program and tablets given by the Let's Read program.” (Teacher T3)*

*“Most of the schools would love to use ICT-related gadgets in the teaching of Mathematics, but the necessary infrastructure is lacking. Almost all schools have radios with pre-recorded Mathematics lessons from ECE to Grade 7 as well as tablets from a programme in the country known as ‘Let’s Read Zambia’.” (DEBO Representative)*

*“There was no appropriate infrastructure put in place for adequate use in the teaching of Mathematics using ICTs as well as the availability of other ICT materials used in teaching Mathematics.” (Head Teacher H4)*

The findings indicated a significant gap in the availability of ICT tools necessary for the effective teaching of Mathematics in Pemba District's selected primary schools. While radios and tablets were available, they offered only basic functionality and were not specialized for Mathematics instruction. There was a clear need for more specialized ICT tools such as computers, interactive whiteboards, and digital math software. These tools would enable teachers to implement more interactive and engaging lessons, catering to diverse learning styles and improving overall student outcomes in Mathematics.

#### **(ii) Need for Mathematics-Specific ICT Tools**

The interviewed educators in the district had expressed a strong need for specialized ICT tools tailored specifically to Mathematics teaching and learning. The teachers highlighted the importance of having access to interactive platforms and software that focused on Mathematics content. Tools like educational games, interactive lessons, and digital resources could make learning more engaging and help students grasp complex mathematical concepts in a more intuitive way. The desire for such resources is evidence for the need to move beyond basic ICT tools and towards more innovative and Mathematics-specific technologies. These study findings were echoed in some of the verbatims are presented below;

*“As a school, we want programmed tablets with digital math games such as math bingo and math scavenger and computers with interactive boards.” (Teacher T14)*

*“We are conscious as a school that the government is calling for ICT integration in primary school teaching, including in Mathematics, which is the right path for our learners in this era. The integration is rather on paper and practicality cannot be ascertained.” (Head Teacher H1)*

*“At my school, there is only one computer. It is usually used by the head teacher and the planning officer. The rest of us hardly have access to it. I normally depend on my computer to practise the use of ICTs at home.” (Teacher T7)*

The demand for specialized ICT tools tailored to Mathematics was evident. Teachers recognized the potential of digital math games, interactive boards, and other software tools to engage students and enhance their learning experience. However, the current ICT infrastructure in schools was inadequate to support such resources. The desire for interactive platforms and content-rich programs reflected the understanding that Mathematics teaching requires more than just basic tools like radios and tablets. Effective integration of ICT in Mathematics instruction hinged on providing tools that could facilitate active learning, problem-solving, and exploration of mathematical concepts. Without access to such tools, the effectiveness of ICT in Mathematics teaching and learning was limited, leaving educators and students without the resources to fully benefit from the potential of technology in teaching.

### **(iii) Lack of Teacher Access to ICT Devices and Training**

Teachers in Pemba District face significant barriers when it comes to accessing and utilizing ICT devices both in the classroom and at home. Many teachers report limited or no access to computers or other ICT devices for their own use, making it difficult for them to practice or familiarize themselves with the technologies they are expected to use in their teaching. Moreover, the lack of sufficient training and professional development in the use of ICT further exacerbates the challenges. Teachers are often unable to integrate ICT effectively into their lessons, leaving them reliant on outdated or underutilized tools. Some participants expressed the following views;

*“Most of us in the primary section hardly see a computer for schoolwork. The only time we have access to the computer is when we are processing the week 5 and 10 assessments as well as end-of-term results. Worst of all, our learners don’t even know how to click the keyboard of the computer. They are denied the opportunity as most of the time the computers are used by the Grade eight and nine classes.”*  
(Teacher T2)

*“At my school, there is only one computer. It is usually used by the head teacher and the planning officer. The rest of us hardly have access to it. I normally depend on my computer to practise the use of ICTs at home.”* (Teacher T7)

The limited access to ICT devices for both teachers and students in Pemba District is a significant barrier to effective ICT integration. The lack of teacher access to ICT tools at school and the limited opportunities for practice at home impede their ability to develop the necessary skills to use technology effectively in their teaching. Moreover, without adequate training and professional development in ICT use, teachers are unable to incorporate digital tools into their Mathematics lessons. This creates a cycle where both teachers and students miss out on the benefits of ICT, further widening the digital divide and hindering the integration of technology in the classroom.

#### **(iv) Student Access to ICT Tools is Limited**

In Pemba District, student access to ICT tools is highly limited, which affects their ability to engage with ICT-integrated teaching methods. This lack of access not only impacts students’ learning experiences but also limits their exposure to digital literacy, which is increasingly crucial in today's education system. Although radios and tablets are available, many students have not had the opportunity to interact with these tools regularly during lessons. This lack of interaction hinders their ability to develop essential ICT skills and makes it difficult for them to take full advantage of the potential learning benefits offered by technology. This was highlighted by some of the participants as indicated in the verbatim quotes below;

*“Since the implementation of ICT in the curriculum, learners have not had an opportunity to access and use ICT materials in their learning process across all subjects.” (Deputy Head Teacher DH5)*

*“Most of the teachers, for instance at this school, do not have the relevant skills and infrastructure to implement the ICTs.” (Head Teacher H1)*

Student access to ICT tools remains inconsistent and insufficient in Pemba District. While some schools have radios and tablets, many students do not have regular access to these devices, limiting their exposure to digital learning resources. The lack of student engagement with ICT tools is concerning, as it hampers their digital literacy development, which is vital for their academic success and future opportunities. Furthermore, the lack of access to ICT materials in all subjects, not just Mathematics, reduces the overall effectiveness of ICT integration within the school curriculum, making it harder to equip students with the necessary skills to thrive in a digital world.

#### **(v) Infrastructure Deficiencies and Implementation Challenges**

The successful integration of ICT into teaching and learning was significantly hindered by a lack of adequate infrastructure in schools. Schools faced challenges related to both physical infrastructure and the technological resources needed to support ICT usage. In addition to a lack of sufficient ICT devices, schools also struggled with unreliable electricity supply, poor internet connectivity, and a lack of technical support. These infrastructure deficiencies prevent schools from fully implementing ICT in their teaching practices, limiting the potential benefits of ICT integration. Some participants expressed the following views;

*“There was no appropriate infrastructure put in place for adequate use in the teaching of Mathematics using ICTs as well as the availability of other ICT materials used in teaching Mathematics.” (Head Teacher H4)*

*“Most of the schools would love to use ICT-related gadgets in the teaching of Mathematics, but the necessary infrastructure is lacking.” (DEBO Representative)*

The lack of adequate infrastructure remained a critical obstacle to ICT integration in Pemba District's schools. Without reliable electricity, internet connectivity, and sufficient ICT devices, the potential for using technology in the classroom is severely limited. Even if schools have access to some ICT tools, their impact is minimal without the necessary infrastructure to support their consistent and effective use. The inability to implement ICT programs at full scale further exacerbates educational inequities, as schools without the necessary infrastructure continue to fall behind in adopting modern teaching methodologies. To address this issue, substantial investments in infrastructure both physical and technological are essential for ensuring that ICT can be fully integrated into teaching and learning processes.

### **4.3. ICT Integration in the Teaching and Learning of Mathematics**

The purpose of this question was to determine if primary schools in Pemba District were integrating ICTs for Mathematics instruction. This investigation aimed to ascertain whether ICTs were integrated into the teaching and learning of Mathematics in the primary school curriculum. To gather relevant data on the integration of ICTs in teaching and learning, the researcher conducted interviews, and observed lessons. The findings for the interviews are presented below.

From the interviews conducted with one teacher from each school, it was generally found that ICT materials were not available for teachers to use in schools, which, in turn, affected effective integration in the teaching and learning of Mathematics.

In indicating the ICTs being integrated into teaching Mathematics in schools, a multiple-response question followed, and the teachers were asked to identify the type of ICTs they use in the teaching and learning of Mathematics process.

#### **(i) ICTs Used in Teaching and Learning of Mathematics**

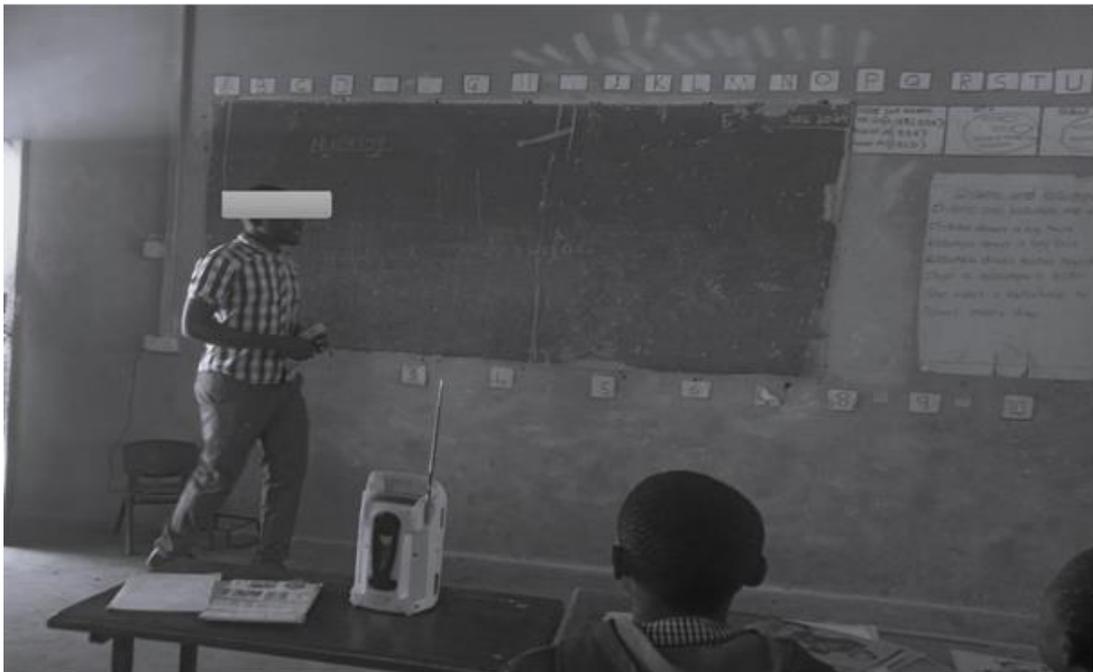
The table summarizing the distribution of ICT usage in schools reveals that, among the available tools, radios, tablets, calculators, and computers were the most commonly mentioned devices used for teaching Mathematics. However, the table

suggests that ICT usage in schools is highly limited, with a significant reliance on radios, tablets, and calculators. These tools are used to some extent but cannot fully meet the teaching and learning needs, especially for Mathematics, which requires more specialized, interactive, and engaging tools for optimal learning. As some participants noted;

*“The use of ICTs in teaching Mathematics in primary schools, especially here where I teach, is very low. Mostly, as a teacher, I use the radio on Thursday when we have radio lessons and use the traditional way of teaching in which I prepare and do most of the demonstrations.” (Teacher T14)*

*“It has been difficult to use ICTs in teaching Mathematics because of a lack of facilities and equipment. However, I have been teaching the subject, using radios and a bit of games from tablets just once in a while.” (Teacher T17)*

Below is a sample of the maths lesson using the available ICT device in the school;



**Figure 5: T14 teaching numeracy using a pre-recorded lesson using a radio**

The picture above shows the teacher who used a pre-recorded audio Mathematics lesson from the memory card inserted into the radio. It was a 30-minute lesson with a

radio teacher giving all the instructions to the learners while the class teacher was maintaining order and following up on the activities.

The results reflect a significant gap in the integration of ICT into Mathematics teaching. While radios and tablets are somewhat available, they are not being integrated and utilized to their full potential. Radios were mostly used for pre-recorded lessons, which, while helpful, did not engage students interactively. Tablets, while they offered some potential, were limited in their use due to their scarcity, poor access, and lack of training. Teachers also reported that they did not integrate ICTs into lessons regularly, and when they did, it was mainly for passive listening or occasional games. This lack of meaningful engagement with ICT tools significantly limited the effectiveness of ICT in enhancing the learning experience in Mathematics. The interviews and observations further revealed that even the limited ICT resources available, such as radios, were not easily accessible due to administrative controls or logistical issues. This showed a disconnect between the availability of resources and their effective use in the classroom.

## **(ii) Teacher Experiences with ICT Integration**

When asked about their experiences with ICT in teaching Mathematics, most of participants indicated that they rarely used ICTs in their lessons, with the main exception being the two days allocated to teaching via radio lessons. Teachers mostly used traditional methods of teaching, such as chalk and blackboard, which many believed were more reliable and effective in delivering Mathematics content. Some of the teachers narrated as highlighted below;

*“I rarely use ICTs in math lessons; only when I have to use a picture as an aid do I do so because I prefer traditional teaching methods.” (Teacher T19)*

*“It is difficult to make connections between Maths theory and practice... I am sure if you ask a learner what Maths games look like, they won’t be able to describe them.” (Teacher from School C)*

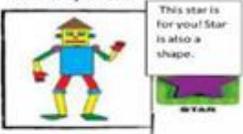
The preference for traditional teaching methods over ICT was a significant finding. Many teachers expressed difficulty in using ICT tools and felt more comfortable with traditional methods, likely due to lack of familiarity or adequate training. The limited frequency of ICT integration (e.g., only using radios for two lessons a week) further emphasized the reluctance and barriers teachers face in using technology. The absence of consistent, meaningful ICT integration in Mathematics lessons diminished students' opportunities to interact with digital learning resources, potentially hindering their development of digital literacy and engagement with the subject matter.

### **(iii) Impact of ICT on Learning Experience**

The findings showed that despite the limited use of ICT, some teachers did integrate technology to enhance learning experiences. For instance, one teacher used an online Maths platform to provide real-time feedback to students and assist with lesson planning. Another teacher used a laptop to prepare well-structured lesson plans and incorporated visual aids, which helped enhance the learning experience. Participants' comments included the following:

*“Online Maths platforms have been providing me with real-time feedback and help... I am also able to access materials that are not available in the school.” (Teacher from School B)*

*“I used a laptop computer to write a lesson plan which was printed with well-drawn shapes. When teaching, I used a whiteboard with different markers to enhance visual learning.” (Teacher from School E)*

<p><b>I. Objectives</b></p> <ol style="list-style-type: none"> <li>Recognize the five basic shapes</li> <li>Name defining characteristics of each shape</li> <li>Give examples of thing for the five basic shapes</li> </ol> <p><b>II. Subject Matter</b></p> <p>Topic: Five basic shapes  Reference: <a href="http://lessons.atteacherstuff.com/441/shapes/">http://lessons.atteacherstuff.com/441/shapes/</a>  <a href="http://www.eskdstuff.com/blog/songs/mr-shape-head-song#sthash.F2sD6Soz.dpuf">http://www.eskdstuff.com/blog/songs/mr-shape-head-song#sthash.F2sD6Soz.dpuf</a>  Materials: cut out color paper of the five basic shapes which are circle, triangle, rectangle and star  Worksheets about shapes  Bond paper and colors</p> <p><b>III. Learning Procedure</b></p> <table border="1"> <thead> <tr> <th>Teachers' activities</th> <th>Pupils' Activities</th> </tr> </thead> <tbody> <tr> <td> <p>A. Preparation:</p> <p>Stand up and let us pray, please lead the prayer, jecil.</p> <p>Is everybody present? Check if your seatmates are there.</p> <p>Very Good, everybody is present. Let's clap our hands for ourselves</p> <p>B. Motivation</p> <p><b>Mr. Shape Head</b></p>  <p>Do you want to meet Mr. Shape head?</p> </td> <td> <p>Angel of God my guardian dear to whom God's love commits me here ever this day is at my side to light and guide to rule and guard. Amen.</p> <p>{ Pupils will check if their seatmates are presents }</p> <p>{ pupils happily clap their hands }</p> <p>Mr. Shape Head</p> <p>Yes, We want!</p> </td> </tr> </tbody> </table>	Teachers' activities	Pupils' Activities	<p>A. Preparation:</p> <p>Stand up and let us pray, please lead the prayer, jecil.</p> <p>Is everybody present? Check if your seatmates are there.</p> <p>Very Good, everybody is present. Let's clap our hands for ourselves</p> <p>B. Motivation</p> <p><b>Mr. Shape Head</b></p>  <p>Do you want to meet Mr. Shape head?</p>	<p>Angel of God my guardian dear to whom God's love commits me here ever this day is at my side to light and guide to rule and guard. Amen.</p> <p>{ Pupils will check if their seatmates are presents }</p> <p>{ pupils happily clap their hands }</p> <p>Mr. Shape Head</p> <p>Yes, We want!</p>	<p><b>Mr. Shape Head song</b></p> <p><b>Chorus:</b> Mr. Shape Head, how are you? Mr. Shape Head, how are you? Mr. Shape Head, how are you? How are you this morning?</p> <p><b>Verse 1:</b> My eyes are square, but I'm okay My ears are circles, but I'm okay My nose is a triangle, but I'm okay For I am Mr. Shape Head</p> <p><b>Chorus</b></p> <p><b>Verse 2:</b> My head is square, but I'm okay My mouth is a rectangle, but I'm okay My hair is a triangle, but I'm okay For I am Mr. Shape Head</p> <p><b>Chorus</b></p> <p><b>C. Presentation</b></p> <p>Can you tell me how Mr. Shape Head describes himself?</p> <p>Very good says Mr. Shape head!</p> <p>Mr. Shape wants to give something for you? What is it? A star.</p>  <p>Let us know more about shapes but let us know first the five basic shapes! Are you ready?</p> <p>His eyes are square, his ears are circles, and his nose is a triangle. His head is square Mouth is a rectangle Hair is a triangle</p> <p>This star is for you! Star is also a shape.</p> <p>Yes, we are!</p>
Teachers' activities	Pupils' Activities				
<p>A. Preparation:</p> <p>Stand up and let us pray, please lead the prayer, jecil.</p> <p>Is everybody present? Check if your seatmates are there.</p> <p>Very Good, everybody is present. Let's clap our hands for ourselves</p> <p>B. Motivation</p> <p><b>Mr. Shape Head</b></p>  <p>Do you want to meet Mr. Shape head?</p>	<p>Angel of God my guardian dear to whom God's love commits me here ever this day is at my side to light and guide to rule and guard. Amen.</p> <p>{ Pupils will check if their seatmates are presents }</p> <p>{ pupils happily clap their hands }</p> <p>Mr. Shape Head</p> <p>Yes, We want!</p>				

**Figure 6: Sample of the printed mathematics lesson prepared by T16**

The positive examples of ICT use highlight its potential to enhance the teaching and learning of Mathematics. Teachers who successfully integrated ICT tools, such as online platforms and digital lesson plans, were able to provide more personalized learning experiences for their students. These examples demonstrate the power of ICT to enhance visual learning, provide immediate feedback, and access additional resources that are not available in the school. However, these instances remain isolated and limited to certain teachers with access to technology. The broader implementation of ICT in schools would require overcoming barriers such as access to devices, internet connectivity, and training to ensure that all teachers can effectively use ICT in their classrooms.

#### **4.4. Challenges Affecting ICT Integration in Mathematics Teaching and Learning**

In this question, the researcher sought to find out the challenges teachers face in integrating ICT in the teaching and learning of Mathematics. The participants were

asked questions on the challenges that they faced in teaching Mathematics in the context of integrating ICTs.

**(i) Lack of Teacher Skills and Training**

One of the most significant barriers to ICT integration is the lack of sufficient skills and training among teachers. This was highlighted by 14 out of 20 teachers and 6 out of 8 administrators, who pointed out that teachers did not feel equipped with the necessary skills to use ICT tools effectively in teaching Mathematics. Participants' comments included the following:

*“14 participants felt that teachers' lack of skills and specific training to incorporate ICTs in the teaching of Mathematics had contributed to poor integration in the subject.”*

*"The teachers do not have materials for reference and learners are prohibited from using some gadgets such as phones in schools." (DH4)*

The results indicated a clear gap in professional development for teachers, especially in terms of learning how to effectively integrate ICT tools into their pedagogical practices. Despite the availability of ICT resources in some schools, the lack of proper training prevents teachers from utilizing these tools to their full potential. This gap in skills may stem from limited access to ICT training programs, a lack of continuous professional development opportunities, and insufficient focus on ICT as part of the curriculum for teacher preparation. This gap was also acknowledged in the study by Mambwe, & Chisha (2016) in a study on preparation level, survival skills, and entrepreneurial knowledge among Retired Teachers in Zambia. In fact, the lack of proper training of teachers in pedagogical practices, is not just limited to ICT but is a pedagogical gap in teacher training that has been identified by other scholars (Mambwe, 2020; Mambwe, 2019 & Mambwe, et al., 2019).

**(ii) Insufficient ICT Resources**

A significant challenge highlighted by both teachers and administrators is the insufficient number of ICT resources such as computers, tablets, math-related games,

and other teaching aids. The limited availability of such resources hinders the ability of teachers to integrate ICT into their Mathematics lessons effectively. Some participants expressed the following views:

*“Primary schools have few or no ICT-related teaching and learning materials for Mathematics. here is a need to do more from a policy point of view to effectively integrate ICTs into the teaching process. The teachers do not have materials for reference.” (DH4)*

The theme of insufficient ICT resources reflects the broader issue of resource constraints in schools, particularly in primary education. This shortage affects not only the availability of devices but also the quality of content (such as Math-related games and interactive learning tools) needed to enhance the learning experience. The lack of infrastructure, including access to electricity and internet, also limits the use of ICT tools. As a result, ICTs are underutilized, and schools are unable to fully harness their potential in the teaching of Mathematics.

### **(iii) Challenges with ICT Resource Availability and Access**

Teachers and administrators consistently mentioned challenges with ICT resource availability, with radios, tablets, and memory cards being the primary resources available in schools. However, the limited number of devices and issues with access (e.g., devices being kept by headteachers or limited to certain teachers) were frequently highlighted as obstacles. In some instances, the availability of ICT resources was not enough to enable regular or meaningful use in classrooms. Some participants expressed the following views:

*“The head teacher keeps the radio in his office. This limits the use of the only electronic gadget (tablet) we have. When he leaves the station, it is practically impossible to access the radio or tablet.” (Teacher T6)*

*“Teachers have access to smartphones and tablets, but these are normally personal and learners are not allowed to use them.” (H3)*

*“The stable network we have is Zamtel, which is very weak on the internet here.”*  
(DH5)

The lack of access to available ICT resources is a significant barrier to effective ICT integration in Mathematics teaching and learning. Even when devices like radios and tablets are available, they are not always accessible to all teachers or students. The fact that these resources are often kept in the headteacher’s office and not readily available for use suggests a management issue and a lack of clear policies for the equitable distribution of resources. Furthermore, the challenges with internet access, particularly in rural areas, further compound the problem. The absence of a stable internet connection makes it difficult to use online resources and platforms that could significantly enhance Mathematics teaching and learning. This lack of access to ICT resources means that even when teachers are motivated to use technology, they are often unable to do so effectively.

**(iv) Inadequate Physical Infrastructure and Power Supply**

Teachers and administrators pointed out the inadequate physical infrastructure, including unreliable electricity sources and power outages, as major challenges that disrupt ICT-related learning activities. Here is what they said;

*“Unreliable sources of power and power outages disrupting ICT-related learning and physical infrastructure of instructional technology, ICTs require modern tools and knowledge which some teachers do not have unless they have some kind of training for effective use in their teaching process.”* (DH4)

In many regions, particularly in rural areas, power supply remains inconsistent. This directly impacts the ability to integrate ICT into classrooms, especially in schools that rely on electronic devices and online resources for teaching Mathematics. Power outages during lessons can disrupt the flow of learning, and inconsistent electricity limits the use of ICT tools like computers and tablets, which are critical for interactive and digital learning experiences.

#### **(v) Teacher Resistance to ICT Integration**

Teachers' resistance to incorporating ICT into their teaching practices was another challenge identified. Many teachers preferred to rely on traditional teaching methods, such as chalk-and-board instruction, and were reluctant to adopt new technology-driven approaches. This resistance could be rooted in a lack of confidence, fear of failure, or skepticism about the effectiveness of ICT in improving student learning outcomes. Some participants expressed the following views:

*“Some teachers are not comfortable using ICTs to teach Mathematics in primary schools.” (DEBO Representative)*

*“There is a need for teachers to have more training in ICT integration, but resistance to ICT due to their traditional methods is a barrier.” (DH4)*

Resistance to ICT integration is often a result of the comfort that teachers feel with traditional methods, which they have practiced for years. The reluctance to adopt ICT could also stem from the lack of familiarity with digital tools, fear of technological failure, and a lack of perceived value in using ICT for Mathematics teaching and learning. Overcoming this resistance requires providing teachers with strong support, including professional development, confidence-building initiatives, and showcasing the benefits of ICT in enhancing student engagement and learning outcomes.

#### **(vi) Language Barriers in ICT-Related Games**

One unique challenge highlighted by the data was the language barrier students faced when using ICT-related games in Mathematics. In schools like School C, where the language of instruction is Tonga, students struggled with English-language games, which led to disengagement and abandonment of the games. As one participant stated;

*“Our learners enjoy some games with Mathematics puzzles but have challenges with English since we use Tonga as a language of instruction during teaching.” (H3)*

Language differences pose significant challenges when using ICT-based learning tools, particularly in regions where the language of instruction differs from the language used in digital resources. For students who are not fluent in English, using educational games or platforms that are primarily in English can create barriers to learning. It becomes essential to localize or adapt ICT materials to the students' primary language to ensure accessibility and engagement. This challenge highlights the need for culturally relevant ICT resources tailored to the linguistic backgrounds of the learners.

#### **(vii) High Costs of ICT Integration**

Several participants mentioned the high costs associated with ICT integration, such as the cost of acquiring computers, tablets, and other ICT tools, as well as the ongoing expenses related to maintaining and updating these resources. As one participant stated,

*“ICT costs related to procurement and maintenance of devices are a significant challenge.” (Extract from questionnaire)*

The financial constraints faced by schools in procuring and maintaining ICT tools are a critical barrier to ICT integration. Schools often lack the funding needed to purchase the required devices or to maintain and update them, making it difficult to implement effective ICT-based learning strategies. This financial challenge is particularly acute in low-income areas where education budgets are limited. Addressing this issue may involve seeking external funding, partnerships with NGOs, or government investment in educational technology.

#### **4.5. Measures for Improving ICT Integration in the Teaching and Learning of Mathematics**

Participants were asked to suggest what they would do to aid in resolving the challenges they faced. The following suggestions were made.

**(i) Teacher Training and Capacity Building**

Both teachers and administrators strongly emphasized the need for targeted and continuous training to enable teachers to effectively integrate ICT tools into their Mathematics lessons. This includes providing professional development opportunities for teachers, particularly those trained before technology became part of the educational landscape. Some participants expressed the following views

*"The government should be deliberate in providing necessary training to teachers to enable them to incorporate essential math-related ICTs."*

*"Capacity building through ongoing professional development of staff in ICT usage could be highly beneficial."*

*"Teachers, especially those who were trained before technology was introduced in colleges, should receive continuous training."*

The theme of continuous professional development highlights the importance of equipping teachers with up-to-date skills and knowledge to effectively incorporate ICT into Mathematics teaching. Since many teachers are not confident in using technology, regular, targeted training sessions could help bridge the gap in skills. Additionally, such training should be tailored to teachers' specific needs, including those who were trained before ICT tools became central to the curriculum. Ensuring that teachers can effectively use ICT tools would help improve the integration of technology into Mathematics lessons.

**(ii) Provision of ICT Resources**

The need for the government and educational authorities to invest in a wide range of ICT resources, particularly Math-related materials like games, puzzles, and computers, was frequently mentioned. Teachers and administrators noted that the lack of sufficient resources was a major challenge to ICT integration. Here is what some participants said;

*"Invest in purchasing math ICT-related materials for the primary level, such as games and puzzles."*

*"There should be an emphasis on making a wide range of math-related ICT equipment available."*

*"Schools should be required to purchase a minimum number of math-related ICT materials, like computers, every term."*

This theme underscores the crucial need for adequate resources to support ICT integration. Without the necessary Math-related ICT tools, such as software, games, and devices, teachers are unable to provide the interactive and engaging learning experiences that ICT can offer. The suggestion to make Math-specific resources available regularly (e.g., purchasing computers every term) points to the need for systematic and ongoing investment in educational technology to ensure that ICT is not just available but integrated into the daily learning process.

### **(iii) Policy Adjustment and Relaxation**

Several participants, particularly administrators, suggested that policy changes were necessary to enable better integration of ICT into schools. One specific suggestion was to relax the policies restricting the use of personal gadgets (e.g., phones) in schools to allow students to fully utilize ICT tools under controlled conditions. Here is what the administrators said;

*"The need to relax the policy on gadgets, such as phones, in schools to allow learners to fully utilize them under controlled conditions cannot be overemphasised."*

*"A deliberate policy should be enforced that requires all schools to purchase a minimum number of math-related ICT materials."*

The theme of policy adjustments emphasizes the importance of creating a more flexible and supportive environment for ICT integration. Currently, some schools have restrictive policies around the use of gadgets like phones, which may limit opportunities for students to use personal devices for learning. Relaxing these

policies, under controlled circumstances, would allow students to use available resources more effectively and encourage greater engagement with ICT-based learning.

#### **(iv) Recruitment of Qualified ICT Teachers**

Another key suggestion from the DEBS representative was to recruit qualified teachers who have the skills to effectively use ICT in Mathematics teaching. This includes ensuring that teachers have the necessary qualifications and competencies to integrate technology in a meaningful way. An administrator suggested that;

*"There is a need to first equip and recruit qualified teachers who can effectively use ICT gadgets in math lessons."*

This theme highlights the importance of having qualified educators who are not only knowledgeable in Mathematics but also skilled in using ICT tools. Hiring teachers with specific expertise in ICT would ensure that technology is integrated into the teaching process from the outset. This also suggests that current teacher recruitment policies should prioritize ICT competency to support the successful implementation of technology in the classroom.

#### **(v) Monitoring and Evaluation of ICT Integration**

The DEBS representative stressed the need for systems to monitor the progress of ICT integration and ensure that the measures are being implemented effectively. This includes establishing mechanisms to track whether schools are purchasing ICT resources and whether teachers are successfully using ICT in their teaching.

*"DEBS should establish mechanisms to monitor the progress and implementation of these measures." "Schools should be encouraged to enhance teachers' capacity in ICT integration and showcase effective integration methods."*

The theme of monitoring and evaluation underscores the need for accountability and continuous improvement. Simply providing resources and training is not enough; there must be ongoing evaluation to ensure that ICT integration is happening

effectively. Regular monitoring can help identify areas where further support is needed and allow for adjustments to be made to ensure that technology is being used as intended.

**(vi) Student Involvement in ICT Use**

While not explicitly mentioned by every participant, the concept of involving students more in ICT use under controlled conditions was implicitly suggested. The idea is to create opportunities for students to use ICT tools, whether personal gadgets or school-provided devices, to enhance their learning experience.

*"Relax the policy on gadgets, such as phones, to allow learners to fully utilize them."*

The finding highlighted the importance of student engagement with ICT tools. Allowing students to use personal devices for learning, when appropriate, can foster more independent and interactive learning experiences. This can also help students develop essential digital literacy skills, which are increasingly important in the modern world.

#### **4.6. Summary of the Findings**

This chapter aimed to present the study findings based on the set questions of this study. It has shown that most schools did not adequately utilise the available resources to teach Mathematics using ICTs. Most of the participants expressed worry that the use of ICTs in the teaching of Mathematics was not moving with time due to some underlying constraints.

Major among the identified challenges were the lack of desire by teachers to use the gadgets (for schools where they were available), the lack of gadgets and the lack of supporting infrastructure, among others. To mitigate the identified challenges, most of the participants suggested a deliberate policy shift. Schools must be helped to deliver to the expected standards by making sure the needed resources are readily available and by utilising Continuing Professional Development to equip all the teachers with the necessary skills. In this study.

Effective integration of ICTs in the teaching and learning of Mathematics requires a radical change in the roles of all actors, as well as in the design and structure of activities. The new role of the teacher in the teaching situation requires new skills that teachers must acquire. It requires significant personal engagement on his part and that traditional environment. Moving forward, addressing these challenges requires targeted investments in ICT infrastructure, comprehensive in-service teacher training programs and supportive policies backed by the availability of necessary materials that prioritize ICT integration in the teaching of Mathematics practices. By overcoming these obstacles, schools can harness the full potential of ICTs to enhance learner engagement, improve learning outcomes and prepare learners for the digital challenges of the future.

## **CHAPTER FIVE**

### **DISCUSSION OF FINDINGS**

#### **5.1. Overview of the discussion of Findings**

This chapter discusses the study findings in relation to existing literature with the theoretical framework of Technological Pedagogical Content Knowledge (TPACK) to offer a comprehensive understanding of ICT integration in Mathematics teaching in sampled schools in Pemba District. The discussion is structured around key themes, including the availability of ICT materials for teaching and learning Mathematics, challenges in ICT integration, and measures to improve ICT use in primary schools. The TPACK framework, which emphasizes the intersection of technology, pedagogy, and content knowledge, serves as a lens to evaluate how these components interact and influence the effectiveness of ICT integration in teaching and learning mathematics. The analysis also highlights gaps between the study findings and prior research, providing insights into the effectiveness of ICT in Mathematics teaching and learning in Pemba District.

#### **5.2. Availability of ICT Materials for Teaching and Learning**

The findings of the study reveal a significant gap in the availability of ICT materials for Mathematics instruction in Pemba District. Despite some initiatives such as the IRI program and Let's Read program, which have introduced tablets and radios, the provision of technology remains minimal. Teachers reported limited access to digital tools that can actively engage students in learning, especially in rural schools. This is consistent with studies by Farhan et al. (2021) and Saleem et al. (2020), which underline that the availability of ICT resources in rural schools is often inadequate, limiting opportunities for interactive and student-centered learning.

According to the TPACK framework, effective ICT integration requires access to tools that enhance both the content being taught and the pedagogical approaches employed by teachers. In Pemba District, the existing technology (such as radios) is more suited for passive learning rather than fostering interactive learning, which is essential for understanding complex mathematical concepts. The use of advanced ICT tools, such as interactive whiteboards or simulation-based programs, would

allow teachers to create more engaging and interactive lessons. These tools are vital in ensuring that ICT integration is not just about using technology but using it in a way that enhances the teaching of Mathematics content.

Further, the study points to the ongoing infrastructural challenges that hinder ICT use, including unreliable electricity and slow internet speeds, which are critical for the proper functioning of many digital tools. These infrastructure issues echo concerns raised in previous studies (Lim & Tay, 2021; Torres et al., 2020), which emphasize that technology cannot be effectively integrated into the classroom without reliable infrastructure. The TPACK framework emphasizes that technology integration requires a stable and supportive environment where all three components—technology, pedagogy, and content knowledge—can interact smoothly. Thus, addressing these infrastructural challenges is essential for creating an environment conducive to effective ICT use in Mathematics teaching and learning.

### **5.3. Analysis of ICT Integration in Mathematics Teaching and learning**

The integration of ICT in Mathematics teaching and learning plays a critical role in enhancing teaching and learning outcomes. The study found that ICT tools are predominantly used to deliver structured lessons rather than engage students in more interactive, problem-solving activities. The use of educational technologies like interactive whiteboards, educational apps, and learning management systems can facilitate a shift from teacher-centered to student-centered approaches. Research by Zhou et al. (2020) and Tran & Nguyen (2021) support the notion that interactive tools can improve engagement and help students better understand abstract mathematical concepts. These tools allow teachers to present complex ideas in more digestible formats, supporting the development of critical thinking and problem-solving skills.

From a TPACK perspective, the study indicates that while teachers possess content knowledge in Mathematics, they lack the technological knowledge required to integrate ICT effectively into their pedagogical practices. This disconnect between the technological and pedagogical knowledge is evident in the limited use of ICT tools for active learning. Effective ICT integration, as suggested by the TPACK framework, requires that teachers not only know how to use technology but also

understand how to incorporate it into their teaching practices to enhance the content they are delivering. The lack of advanced ICT tools in Pemba District schools' limits teachers' ability to adopt such pedagogical practices, thereby hindering the development of a truly interactive and engaging learning environment for students.

Moreover, the study highlights the inadequacy of professional development programs in the region. Teachers reported feeling unprepared to use ICT tools effectively in the classroom, particularly in Mathematics teaching and learning. This finding mirrors the results of Dlamini & Masuku (2022), who argue that the lack of ICT training among teachers is a significant barrier to the effective use of technology in teaching and learning. In the context of the TPACK framework, teacher training must focus on building teachers' technological knowledge, pedagogical strategies, and understanding of how these elements can be combined to teach specific content areas, such as Mathematics. Without this holistic understanding, ICT tools cannot be used to their full potential, and the benefits of technology in education remain limited.

#### **5.4. Challenges in ICT Integration in the teaching and learning of mathematics**

The study identified several challenges to the effective integration of ICT in Mathematics teaching and learning, the most notable being the lack of adequate teacher training. Many teachers in Pemba District reported insufficient exposure to ICT tools during their pre-service training, and they feel unconfident in using digital technologies in the classroom. This issue aligns with research by Zhou et al. (2020) and Lufungulo (2015), which points out that teachers' limited ICT skills hinder the integration of technology in classrooms. From the perspective of the TPACK framework, it is evident that for ICT to be effectively integrated, teachers need to develop not only content-specific knowledge but also the technological skills necessary to utilize digital tools effectively within the context of their teaching.

In addition, the study found that the available ICT resources are often outdated or insufficient in number, limiting the ability of teachers to use technology to support interactive learning in Mathematics. Many schools are reliant on outdated equipment, and only a small number of students can benefit from ICT resources at any given time. This issue exacerbates the digital divide between urban and rural schools and

underscores the need for equitable distribution of ICT resources. The findings support the work of Ahmad et al. (2022) and Nkosi (2021), who argue that unequal access to digital tools is a significant barrier to ICT integration in rural schools. According to the TPACK framework, technological knowledge must be paired with appropriate tools and resources to ensure that teachers can effectively support their students' learning.

Furthermore, the lack of consistent electricity and internet access further complicates ICT integration in rural schools. Teachers expressed frustration with the unreliability of electricity, which often disrupts lessons and prevents the use of ICT tools. These infrastructural challenges mirror the experiences of other developing countries, where poor infrastructure is a major barrier to ICT adoption in education (Lim & Tay, 2021). The TPACK framework stresses that technology integration cannot occur in isolation from the surrounding infrastructure and resources. A lack of reliable electricity and internet undermines the potential benefits of ICT integration, highlighting the importance of addressing these foundational issues before meaningful ICT adoption can occur.

### **5.5. Measures for Improving ICT Integration in the teaching and learning of mathematics**

To address the barriers to ICT integration, several measures were suggested by study participants. One of the key recommendations was the establishment of comprehensive teacher training programs focused on developing teachers' technological and pedagogical skills. Training should not only cover how to use ICT tools but also how to integrate them effectively into Mathematics teaching. This aligns with the TPACK framework, which emphasizes that teachers must possess a deep understanding of how to blend technology, pedagogy, and content knowledge to create engaging learning experiences. Training programs should be tailored to the specific needs of Mathematics teachers, helping them understand how ICT tools can support the teaching of mathematical concepts and foster student-centered learning.

Another recommendation was the need for increased investment in ICT resources, particularly in rural schools. Teachers and school administrators emphasized the importance of acquiring more computers, interactive whiteboards, and educational

software to support Mathematics instruction. This recommendation aligns with studies by Zhou et al. (2020), which highlight the critical role of diverse ICT tools in improving student engagement and learning outcomes. The TPACK framework suggests that technology should not only support teaching practices but should also provide students with tools that enable active engagement with the content. In this context, schools in Pemba District need to prioritize the acquisition of ICT tools that facilitate interactive, hands-on learning experiences.

Additionally, participants recommended policy changes to ensure that ICT resources are distributed equitably across schools and that teachers receive ongoing professional development in ICT integration. Policy-driven reforms are essential for ensuring that ICT adoption is not left to individual schools but is supported at a national level. This reflects the broader trend identified by UNESCO (2020), which argues that sustainable ICT integration in teaching and learning requires strong governmental support and policy frameworks. The TPACK framework highlights that such systemic support is necessary to align technology, pedagogy, and content knowledge effectively across the education system.

## **5.6. Comparative Analysis with Existing Literature**

The findings from this study align with global trends in ICT integration, particularly in resource-constrained settings. Similar barriers, such as inadequate infrastructure, insufficient teacher training, and limited access to ICT resources, have been documented in other developing countries (Saleem et al., 2020; Ahmad et al., 2022). However, the study also highlights the importance of adopting a holistic approach to ICT integration that considers not only technological resources but also pedagogy and content knowledge. Research in high-performing education systems, such as Finland, demonstrates the success of integrating ICT when all three components of TPACK are addressed (Kumpulainen & Wray, 2017). In contrast, the situation in Pemba District suggests that a more balanced approach is necessary for effective ICT integration in Mathematics teaching and learning. This includes addressing infrastructural challenges, providing targeted teacher training, and ensuring equitable access to resources.

## **5.7. Summary**

In summary, the study highlights the critical role of ICT in enhancing Mathematics teaching and learning but also underscores significant challenges that need to be addressed. The findings suggest that ICT integration in Pemba District is hindered by limited access to resources, inadequate teacher training, and infrastructural challenges. To overcome these barriers, the study recommends targeted teacher training, increased investment in ICT resources, and policy reforms to support ICT adoption in schools. The integration of the TPACK framework provides valuable insights into the need for a holistic approach to ICT integration, where technology, pedagogy, and content knowledge work together to create an effective learning environment. By addressing these challenges, it is possible to unlock the potential of ICT to transform Mathematics teaching and learning and improve student outcomes in Pemba District.

## CHAPTER SIX

### CONCLUSION AND RECOMMENDATIONS

#### 6.1 Conclusion

The integration of Information and Communication Technology (ICT) in Mathematics teaching and learning offers a significant opportunity to enhance learning outcomes, improve student engagement, and foster critical thinking skills. This study explored the extent of ICT tool integration in the teaching of Mathematics in the sampled schools in Pemba District, with a particular focus on the challenges, benefits, and areas for improvement. While radio-based instruction plays a notable role in the current ICT landscape, it remains a passive medium, limiting its effectiveness in providing interactive, engaging, and deeper learning experiences necessary for fostering conceptual understanding.

The study found that the availability of diverse and interactive digital tools is limited, and this lack of resources severely restricts the potential of ICT in Mathematics teaching and learning. Teachers are generally aware of the potential benefits of ICT, but challenges such as limited infrastructure (e.g., computers, tablets, and interactive boards), erratic electricity, poor internet connectivity, and insufficient teacher training on ICT integration hinder effective adoption. Despite these challenges, there is a growing willingness among educators to incorporate ICT into their teaching practices, provided they receive adequate resources and support.

In the context of TPACK (Technological Pedagogical Content Knowledge), it is evident that teachers need to develop a deep understanding of how to integrate technology, pedagogy, and content knowledge. However, the current limitations in training and resources have prevented teachers from mastering this integration. TPACK emphasizes the importance of blending knowledge across three domains: content (Mathematics), pedagogy (teaching methods), and technology (digital tools) to enhance the teaching and learning process. In this study, the lack of sufficient training in this framework, especially in how ICT can align with teaching methodologies and Mathematics content, was a significant gap.

## **6.2 Recommendations**

To enhance the integration of ICT in Mathematics teaching and learning, the following recommendations are proposed

### **6.2.1 Policy and Infrastructure Development**

**Increase Investment in ICT Infrastructure:** There should be greater investment in ICT infrastructure, focusing on the procurement and distribution of digital tools like computers, tablets, projectors, and interactive boards. Rural schools should be prioritized to bridge the digital divide. This infrastructure is crucial for fostering a learning environment where TPACK can thrive, as it ensures teachers and students have the necessary technological tools to support effective learning and teaching.

**Improve Electricity and Internet Connectivity:** Schools should be equipped with sustainable power solutions, including solar energy, and efforts should be made to enhance internet connectivity. This is essential for providing both teachers and students access to online teaching and learning resources, which is crucial for fostering the effective use of technology in the classroom.

**Develop ICT Integration Policies:** Clear guidelines and policies should be established for ICT integration in Mathematics teaching and learning, including frameworks for evaluating the effectiveness of digital tools and ensuring alignment with educational objectives. Policy reforms should support the integration of TPACK, encouraging a balanced approach to pedagogy, content, and technology in teaching.

### **6.2.2 Teacher Capacity Building**

**Enhance Teacher Training Programs:** Professional development programs should be introduced to equip teachers with the skills necessary for effective ICT integration in Mathematics instruction. These programs should emphasize both technical proficiency and pedagogical strategies, focusing on how technology can support mathematical content and enhance student learning outcomes.

**Establish ICT Support Networks:** Schools should create ICT mentorship programs where experienced teachers support their peers in effectively using digital tools in the classroom. These programs should also include online forums and workshops, where educators can share best practices and troubleshoot challenges collaboratively.

Encourage the Use of Open Educational Resources (OERs): Teachers should be encouraged to utilize free and open-source educational resources, which can enhance Mathematics teaching without significant financial investment. These resources should be aligned with the curriculum and integrated into the teaching process, ensuring that technology enhances both pedagogy and content delivery.

### **6.2.3 Student Engagement and Digital Learning Enhancement**

Promote Interactive Learning Approaches: Schools should prioritize interactive learning methods that utilize educational software, simulations, and gamification techniques. These methods can significantly enhance students' engagement and improve their conceptual understanding of Mathematics. The application of interactive learning through digital tools supports the TPACK framework by engaging students in the learning process through technology and effective pedagogical strategies.

Integrate Mobile Learning: Given the ubiquity of mobile phones, schools should encourage the use of mobile learning applications that support Mathematics instruction. Mobile apps can provide students with opportunities for learning outside the classroom and can be used to reinforce the concepts taught in class.

Foster a Culture of Digital Literacy: To ensure effective ICT integration, students should be encouraged to develop digital literacy skills. These skills will enable them to effectively use ICT tools for learning and problem-solving, reinforcing the need for a strong foundation in digital competencies within the curriculum.

### **6.2.4 Community and Stakeholder Involvement**

Engage Parents and the Community: Awareness programs should be conducted to educate parents about the benefits of ICT in Mathematics teaching and learning. This can foster support for the provision of digital resources at home, thus enhancing students' access to learning tools and fostering a more supportive learning environment.

Public-Private Partnerships: Collaborations between the government, private sector, and NGOs should be strengthened to fund ICT initiatives in schools. These

partnerships can provide the necessary expertise, funding, and technological solutions to help integrate ICT effectively into the classroom.

**Create Localized Digital Content:** Digital content that is tailored to local curricula and students' needs should be developed. This content should be culturally relevant and available in local languages to ensure it meets the specific challenges faced by students in various regions.

### **6.3 Recommendations for Future Studies**

While this study offered critical insights into ICT integration in Mathematics teaching and learning, further research is necessary to address the gaps identified and explore new dimensions. The following areas were suggested for future studies:

**Comparative Studies on ICT Integration Models:** Future research should compare ICT integration strategies across different districts or regions to identify best practices that can be adopted more broadly.

**Longitudinal Impact of ICT on Mathematics Performance:** A long-term study could assess the impact of ICT on students' performance in Mathematics. This study would explore the sustainability and effectiveness of ICT tools over time.

**Exploration of Teacher Attitudes and Readiness:** Future research should delve deeper into the psychological factors affecting teachers' readiness to integrate ICT. Understanding these factors will help design interventions that support teachers' confidence and competence in adopting digital tools.

**Evaluation of Cost-Effective ICT Solutions:** Research into affordable and scalable ICT solutions is necessary to ensure that resource-constrained schools can still benefit from the integration of technology in Mathematics teaching.

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## **LIST OF APPENDICES**

### **Appendix A: One-on-One Interview Guide for Teachers.**

1. What ICTs are available in the school that you use in teaching Mathematics?
2. What other devices would you want to use but are not available in the school?
3. Do you have basic knowledge of ICT (if it's a computer Microsoft Office) about teaching and learning Mathematics?
4. Do you have confidence in integrating various ICTs available in teaching Mathematics at the primary level?
5. What challenges do you have in the use of ICT in teaching Mathematics?
6. How do you integrate ICT in the teaching and learning of Mathematics in your school?
7. How do you utilise ICT to attract learners to a Mathematics lesson?
8. How does the school management support teaching using ICT tools in the school?
9. How do different ICT applications, audio, verbal, pictures and communicative practices impact communicative practices in the teaching of Mathematics at the primary level?
10. What are some of the measures that can be put to improve the integration of teaching and learning using ICT in Mathematics?
11. In your capacity, what have you done to help integrate ICT in teaching Mathematics?
12. Is the Ministry of Education doing enough to support ICT usage in the school?

**THANK YOU**

**Appendix B: Open Open-ended questionnaire for administrators.**

Dear respondent,

You have been purposively selected to help in answering this research study. The exercise is purely for academic purposes. You are therefore requested to freely answer all the questions in this paper for your responses will be treated with high confidentiality.

**INSTRUCTIONS**

1. Do not write your name on this questionnaire.
2. You are free to answer all the questions subjectively and precisely.
3. Explain in the spaces provided.

***PART A***

**PERSONAL DETAILS**

Age.....

Level of Education.....

Sex.....

Years in service.....

1. What ICT equipment is available in your school that can be used to teach Mathematics?

.....  
.....

2. Are there any other equipment that you would want the school to have to enhance the teaching of Mathematics in the school? If yes, mention them.

.....  
.....

3. In any of your monitoring schedules, what ICT devices do the teachers integrate often in facilitating Mathematics lessons?

.....  
.....

4. How often do the teachers integrate ICTs in teaching Mathematics in the school?

.....  
.....

5. What barriers do your teachers find in using ICT in teaching Mathematics?

.....  
.....  
6. How competent are your teachers and learners in the use of ICTs in teaching and learning?

.....  
.....  
7. What is the importance of integration of ICTs in the teaching of Mathematics in your school?

.....  
.....  
8. From your perspective, is the Ministry of Education doing enough to support ICTs in schools?

.....  
.....  
9. What other support do you have apart from the Ministry of Education to have ICT equipment in the school?

.....  
.....  
10. What are some of the measures that can be put to improve the integration of teaching and learning using ICT in Mathematics?

.....  
.....  
11. Anything that you would want to share emanating from the discussion?

**THANK YOU**

## Appendix C: Data Collection Sheet

DATA COLLECTION SHEET																								
Materials	LIST OF EIGHT (8) SCHOOLS																							
	School A			School B			School C			School D			School E			School F			School G			School H		
	QTY	Admn	T/L	QTY	Admin	T/L																		
Cell Phones	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>
Radios	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	6	<input type="checkbox"/>	<input type="checkbox"/>	6	<input type="checkbox"/>	<input type="checkbox"/>	5	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6	<input type="checkbox"/>	<input type="checkbox"/>
Television	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>
Printers	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Photocopiers	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Laptops	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>
Desktops	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3	<input type="checkbox"/>	<input type="checkbox"/>	4	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ICT trained teachers	4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	2	<input type="checkbox"/>	<input type="checkbox"/>
Internet	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Whiteboards	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>
Maths related games	23	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	3	<input type="checkbox"/>	<input type="checkbox"/>	0	<input type="checkbox"/>	<input type="checkbox"/>									
Tablet	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>

## **Appendix D: Consent Form**

Dear Participant,

My name is Mazabuka Host. I am a student at the University of Zambia. You are invited to participate in a research project entitled: An Investigation of the Integration of ICTs in the Teaching and Learning of Mathematics at the Primary School Level in selected schools of Pemba District, Southern Province. This study will explore the integration of ICTs in the Teaching and Learning of Mathematics at the Primary Level in selected schools of Pemba District in Southern Province. This study has been approved by the University of Zambia Directorate of Research and Graduate Studies.

The one-on-one study interview which will be recorded was developed to inquire a few questions regarding the status of integration of ICT in teaching Mathematics Primary School Teachers' attitudes towards ICT integration in the Mathematics classroom. I am hopeful that this information can add to the existing literature on ICT integration in the district, province and classrooms in Zambia, thereby helping in curriculum review and implementation of written policy. There are no identified risks from participating in this research.

Information that you provide during the interview and answering the questionnaire is confidential. Participation in this research is completely voluntary and you may refuse to participate without consequences. The interview will take approximately 20 minutes to complete. You will not receive compensation for participating in the research study. Responses to the study will only be reported in aggregated form to protect the identity of participants. The results will be presented at the University of Zambia presentations. Neither the researcher nor the university has a conflict of interest with the results.

I freely give my consent to participate in this research study and have been given a copy of this form for my information.

Should you have any questions about the research or any related matters, please contact the researcher at [hostmazabuka@gmail.com](mailto:hostmazabuka@gmail.com) or 0979583110. Thank you for your consideration. Your help is greatly appreciated.

Signature: ..... Date: .....

## Appendix E: Letter Of Approval



### THE UNIVERSITY OF ZAMBIA DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

Great East Road Campus | P.O. Box 32379 | Lusaka10101 | Tel: +260-211-290 258/291 777 Fax: (+260)-211-290 258/253 952 | E-mail: [director.drugs@unza.zm](mailto:director.drugs@unza.zm) | Website: [www.unza.zm](http://www.unza.zm)

#### APPROVAL OF STUDY

**IORG No. 0005376**  
**HSSREC IRB No. 00006464**  
**REF NO. HSSREC-2024-FEB-018**

21<sup>st</sup> March, 2024

Mr. Host Mazabuka  
The University of Zambia  
P.O. Box 32379  
**LUSAKA**

Dear Mr. Mazabuka

**RE: "EXPLORATION OF ICTS IN THE TEACHING AND LEARNING OF MATHEMATICS AT PRIMARY SCHOOL LEVEL IN SELECTED SCHOOLS OF PEMBA DISTRICT, SOUTHERN PROVINCE."**

Reference is made to your submission of the protocol captioned above. The HSSREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

REVIEW TYPE	ORDINARY REVIEW	APPROVAL NO. HSSREC:- 2024- FEB – 018
Approval and Expiry Date	Approval Date: 21 <sup>st</sup> March, 2024	Expiry Date: 20 <sup>th</sup> March, 2025
Protocol Version and Date	Version - Nil.	20 <sup>th</sup> March, 2025
Information Sheet, Consent Forms and Dates	<input type="checkbox"/> English.	To be provided
Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	
Number of Participants Approved for Study		

---

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

#### **CONDITIONS OF APPROVAL**

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to HSSREC within 5 days.
- All protocol modifications must be approved by HSSREC prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to HSSREC within 5 working days.
- All recruitment materials must be approved by HSSREC prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. HSSREC will only approve a study for a period of 12 months.
- It is the responsibility of the PI to renew his/her ethics approval through a renewal application to HSSREC.
- Where the PI desires to extend the study after expiry of the study period, documents for study extension must be received by HSSREC at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Documents received within 30 days after expiry will be labelled "late submissions" and will incur a penalty fee of K500.00. No study shall be renewed whose documents are submitted for renewal 30 days after expiry of the certificate.
- Every 6 (six) months a progress report form supplied by The University of Zambia Humanities and Social Sciences Research Ethics Committee as an IRB must be filled in and submitted to us. There is a penalty of K500.00 for failure to submit the report.
- When closing a project, the PI is responsible for notifying, in writing or using the Research Ethics and Management Online (REMO), both HSSREC and the National Health Research Authority (NHRA) when ethics certification is no longer required for a project.
- In order to close an approved study, a Closing Report must be submitted in writing or through the REMO system. A Closing Report should be filed when data collection has ended and the study team will no longer be using human participants or animals or secondary data or have any direct or indirect contact with the research participants or animals for the study.
- Filing a closing report (rather than just letting your approval lapse) is important as it assists HSSREC in efficiently tracking and reporting on projects. Note that some funding agencies and sponsors require a notice of closure from the IRB which had approved the study and can only be generated after the Closing Report has been filed.

- A reprint of this letter shall be done at a fee.
- All protocol modifications must be approved by HSSREC by way of an application for an amendment prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address or methodology and methods. Many modifications entail minimal risk adjustments to a protocol and/or consent form and can be made on an Expedited basis (via the IRB Chair). Some examples are: format changes, correcting spelling errors, adding key personnel, minor changes to questionnaires, recruiting and changes, and so forth. Other, more substantive changes, especially those that may alter the risk-benefit ratio, may require Full Board review. In all cases, except where noted above regarding subject safety, any changes to any protocol document or procedure must first be approved by HSSREC before they can be implemented.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of HSSREC, we would like to wish you all the success as you carry out your study.

Yours faithfully,



**DR. J. I. Ziwa**

**CHAIRPERSON  
THE UNIVERSITY OF ZAMBIA HUMANITIES AND  
SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE - IRB**

cc: Director, Directorate of Research and Graduate Studies  
Assistant Director (Research), Directorate of Research and Graduate Studies  
Assistant Registrar (Research), Directorate of Research and Graduate Studies

## Appendix F: Permission Letter A

*All communications should be addressed  
to the District Education Board Secretary  
Not to any individual by name.  
Email: pembadeb@yahoo.com*



In reply please Quote

**MINISTRY OF EDUCATION  
OFFICE OF THE DISTRICT EDUCATION BOARD SECRETARY  
P O BOX 640042  
PEMBA**

25<sup>th</sup> March, 2024

To: Head teachers in the 8 selected primary schools  
**PEMBA DISTRICT**

**RE: PERMISSION TO CONDUCT RESEARCH FIELDWORK FOR  
MASTERS PROGRAM-YOURSELF-MAZABUKA HOST (20169207)**

Reference is made to the above subject matter.

I am writing to grant you permission to conduct field work in 8 selected schools within the district for your research study titled EXPLORATION OF ICTS INTEGRATION IN THE TEACHING AND LEARNING OF MATHEMATICS AT PRIMARY SCHOOL LEVEL IN SELECTED SCHOOLS OF PEMBA DISTRICT, SOUTHERN PROVINCE. You are permitted to conduct field work in the following schools;

1. Muzoka Primary
2. Pemba Primary
3. Choompa Primary
4. Kanchomba Primary
5. Siazwela Primary
6. Simooya Primary
7. Cheelo Primary
8. Maambo Primary

The office wishes you all the best as you conduct your field work.

Yours faithfully,

Nzila Francis Himoonde (Mr)  
District Education Board Secretary  
**PEMBA DISTRICT**

**Appendix G: Permission Letter: B**



THE UNIVERSITY OF ZAMBIA  
OFFICE OF THE DEAN, EDUCATION

Telephone: 291777/291381  
Telegram: UNZA, LUSAKA  
Telex: UNZALU ZA 44370

P.O. Box 32379  
Lusaka, Zambia  
Fax: +260-1-25395

21-03-2024

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: FIELD WORK FOR MASTERS/PHD STUDENTS

The bearer of this letter Mr. M. MAZABIKA Host..... Computer number 22104119..... is a duly registered student at the University of Zambia, School of Education.

He/she is taking a Masters/PhD programme in Education. The programme has a fieldwork component which he/she has to complete.

We shall greatly appreciate if the necessary assistance is rendered to him/her

Yours faithfully,

Bibian Kalinde  
ASSISTANT DEAN- POSTGRADUATE STUDIES - SCHOOL OF EDUCATION

c.c. Dean, Education

Director, DRCS

