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EXAMINING THE IMPACT OF ICT ON O'LEVEL MATHEMATICS TEACHING AND LEARNING IN BINDURA DISTRICT RURAL SCHOOLS. A CASE STUDY OF BINDURA DISTRICT RURAL SCHOOLS AND WAYERERA SECONDARY SCHOOL.

BY

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RELEASE FORM

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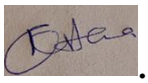
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DEDICATION

To my beloved mom, my sister Voice and my baby boy Adriel for their support and patience during the long march.

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ABSTRACT

This study examined the integration and impact of Information and Communication Technologies (ICTs) on mathematics teaching and learning in rural Ordinary level schools within the Bindura District of Zimbabwe, focusing on Wayerera Secondary School as a case study. Adopting an interpretivist philosophy and a case study. Semi-structured interviews with four students and two mathematics teachers to explore the "digital divide" and its effects on academic performance. The theoretical framework was grounded in the Diffusion of Innovations Theory, the Technology Acceptance Model (TAM), and the Technological Pedagogical Content Knowledge (TPACK) model. Study findings from the interviews revealed a significant difference between the recognized potential of ICT and its actual classroom application. Major barriers included a severe lack of modern infrastructure, such as reliable electricity and internet connectivity, outdated hardware, and a high student-to-computer ratio. Furthermore, while teachers exhibited positive attitudes toward technology, they lacked the specialized TPACK training necessary for advanced pedagogical integration. Despite these challenges, it was suggested that even limited ICT exposure significantly enhanced learner motivation, reduced mathematics anxiety, and improved conceptual understanding. The study concluded by recommending prioritized investments in solar power, broadband infrastructure, and subject-specific teacher professional development to ensure equitable education in rural contexts.

CHAPTER ONE
INTRODUCTION

1.1 Introduction

The integration of Information and Communication Technologies (ICTs) into education has become an important driver of innovation in teaching and learning across the globe. Mathematics, as a foundation subject in science, technology, and problem-solving, has especially benefited from ICT tools such as computers, interactive software, projectors, and mobile applications. However, disparities in access to and use of ICT between urban and rural schools remain a challenge. This significant disparity, often referred to as the "digital divide" exists which creates educational inequalities between urban and rural or socio-economically different populations. In Zimbabwe, particularly in rural districts such as Bindura, schools faced unique obstacles that influenced the extent to which ICT can positively impact mathematics teaching and learning. The study sought to examine how ICT was being used in rural schools of Bindura District and to analyze its impact on mathematics instruction and learner performance.

1.2 Background to the Study

The integration of Information and Communication Technologies (ICT) into education has become a central focus for improving teaching and learning outcomes, particularly in subjects like mathematics. In Zimbabwe, the government has prioritized ICT integration to modernize the education system and align it with the demands of the digital age (Nhongo & Siziba, 2022). The rapid diffusion of information and communication technologies (ICT) transformed educational practice worldwide, prompting curriculum designers and mathematics educators to investigate how digital tools such as dynamic geometry software, learning management systems, and online resources can support mathematical understanding, problem solving, and classroom instruction (Hwang, 2023). Research suggested that technology, when academically integrated, can improve instructional quality and scaffold students' mathematical thinking—especially through visualization, immediate feedback, and opportunities for repeated practice (Hwang, 2023). Studies and systematic reviews reported a range of positive outcomes from ICT use in mathematics, that is increased learner engagement, improved achievement, richer formative assessment, and expanded opportunities for individualized and collaborative

learning (Das, 2019). However, these benefits depended strongly on how ICT is used (pedagogical model), teacher competence with digital tools, and the availability of appropriate resources and support (Okur and Dikilitaş, 2024).

Rural schools faced quite a number of challenges that weakened the potential impact of ICT. The so-called "digital divide"—unequal access to devices, reliable electricity, internet connectivity, and trained personnel—remained a recurrent barrier to meaningful ICT integration in rural settings. Where ICT infrastructure or teacher training was weak, technology adoption often failed to translate into sustained learning gains (Mustafa, 2024). Even when some ICT tools were available, they were often insufficient for the student population, leading to a situation where multiple students had to share a single device, hindering personalized learning (Harare, 2013). Studies in comparable rural contexts also highlighted related constraints such as limited technical support, heavy teacher workloads, and syllabi that are not adapted to blended or technology-mediated instruction (Mustafa, 2024). Within Zimbabwe, and in the Bindura educational environment specifically, research indicated both interest in and uneven adoption of ICT in mathematics teaching. Investigations involving pre-service and in-service teachers at institutions connected to Bindura pointed to positive perceptions of ICT's potential alongside practical barriers (infrastructure, training, and policy implementation gaps) that limited consistent classroom use (Dzinoreva, 2022). This local evidence suggested that there was variation in readiness and outcomes.

Taken together, the literature showed a credible theoretical and empirical basis for expecting ICT to influence mathematics teaching and learning, but it also signaled important contingencies, especially in rural, resource-constrained schools that justified focused research. For Bindura District's rural schools, there was a clear research gap in empirically documenting the current level and forms of ICT availability and use in mathematics lessons, teacher competencies and attitudes toward ICT, and concrete effects on pedagogy and student outcomes under prevailing local conditions. This study aimed at filling these gaps by examining the impact of ICT on mathematics teaching and learning in Bindura District rural schools.

1.3 Statement of the Problem

While ICT had the potential to transform the teaching and learning of mathematics, its effective integration in rural schools remained limited. Rural schools in Bindura District continued to

face resource and training constraints, which hindered the adoption of ICT in mathematics classrooms. There was limited research on how ICT tools were being used in these schools and the specific impact they had on teaching and learning outcomes in mathematics. This raised a concern: Are learners in rural areas benefiting from the advantages ICT offers in enhancing mathematical understanding and performance? The lack of empirical evidence on the extent, nature, and impact of ICT use in rural mathematics classrooms in Bindura District presented a gap that this study sought to address.

1.4 Research Objectives

1. To identify use and access of ICT resources in mathematics classrooms in Bindura District rural schools.

2. To assess teachers' ICT competencies in ICT usage in teaching mathematics.

3. To identify the teachers' attitudes towards ICT usage in teaching mathematics.

4 To evaluate the extent to which ICT is integrated into mathematics teaching practices in rural schools.

5 To determine the impact of ICT use on learners' attitudes, motivation, and performance in mathematics.

6. To identify challenges faced by teachers and learners in integrating ICT into mathematics teaching and learning in rural schools.

7. To suggest strategies for improving ICT integration in the teaching and learning of mathematics in rural contexts.

1.5 Research Sub-Questions

1. What ICT resources were available, accessible and used for teaching and learning mathematics in Bindura District rural schools?

2. What were the ICT competencies of mathematics teachers in rural schools?

3.What attitudes did the teachers hold towards integrating ICT into their teaching of mathematics in rural schools?

4. To what extent was ICT integrated into mathematics teaching practices in rural schools?

5. How did the use of ICT affect learners' attitudes, motivation, and performance in mathematics?

6. What challenges hindered the effective integration of ICT in mathematics teaching and learning in Bindura District rural schools?

7. What strategies were implemented to enhance ICT use in mathematics teaching and learning in rural schools?

1.6 Expected Research Contributions

1.6.1 Theoretical Contributions

The research contributed to the theoretical understanding of ICT involvement in mathematics education, particularly in the O-level context. By synthesizing findings from previous studies and examining the impact of ICT integration in mathematics teaching and learning, this study helped to refine existing theoretical models.

1.6.2 Practical Contributions

The study's findings provided valuable insights for educators and policymakers on how to better integrate ICT in mathematics education. It also offered practical recommendations for schools to enhance student learning through ICT involvement and also how best they could make maximum use of technology in the teaching and learning of mathematics.

1.7 Limitations

This study focused exclusively on O-level students and was not largely applicable to other educational levels. The study also relied on self-reported data, which may have introduced biases in participants' responses. Additionally, the research did not examine the effects of ICT integration in other subjects, thus focusing solely on mathematics. The study examined ICT impact on mathematics education at the O-level, excluding other factors such as teacher quality, peer influence, or curriculum changes. It focused on students from rural schools, which limited the scope of its findings to rural contexts. Furthermore, the research did not assess the long-term effects of ICT integration beyond the O-level examination period.

1.8 Delimitations

The study was delimited to Wayerera Secondary School. It is located in Bindura District, Mashonaland Central Province, Zimbabwe. This geographic focus allowed for an in-depth exploration of ICT within a specific rural educational context. Conceptually, the study was delimited to the integration of ICT in mathematics education, excluding other subject areas and levels that are not O'level. It concentrated on how ICT can enhance conceptual understanding, teaching strategies, and learner engagement in mathematics.

1.9 Definition of Terms

- **Information and Communication Technology (ICT) -** "ICT refers to the use of computers, software, internet, and other digital technologies to manage, process, and communicate information." (UNESCO, 2011). In this context, ICT therefore referred to the use of computer-based learning into the classroom in order to broaden learners experience and knowledge.
- **Mathematics Teaching and Learning -** "Mathematics teaching and learning involve the processes of instructing and acquiring mathematical knowledge, skills, and concepts." (Kilpatrick et al., 2001). Therefore, mathematics teaching and learning can be viewed as the process where teachers impart mathematical knowledge and skills to learners.
- **Rural schools - Rural** schools are generally characterized as those in a geographical area with a population of less than 2,500, having a lower population density and often a less diversified economy than urban areas (Khattri, Riley, & Kane, 1997, as cited in Trindade & da Costa, 2019). These are those schools that are found outside towns and cities, and which are usually economically less privileged
- **Urban schools –** The National Center for Education Statistics (2022) defines urban schools as those schools located in urbanized areas or urban clusters with populations greater than 2500. Urban schools have higher populations, better resources and are usually found in towns and cities.

1.10 Organization of the Study

Chapter 1: Introduction

This chapter provided an overview of the research topic, outlined the research problem, and presented the study's objectives and scope.

Chapter 2: Literature Review

This chapter reviewed relevant literature on ICT involvement in mathematics teaching and learning in rural schools and its impact on students' academic outcomes. It also established the theoretical framework for the study.

Chapter 3: Research Methodology

This chapter outlined the research design, data collection methods, and analytical techniques used in the study.

Chapter 4: Findings

This chapter presented the results of the research, including statistical analyses and qualitative findings.

Chapter 5: Conclusions and Recommendations

This chapter summarized the key findings, discusses their implications for practice, and offered recommendations for future research and interventions.

1.11 Chapter Summary

This chapter introduced the study, including the background, problem statement, research objectives, and scope of the study. It also outlined the need for research into the involvement of ICT and its impact on mathematics teaching and learning at O-level in Bindura District Rural Schools. The following chapter will present a detailed review of relevant literature to establish the theoretical and empirical foundations for the study.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter examined current studies on how ICT involvement affect the learning of mathematics at O level. A critical review of the literature was required to assist the researcher in developing a comprehensive grasp of and insight into earlier research related to the research questions.

2.2 Theoretical frameworks

The theoretical framework for understanding how adoption of ICT influenced the teaching and learning of mathematics at the O-level level are rooted in various educational theories that highlight the importance of technology and innovation.

2.2.1 The Diffusion of Innovations Theory

The Diffusion of Innovations (DOI) Theory which was developed by Everett Rogers (1962), provided a useful context for understanding how new ideas, practices, and technologies spread within a social system. Rogers defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003). In the context of education, particularly mathematics teaching and learning, this theory helped analyze how teachers and learners adopt and integrate Information and Communication Technologies (ICTs), pedagogical innovations, and new mathematical approaches in classrooms. The theory identified five key elements that influence the adoption of an innovation: the innovation itself, communication channels, time, the social system, and the adopters' characteristics. Rogers (2003) classified adopters into five categories: innovators, early adopters, early majority, late majority, and laggards. These categories helped explain the differences in the rate at which mathematics teachers embrace and use ICT in the teaching and learning setup. For instance, some teachers quickly embraced digital tools such as GeoGebra, Desmos, and Mathematica, while others were hesitant due to factors like lack of training, inadequate resources, or resistance to change (Buabeng-Andoh, 2012). The diffusion process

in mathematics education was, therefore, not only influenced by the availability of technologies but also by teachers' attitudes, perceived usefulness of the innovation, and institutional support (Tondeur et al., 2017).

In mathematics teaching, compatibility could depend on whether the innovation aligns with the curriculum, assessment standards, and teachers' academic beliefs. Studies showed that when teachers perceived ICT use as compatible with mathematics learning goals, they were more inclined to adopt it (Ertmer and Ottenbreit-Leftwich, 2010). Conversely, perceived incompatibility or lack of confidence in using digital tools could slow the diffusion process (Buabeng-Andoh, 2012). In rural or resource-limited schools, such as those in Bindura District, teachers would find integrating ICTs in mathematics complex due to limited access to digital resources, unreliable internet, or insufficient training (Chigona, 2015).

2.2.2 Technology Acceptance Model (TAM)

Originally developed by Davis (1986) and later refined by Davis, Bagozzi, and Warshaw (1989), Technology Acceptance Model (TAM) explained how users come to accept and use technology. It proposed that two key variables, perceived usefulness (PU) and perceived ease of use (PEOU) determined individuals' attitudes toward technology, which in turn influenced their behavioral intention to use it. In the context of mathematics education, the TAM framework provided valuable insights into how both teachers and students adopt Information and Communication Technologies (ICTs) such as graphing software, computer algebra systems, and online learning platforms. Perceived usefulness referred to the extent to which individuals believe that using technology will enhance their teaching or learning performance. For instance, in mathematics teaching teachers who perceived digital tools like GeoGebra or Desmos as helpful in illustrating abstract concepts were more likely to integrate them into lessons (Hohenwarter and Jones, 2007). Likewise, perceived ease of use referred to the degree to which technology was seen as user-friendly and free of effort (Venkatesh and Davis, 2000). When teachers and students found mathematics software intuitive and easy to navigate, their acceptance rates tended to increase significantly.

Pierce and Ball (2009) observed that secondary school mathematics teachers were more willing to employ technology when they recognized its potential to improve students' conceptual understanding and problem-solving abilities. Similarly, Aypay (2010) noted that teachers' positive perceptions of technology led to more effective use of digital tools, enhancing mathematical communication and engagement among learners. However, acceptance of technology in mathematics teaching was not solely determined by the technology's features

but also by contextual and human factors. For example, Buabeng-Andoh (2012) highlighted that limited training, lack of technical support, and inadequate access to digital resources were major barriers to ICT integration, especially in developing countries. In rural areas such as Bindura District, where infrastructural challenges persist, teachers' acceptance of technology was hindered despite positive attitudes toward its usefulness.

2.2.3 Technological Pedagogical Content Knowledge (TPACK) framework

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), provided a comprehensive model for integrating technology in teaching. It extended Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) by adding a technological dimension, emphasizing that effective technology integration requires an advanced understanding of the relationships between technology (TK), pedagogy (PK), and content (CK). According to Mishra and Koehler (2006), TPACK represented the intersection of these three forms of knowledge, enabling teachers to design and deliver lessons that effectively combined subject matter expertise, appropriate pedagogical strategies, and relevant technologies. In mathematics education, TPACK played a vital role because mathematical understanding often relied on abstract and complex concepts that could be made more concrete through digital tools such as GeoGebra, Desmos, and dynamic graphing software (Niess, 2011).

The Technological Content Knowledge (TCK) component of the TPACK model was particularly relevant to mathematics teachers, as it involved understanding how technology can represent and transform mathematical content. A teacher with strong TCK knew how tools like graphing calculators, simulations, or virtual manipulatives could support the representation of mathematical relationships (Niess, 2005). In contrast, Technological Pedagogical Knowledge (TPK) focused on understanding how technology influenced teaching methods and classroom interactions, such as using interactive whiteboards or online quizzes to enhance engagement and feedback (Koh and Chai, 2016).

2.3 The Impact of ICT on Students' Academic Performance in Mathematics at the O-level

Recent studies showed of a statistically significant positive effect of ICT on students' mathematics achievement. However, researchers concurred that this impact was not a result of technology's mere presence, but rather its strategic academic placement, which is then aided by teacher competence, infrastructure, and the nature of student usage. ICT tools facilitated a

shift in education from abstract memorization to active, visual exploration (Haleem et al., 2022). Dynamic software, such as GeoGebra or advanced graphing calculators, allowed students to manipulate mathematical representations (graphical, symbolic, and numerical) in real-time. This capability enabled O'level learners to overcome the abstract nature of topics like functions, transformations, and coordinate geometry, thereby fostering a deeper and more durable conceptual understanding (Yildiz and Arpaci, 2024). This meant that even without the teacher's presence, the learner could research and learn a topic by themselves and understand it. It also allowed learners to also visit those topics that they did not understand during lesson time and research more on it, downloading tutorials to as to get a better grasp of the concept. When ICT was blended with a structured instructional approach, students demonstrated enhanced confidence and greater persistence in tackling non-routine problems (ResearchGate, 2025).

The interactive nature of modern ICT resources, including educational simulations and gamified learning platforms, significantly increased student motivation and engagement with the subject (Bhutoria and Aljabri, 2022). ICT provided a stimulating and enticing approach to learning which made the learning process fun and interesting through the use of videos, simulations, educational games, and real time applications which provided the learner with answers at that time without waiting for the teacher. This enabled the learner to correct their mistakes when they were wrong and at the same time give them the motivation to continue working if they got the questions right. This rise in interest was critical, as a positive attitude towards mathematics is a powerful predictor of academic success (Rashidov, 2020). Furthermore, ICT supported self-regulated learning by providing immediate, individualized feedback on practice exercises, allowing students to identify and correct errors autonomously—a feature critical for mastery-based learning (UNL Digital Commons, 2025).

2.4 The Relationship Between teachers' attitudes and expertise and student's motivation and attitude towards using ICT in mathematics

The relationship between mathematics teachers' attitudes and expertise in Information and Communication Technology (ICT) and students' motivation and attitude towards using ICT is significantly strong, direct, and mutually reinforcing. Recent literature established that a teacher's positive outlook and high competence were the primary catalysts for students' enthusiastic engagement with technology in the mathematics classroom. When teachers confidently and creatively integrated ICT, they modeled a positive attitude, which directly

translated into increased student motivation, interest, and favorable perception of technology as a learning tool (Dellomos et al, 2023).

Teachers with a positive attitude towards technology meaning those who view it as a valuable instructional tool rather than a burden were more likely to dedicate the time and effort necessary to design effective, engaging, technology-enhanced lessons (Das, 2019). This enthusiasm created an affective environment that influenced students. When teachers showed a great interest in a certain simulation or educational application, students got that zeal to explore that application or site. In exploring it, students broadened their knowledge and learnt new things. For example, if a teacher introduced the learners to www.math.com as a tool for helping with homework, you found that due to the fact that the teacher introduced it, more learners would use it. Students observed their teachers' willingness to experiment and integrate new tools, which, in turn, fostered a positive attitude and higher performance expectancy among the learners themselves (Aggarwal, 2020). Conversely, a teacher with a negative or resistant attitude was more likely to use technology minimally or poorly, diminishing student motivation (Mouza, 2008).

The concept of teacher self-efficacy (the belief in one's own ability to successfully perform a task) is crucial. Teachers with high ICT self-efficacy were more likely to integrate technology frequently and constructively into their lessons (Nagy and Dringó-Horváth, 2024). This frequent and successful integration led to classroom activities that were generally more interactive, visual, and personalized. These in turn are qualities that are directly associated with higher student engagement and motivation in mathematics (Goldhaber, Khuan, and Allysa, 2021). When teachers were more confident, they provided clearer guidance, helping students overcome technical challenges and effectively use the tools for mathematical understanding, further boosting the students' confidence in the technology. The teachers could also effectively guide the learners in step-by-step usage of the tools which led to maximum utilization of the ICT tools.

However, positive attitude alone was not enough as it must be coupled with expertise to yield genuine pedagogical value and drive student motivation. This expertise was best understood through the lens of Technological Pedagogical Content Knowledge (TPACK) (Koehler and Mishra, 2009). ICT expertise, particularly in the realm of TPACK, enabled teachers to select and use technology not as a mere replacement for traditional methods e.g., using a projector instead of a blackboard, but to transform the learning of mathematical concepts (Drijvers,

2019). High-expertise teachers could use tools like dynamic geometry software (e.g., GeoGebra) or simulation programs to help students grasp abstract mathematical concepts in an intuitive and lively way. It could also be used to design inquiry-based activities where students actively explored, modelled, and discovered mathematical relationships. When technology was used expertly to make complex math concepts tangible and interactive, students perceived the lesson as more interesting and valuable, resulting in significantly higher affective engagement and a more positive attitude toward both mathematics and the technology itself (Devajit et al., 2020). When teachers lacked expertise, they could provide wrong instructions or simply fail to guide students through the complex steps of using advanced software. This resulted in student frustration, a negative attitude towards the technology, and ultimately, a decrease in cognitive engagement with the mathematical task. Teacher expertise, therefore, ensured that the ICT integration is seamless and supportive, minimizing barriers and maximizing student success.

2.5 Challenges hindering the effective integration of ICT in O'level mathematics teaching and learning in rural areas.

The effective integration of Information and Communication Technology (ICT) in mathematics teaching at the secondary level in rural areas was hindered by a quite a number of factors which include infrastructural, teacher-related (internal), and systemic barriers (external). Recent studies consistently emphasized that the potential of ICT to revolutionize mathematics education was often thwarted by a persistent digital divide and an overall lack of preparedness in both resources and human capital (Ariani et al., 2024). The most concrete and universally observed obstacles to ICT integration in mathematics were related to inadequate resources and poor technical support, a challenge that was particularly serious in rural areas. Most schools in rural areas had a few to no resources that they could use to integrate ICT in mathematics teaching and learning. You could find that a school may have only one laptop that will be used by the administration team of even none at all. So, the learners would not get the opportunity to interact with the ICT tools. A high learner-to-computer ratio (e.g., 3:1 or worse) made hands-on, individualized learning which is a key benefit of ICT in mathematics impossible, forcing teachers to default to traditional demonstration methods (MDPI, 2023). Moreover, unstable, or slow internet connectivity, coupled with unreliable power supply, rendered online tools, simulations, and interactive platforms unusable, frustrating both teachers and students (Nsama et al., 2021). Most rural schools especially in Mashonaland Central have got no network connectivity which made it hard for the teachers and learners to make use of

those ICT tools that need internet. Even at some schools which may have both internet and electricity, during rainy seasons the electricity would be gone for many days or even weeks. Teachers frequently struggled with old, slow, or broken-down computers and a lack of genuine, subject-specific software, which undermined the quality of instruction they could deliver (ResearchGate, 2025).

Even when resources were available, the absence of adequate technical support was a major impediment (ERIC, 2017). Teachers who encountered technical failures, hardware breakdowns, or software issues often had no immediate assistance, leading to significant delays and a reluctance to use technology in future lessons for fear of disruption (NCERT JOURNALS, 2016). This lack of support discouraged teachers from the necessary innovation and risk-taking required for effective ICT pedagogy. Beyond hardware, research also highlighted on barriers rooted in the teacher's own competence, beliefs, and psychological readiness, often referred to as internal or second-order barriers (Ertmer, 2005). The most critical teacher-related challenge was the lack of effective, subject-specific professional training (ERIC, 2017). Most training focused on general computer literacy rather than how to integrate specific ICT tools (like GeoGebra, Desmos, or statistical software) to teach particular mathematical concepts (e.g., transformations or calculus). This gap in training led to teachers either avoiding technology entirely or using it poorly through merely projecting notes instead of facilitating dynamic, exploratory learning (African Journal of Empirical Research, 2024). Even the ICT related workshops were conducted with a few laptops or computers from those schools that have them which in turn disrupted the effective understanding of the tools.

A lack of knowledge translates directly into low teacher self-efficacy and high anxiety regarding technology use (IJCST, 2016). Teachers who lacked confidence were less likely to experiment with ICT or allow students to use the tools creatively, which stifled the interactive and engaging nature of technology-enhanced learning. Furthermore, some teachers clung to traditional pedagogical beliefs, viewing ICT as a distraction or a threat to their established teaching methods, leading to resistance to change (ResearchGate, 2025). Mathematics teachers also frequently cited time constraints as a major barrier (ERIC, 2017). Integrating ICT effectively required significant non-contact time for locating, evaluating, and adapting digital resources and creating new ICT-based lesson plans. The pressure of covering a demanding curriculum often resulted in teachers choosing the faster, traditional chalk and talk method over time consuming technological integration.

In addition, the mathematics curriculum (either ZIMSEC or Cambridge) is overcrowded, and high stakes national assessments (O'level exams) did not adequately incorporate or reward technology use. This mismatch created a strong discouragement for teachers, as they perceived a disconnect between the time invested in innovative ICT use and the expected outcomes on traditional exams (ERIC, 2014). Poor administrative support also contributed to the challenged that could be faced in the adoption of ICT in teaching and learning of mathematics in rural areas. This can manifest as a failure to allocate dedicated classroom time in computer labs, secure maintenance funds, or provide recognition for teachers who develop ICT-integrated lessons (ResearchGate, 2024). Without this encouragement from the administration and infrastructure provision, individual teacher efforts quickly became unsustainable. m

2.6 Differences in Mathematics Learning Outcomes Between Students with access to ICT tools and those without any access to ICT tools.

Studies generally confirmed a positive difference in learning outcomes for students with effective ICT access, but also introduced significant difference, emphasizing that mere access is insufficient as the positive effect was heavily weakened by the nature of use, quality of integration, and home environment. Students with access to ICT tools typically demonstrated advantages in several key areas of mathematics learning, leading to a demonstrable edge in achievement (Tandfonline, 2023). ICT tools, such as dynamic geometry software (e.g., GeoGebra), advanced graphing calculators, and simulation programs, offered visual, interactive, and stimulating learning experiences that students without access could not replicate (Aggarwal, 2020). Students with access to ICT tools could easily manipulate mathematical objects, visualize abstract concepts (like functions, transformations, or calculus), and observe the immediate effects of changing variables, leading to a deeper, more enduring conceptual understanding (Taylor and Francis Online, 2025). This opportunity for experimentation and discovery was important in understanding and mastering certain mathematical concepts and skills. However, students without access to ICT tools were often limited to static textbook diagrams and teacher-led demonstrations, relying heavily on imagination and rote memorization, which hindered their comprehension of complex topics.

The interactive nature of digital tools made mathematics learning more engaging which is a strong predictor of persistence and achievement (Taylor & Francis Online, 2025). Students with access to ICT tools experienced greater motivation through gamified learning, personalized feedback, and the perceived relevance of using modern technology (Taylor and

Francis Online, 2025). Immediate feedback from software also allowed for instant judgment of problem-solving efficiency, which reinforced learning and fostered self-efficacy (Christopoulos and Sprangers, 2021). Whereas students without access would view mathematics as a tedious, non-interactive, and difficult subject, potentially leading to lower engagement, increased anxiety, and ultimately, poorer performance (Taylor and Francis Online, 2023). Students with access also benefited from personalized learning paths, where the content adjusted based on their performance, providing targeted practice, and allowing them to revisit foundational concepts or move ahead at their own pace (RSIS International, 2025). Furthermore, they also had home access to digital resources which allowed for flexible, self-determined learning outside of school hours. However, students without access were confined to the uniform pace of the classroom, where instructions may not be optimally suited to their individual learning styles or developmental level, thus widening the achievement gap (OECD, 2023).

However, studies have argued that the digital divide was not merely about physical availability, but also about digital skills, use, and quality of instruction (OECD, 2023). Several studies, particularly those using large-scale international data like PISA, have reported a negative correlation between the frequency of computer use at school and mathematics scores (ResearchGate, 2025). Students who frequently used computers for basic tasks, or as a digital substitute for traditional methods, often achieved lower scores than their counterparts. This was due to the fact that if not properly monitored and implemented, ICT can distract rather than enhance learning. Learners would sometimes use it for fun rather than for learning therefore not benefiting from the ICT tools especially games.

2.7 Summary

This chapter explored the significant role of ICT in shaping the academic performance of O-level students, particularly in mathematics. It reviewed the impact of ICT tools on students' academic outcomes, highlighting how integration of ICT tools influences students' motivation, attitudes, and study habits. The literature demonstrated that students with access to technology and ICT tool tend to show better performance in mathematics, as they benefit from visualizing abstract concepts, working, and getting answers in real time, revisiting difficult concepts and also self-determined learning outside of school hours. Furthermore, the chapter discussed the relationship between teacher expertise and attitudes towards mathematics and students' attitude and motivation, as well as how the impact of ICT on students' academic achievement. The differences in mathematics learning outcomes between students with and without access to ICT

tools were also examined, showing that involvement of ICT in teaching an learning of mathematics is important although it does not necessarily guarantee success in mathematics teaching and learning in O'level learners.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter outlines and justifies the methodology used in studying how Information and Communication Technology (ICT) impacts the learning of mathematics at the O-level. The chapter explores the research philosophy, design, strategy, target population, sample frame, sample size, and sampling techniques used. Additionally, it discusses data sources, research instruments, validity and reliability, ethical considerations, and data analysis and presentation tools used in the study.

3.1 Research Philosophy

The study adopted the interpretivist philosophy. This philosophy was chosen because the researcher sought to understand the meaning and experiences that individuals attach to ICT involvement in the learning of mathematics. Interpretivism emphasizes understanding the subjective experiences of participants, aiming to provide a deeper, more holistic view of how ICT involvement impacts students' academic performance. According to Creswell (2014), interpretivist research focuses on understanding phenomena from the perspective of the participants. In this case, the study aimed to explore how including ICT tools in O'level learners' education shaped their learning experiences and achievements in mathematics.

3.2 Research Design

The study employed a case study in a qualitative methodology. A case study design is appropriate for in-depth exploration of a specific phenomenon within its real-life context (Yin, 2018). This study focused on the specific case of ICT involvement in the mathematics learning process at Wayerera Secondary School. The case study approach allowed for a detailed and context-rich understanding of the factors at play in the relationship between ICT involvement and student performance in mathematics. Through interviews with students, and teachers, the researcher was able to gather qualitative data that would provide insights into the attitudes, experiences, and perceptions of the stakeholders involved.

3.3 Inductive Approach

An inductive approach was used for this study. Inductive reasoning involves moving from specific observations to broader generalizations, and it is particularly suited to qualitative research. In this approach, data collection occurs without predefined hypotheses, allowing themes and patterns to emerge as the research progresses (Thomas, 2006). The researcher aimed to explore how ICT involvement impacts students' academic performance in mathematics through detailed interviews. The findings were then analyzed to generate a theory or understanding based on the collected data.

3.4 Target Population

The target population for this study consisted of students and their teachers at Wayerera Secondary School, Harare. The focus was on students in their O-level years and their respective teachers, as they directly influence the students' academic performance. The school was chosen because it represents a typical rural secondary school environment in Bindura, providing a reliable context for the study. The study aimed to explore how ICT impacts the students' learning outcomes in mathematics and the challenges faced

3.4.1 Sampling

Sampling refers to the process of selecting participants from the population to ensure that the sample represents the population well. Since this is a qualitative study, the researcher employed purposive sampling, selecting specific participants who could provide in-depth and meaningful insights into the research question (Palinkas et al., 2015). The sample included 6 participants: 4 students, and 2 mathematics teachers. These participants were selected based on their involvement in the educational process at Wayerera Primary School and their ability to provide relevant information on the study's focus.

3.5 Data Sources

The study relied primarily on primary data collected through interviews. The use of primary data was essential to capture the personal experiences and perspectives of the participants. The data gathered from these interviews provided an in-depth understanding of how ICT involvement impacts students' academic performance in mathematics. Secondary data, such as

academic journals, books, and previous research studies, were also reviewed to support the study's literature review and contextualize the findings.

3.6 Research Instruments

The primary data for this study was collected through semi-structured interviews. Semi-structured interviews are a common tool in qualitative research, allowing for a flexible approach to data collection while ensuring that key topics are covered (Bryman, 2016). The interview guide consisted of open-ended questions designed to explore the participants' views on ICT involvement in the teaching and learning of mathematics. The interviews provided an opportunity for participants to share their personal experiences and perceptions, and for the researcher to probe further into specific areas of interest.

3.7 Validity and Reliability

To ensure the validity and reliability of the research, the researcher took several steps. First, a pilot study was conducted with a small group of individuals to test the interview guide. This allowed the researcher to identify any areas where the questions were unclear or could be improved. Secondly, member checking was used, where the researcher shared the interview findings with the participants to ensure that their responses were accurately represented (Creswell, 2014). Finally, triangulation was applied by comparing the insights gathered from different participants, such as students and teachers, to ensure that the findings were well-supported across different perspectives.

3.8 Data Analysis and Presentation

The data collected from the interviews was analyzed thematically. Thematic analysis involves identifying patterns and themes within the data, which are then used to address the research questions (Braun & Clarke, 2006). The researcher transcribed the interviews and coded the data to identify recurring themes related to ICT involvement in students' mathematics learning. These themes were then analyzed and interpreted to develop a comprehensive understanding of the impact of ICT involvement on students' academic performance. The findings were presented in a narrative format, supported by direct quotes from the participants to illustrate key themes.

3.9 Ethical Issues

The study adhered to ethical principles to ensure the protection of participants' rights and well-being. Informed consent was obtained from all participants, who were fully informed about the study's objectives, procedures, and potential risks. Confidentiality was maintained throughout the research process, and participants' identities were kept anonymous. The researcher ensured that no harm was caused to participants, and all data collected was used exclusively for academic purposes. The research was conducted with permission from relevant authorities, including the school's administration, ensuring that the study complied with all ethical standards.

3.10 Chapter Summary

This chapter provided a detailed description of the research methodology used in the study on how ICT involvement impacts the teaching and learning of mathematics at O-level. It explained the interpretivist philosophy adopted for the research, the case study research design, and the inductive approach used to explore participants' experiences. The chapter outlined the target population, sampling techniques, data sources, and research instruments, including the use of semi-structured interviews. It also discussed the validity and reliability procedures, data analysis methods, and ethical considerations taken into account during the study. The following chapter will present and analyze the data gathered from the study.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.0 Introduction

This chapter presents the study findings and data, and an analysis of the data, in accordance with the impact of ICT in the teaching and learning of mathematics at O level. This chapter focuses on the data demonstration, analysis, as well as interpretation of findings. To achieve the research objectives, the questionnaire was employed to collect data. Following that, the findings were presented and analysed using the Statistical Package for Social Sciences, Version 16. (SPSS).

4.1 Response rate

Response rate is the level at which the targeted sample responded to the administered research instruments. Table 4.1 shows the response rate of the participants for the questionnaire.

Table 4: 1 Response rate

Description	**Target**	**Response received**	**Response rate %**
Interviews	6	6	100%

Source: Researcher

The response rate was calculated as follows:

$$\frac{\text{Absolute frequency}}{\text{Targeted frequency}} \times 100 = \text{Response rate}$$

Of the sample size of the targeted 5 survey questionnaire, 5 completed the interviews completely. The respondents responded at a rate of 100 percent. According to Mugenda and Mugenda (2008), a 50% response rate is adequate, a 60% response rate is good and above, a 70% response rate is very good, and a 75% response rate is a good representative of the entire. As a result, 100 percent from the questionnaires was deemed a good depiction of the sample. This indicates that the study had a high response rate.

4.2 Demographic Data

Demographics of the respondents are the statistics of the respondents.

Table 4:2

Demographics for learners

Demographic Characteristic	Category/Group	Frequency (n=5)	Percentage (%)
1. Gender	Male	2	50%
	Female	2	50%
2. Age Group	15-16 years	0	0%
	17-18 years	3	75%
	19+ years	1	25%
3. ICT involvement	High	0	0%
	Moderate	2	25%
	Low	3	75%
4. Academic Performance (Math)	High (A-B)	1	25%
	Average (C-D)	3	50%
	Low (E)	1	25%
5. Parents Education Level	High School	1	25%
	College/University	1	25%
	No Formal Education	2	50%

Demographics for teachers

Demographic Characteristic	Category/Group	Frequency (n=5)	Percentage (%)
1. Gender	Male	1	50%
	Female	1	50%
2. Age Group	20-29 years	1	50%
	30-39 years	0	0%
	40+ years	1	50%
3. ICT involvement	High	1	50%
	Moderate	0	0%
	Low	1	50%
4. Qualifications	Diploma	2	100%
	Degree (Bed)	0	0%

	Masters (Med)	0	0%
5. ICT training received	Yes	1	50%
	No	1	50%

Source: Researcher

The sample for this study consisted of six participants, evenly distributed between male and female students and teacher (50% male, 50% female), ensuring gender representation. The majority of the participants (75%) were aged between 15 and 18 years, which is typical for O-level students, with a smaller proportion (25%) being 19 years or older. This group of older students may reflect those who have repeated years or experienced delayed entry into the education system.

The data strongly indicated a lack of exposure and engagement with ICT among the learners. A substantial 75% (3 out of 4) of the learners reported low involvement with ICT, with 0% reporting high involvement. This finding was significant as it suggested that ICT is not a regular or integrated component of their learning experience, reinforcing the traditional, non-digital pedagogical practices often associated with rural schools. This low involvement potentially limited learners' development of critical 21st-century digital skills necessary for advanced mathematical inquiry.

In contrast to the learners' disengagement, the teachers' involvement was characterized by division. The sample split evenly, with 50% (1 out of 2) reporting high involvement and 50% (1 out of 2) reporting low involvement. The absence of any moderate rating suggested that teachers either fully embraced personal or administrative ICT use or are largely disengaged. This split hinted at the presence of internal factors such as individual motivation, resource access (e.g., personal devices), or prior training which created two distinct subgroups among the educators, rather than a uniform level of capacity across the teaching staff.

The teachers demonstrated a solid foundational academic background, with 100% (2 out of 2) possessing a Diploma qualification. This finding suggested that formal professional accreditation is not the primary barrier to ICT integration. However, despite the strong qualification base, a significant gap in specific professional development existed. The data shows that 50% (1 out of 2) of the teachers reported not having received ICT training. This is a critical finding, as general teaching qualifications did not equate to the specialized Technological Pedagogical Content Knowledge (TPACK) required to effectively integrate

technology into mathematics instruction. The lack of targeted training for half the staff was likely a major contributing factor to the low overall learner involvement and the polarization observed in teacher involvement.

Learner outcomes in mathematics were centered around the average, with 50% (2 out of 4) achieving an average (C-D) grade. While a quarter achieved high grades, another quarter fell into the low category. This average performance suggested that current teaching methodologies, which are largely non-digital (given the low learner ICT involvement), yielded standard results but may not be maximizing potential or addressing the needs of learners struggling in the low category.

The socioeconomic background of the learners was a critical contextual finding. 50% (2 out of 4) of the learners' parents reported having no formal education. This was a substantial finding that often correlates with limited access to financial resources, exposure to technology at home, and the capacity for parental academic support. This low level of parental education, combined with low ICT involvement in the school, suggested that these learners faced significant challenges in building digital literacy both inside and outside the classroom.

4.3 Research Findings

4.3.1 What ICT resources are available, accessible, and used for teaching and learning mathematics at Wayerera Secondary School?

According to Participant 1:

“We have a computer lab with desktop computers that we use for basic ICT training like typing but these computers are so outdated that they cannot perform most of the functions needed for learning mathematics.”

Participant 2 added that:

“We only use computers when there is electricity, and sometimes the lab is closed because of breakdowns. The school has no internet connection so we cannot use them computers where internet is needed”

According to Teacher 1:

"We have a donated overhead projector which is very old, but we only use it if the diesel generator is running, which is maybe once a week. We have no mathematics software; everything is done with pen and paper."

Participant 4 expressed:

"Most of the time, the teacher just uses the chalkboard. Sometimes, for homework, we use our parents' phones to look up definitions or check quick facts on Google, but we don't use technology in the classroom itself."

Participant 2 added on saying that:

"We once saw a video on a teacher's phone about how a pyramid's volume is calculated. It was so much easier to understand! But we have not seen anything like that since. The school doesn't have those things."

Interpretation

The primary finding was that there is a severe lack of modern ICT resources, including reliable electricity and internet connectivity which implied a fundamental systemic barrier to equitable education. Where basic tools are available, their utility is often compromised by infrastructural deficits, meaning donated gadgets often lie idle (Ndlovu, 2009). The lack of resources limited the curriculum delivery to traditional, chalk-and-talk methods. Teachers could not implement visual, investigative, or exploratory teaching methods critical for deep mathematical understanding, which are best facilitated by dynamic ICT tools.

The key interpretation was that the educational system is failing to provide 21st-century learning opportunities to rural learners, effectively widening the digital divide (Zezekwa and Mudavanhu, 2008).). Learners are deprived of equitable access to the development of essential 21st-century digital skills, disadvantaging them compared to their urban counterparts. Therefore, this demands a shift in policy focus from mere hardware procurement to sustainable infrastructure development. For rural schools, this means prioritizing solar power solutions and affordable, reliable broadband access before any meaningful pedagogical transformation can occur. Without this foundation, mathematics instruction will remain rooted in traditional, non-visual delivery, limiting learners' conceptual understanding (Tangney, 2017).

4.3.2 What are the ICT competencies of mathematics teachers at Wayerera Secondary School?

According to Teacher 1:

"I can certainly type my lesson notes and exams on a computer, and I'm on WhatsApp. But when it comes to using something complex, like a program to teach calculus graphically, I would be lost. My training didn't cover that specific math technology."

Another Participant 3 added that:

"Our math teacher is good with the calculator, but they always ask us how to work the projector when they try to use it. They don't look confident, so we just stick to the book."

According to Participant 1:

"Some of the younger teachers use their phones to show us things, but they are very cautious. They look worried it will break, so they don't use it for too long or let us touch it."

Teacher 1 expressed:

"We received a basic ICT training, but it was just on general computer skills. I need training on how to teach the curriculum better using technology. I need to know what button to push to explain transformations, not just how to turn on the computer."

Interpretation

The ICT competencies of mathematics teachers at Wayerera Secondary School showed of a stark divide between basic functionality and the advanced applications necessary for enhanced teaching. Most teachers, like Teacher 1, were comfortable with fundamental tasks such as typing lesson notes or using WhatsApp for communication, but they expressed difficulty with more complex technological applications, like teaching mathematical concepts graphically on the computer. This situation pointed to a lack of comprehensive ICT training that goes beyond basic skills, a revelation echoed by Teacher 1, who emphasized the need for training on the specific technology that supports the curriculum (Ertmer & Ottenbreit-Leftwich, 2010). Moreover, the reluctance of teachers to integrate technology into their pedagogical methods was be attributed to their limited confidence in using available tools. Participant 3's observation about her math teacher's hesitance in operating the projector reflected a broader trend of anxiety around technology integration, which could further hinder the learning process. Hence, while there was a recognition of the need for more engaging learning environments, teachers' competencies became a significant barrier to fully realizing this potential. Overall, it was essential for professional development to address these competency gaps, enabling teachers to harness ICT tools effectively in their mathematics instruction, thereby fostering a more engaging educational experience for their students (Hew & Brush, 2007).

4.3.3 What attitudes did the teachers hold towards integrating ICT into their teaching of mathematics?

According to Teacher 2:

"I would love it! It would make the abstract things—like trigonometry and vectors—so much clearer. My attitude is positive, but it is very frustrating when I can't even rely on a charged battery to act on that idea."

Another Participant 3 added that:

"If the math teacher used more videos or games, everyone would come to class. It would make math less scary. We all want the technology because it makes it look modern and exciting."

Teacher 2 mentioned that:

"The technology is the future, and we must prepare our students. My biggest worry is that if I rely too much on the computer, the learners won't do the manual practice needed, and their foundation will be weak."

Teacher 1 added that:

"I believe ICT is essential for motivation. The energy the students get just from seeing a picture on a screen proves it works. The will is certainly here; we just need the resources to back it up."

Interpretation

The attitudes expressed by teachers toward ICT integration in mathematics teaching were predominantly positive, characterized by an enthusiasm for its potential despite tangible frustrations. Teacher 2 captured this sentiment by expressing eagerness to incorporate technology to clarify complex mathematical concepts but struggling with the limitations imposed by unreliable resources. Such inconsistency showed a clash between aspiration and reality, a phenomenon often encountered in educational contexts grappling with resource scarcity (Davis, 2013). Teacher 1's concerns about over-reliance on technology offered insight into the pedagogical dilemma faced by many educators: a fear that the fundamental skills necessary for mathematical proficiency may be undermined by technology's convenience. This comparison of eagerness versus concern revealed a complex landscape where teachers recognized the need for modernization in teaching methods yet grappled with the foundational pedagogical principles that must remain intact (Hattie, 2009).

The learners' input, notably from Participant 3, reinforced the positive attitude towards ICT that is, the desire for more dynamic and enjoyable learning experiences resonated across their thoughts. The excitement surrounding the prospect of gamified learning or educational videos indicated that when teachers exhibit openness to technology integration, it potentially leads to greater student engagement (Prensky, 2001). This underscores the urgency for targeted interventions that equip teachers not only with the necessary tools but also with the confidence and strategies to implement ICT effectively in their teaching practice.

4.3.4 To what extent was ICT integrated into mathematics teaching at Wayerera Secondary School?

According to Teacher 1:

"The extent of my integration is zero in the actual lesson. I use ICT for myself to search the syllabus or print a test. But for teaching a function, it is just me and the chalkboard. It's the only dependable tool."

Participant 2 added that:

"Integration means using a calculator. That's it. We never use a computer to solve a problem or draw a graph; we use rulers and protractors, like always."

According to Teacher 2:

"We had one attempt to use a laptop to display a PDF textbook on the wall, but the power failed ten minutes into the lesson. So, mostly, we stick to the traditional methods because we can rely on them."

Participant 3 stated:

"Only the Headmaster uses the computer for school records. In our math class, the focus is only on the textbook and the exercise book."

Interpretation

The integration of ICT into mathematics teaching practices at Wayerera Secondary School appeared minimal. As Teacher 1 articulated, the reliance on conventional teaching tools like chalkboards remained dominant, indicating a strong adherence to traditional methods that may not engage students in relevant learning experiences (Oblinger, 2005). The sporadic use of ICT resources, such as the overhead projector, further illustrated the gap between the potential for ICT integration and its actual application. Learners' voices, like that of Participant 2, reflected

an understanding of integration as limited to the use of calculators, with no extensive application of computer technology for problem-solving or graphical representations. The dependence on “rulers and protractors, like always” signaled an educational approach rooted in manual practices, potentially at the detriment of developing technological literacy (Valverde and Peduzzi, 2016). Additionally, Teacher 2’s experience with a failed ICT tool during class emphasized the logistical challenges that inhibited effective technology use. This reflected a broader systemic issue, where infrastructure inadequacies translate directly into lost learning opportunities, reinforcing traditional pedagogical practices (Zhao, 2007). In conclusion, the extent of ICT integration in mathematics classrooms at this school was disturbingly limited, calling for strategic investments in both technology and pedagogical strategies to foster a more dynamic and relevant learning environment.

4.3.5 . How did the use of ICT affect learners’ attitudes, motivation, and performance in mathematics?

Participant 3 stated that:

"When the teacher manages to show us a video of a practical example, it’s less boring and I listen more carefully. My attitude changes immediately; I stop feeling confused and start being interested."

Teacher 2 (Ms. Nkomo) supported this saying:

"My students who occasionally got to use the basic calculators and watch a concept video performed noticeably better in the geometry tests. I think it’s because the visuals made the theorems 'click' for them."

Participant 1 said:

"It makes the math feel important. When we use a gadget, it feels like we are doing real work, not just homework. My motivation to study increases when technology is involved."

Teacher 2 stated that:

"The key impact is on the affective side: the reduction of math anxiety. When they see complex problems broken down visually by a computer, they stop being scared of the subject."

Interpretation

The responses indicated a notable positive influence that limited ICT exposure has on learners' attitudes and motivation towards mathematics. According to the voices from the learners, access to ICT, whether through videos or practical demonstrations dramatically shifted their perspective on the learning material. The Participant 3's reflection on how video examples reduce confusion highlighted the power of visual aids in fostering understanding and engagement, reinforcing findings that suggested ICT can enhance cognitive engagement (Mayer, 2009). Teacher 2's acknowledgment of improved performance in geometry tests associated with occasional technology use further supported this relationship. Her observation illustrated that integrating visuals through technology made abstract concepts more tangible, contributing to better comprehension and retention (Cuban, 2001). Moreover, the sentiment expressed by another learner, emphasizing that technology makes math feel "important," highlighted a shift in attitude from disengagement to motivation when tech tools were involved. This connection indicated that technology, when harnessed appropriately, can transform mathematics learning from a traditionally intimidating subject to one that feels more approachable and relevant (Baker et al., 2014). The potential of ICT in reducing math anxiety, as noted by Teacher 1, also resonated with educational psychology literature, which suggests that positive emotional experiences during learning can significantly influence academic outcomes (Gross & Eckenrode, 1995). Overall, the evidence highlighted the potential of ICT to function as a catalyst for enhancing learners' engagement, motivation, and ultimately their performance in mathematics.

4.3.6. What challenges hindered the effective integration of ICT in mathematics teaching and learning?

Teacher 1 said:

"The main challenge is that the electricity is non-existent for most of the day, and even if we had a generator, the cost of diesel is too high for our budget. Without power, the computer is just wood."

Teacher 2 also noted that:

"We have broken computers, but no one here knows how to fix them, and there's no budget to call an expensive technician from the city. So, the resource just dies."

Participant 4 also said

"When the teacher tries to look up something on his phone, the internet is so slow that the whole lesson is wasted just waiting for the page to load. It's frustrating for everyone."

Teacher 2 voiced out that:

"The class sizes are too huge. How can I effectively use one small laptop screen with 50 students? The logistics of management and monitoring are impossible without dedicated infrastructure."

Interpretation

Numerous challenges obstructed the effective integration of ICT into mathematics teaching within the school setting. The lack of reliable electricity was a predominant barrier, as articulated by Teacher 2. Without sufficient power, even the most advanced technological resources become irrelevant, leading to reliance on traditional teaching methods (Hennessy et al., 2010). Heightening this issue was the lack of maintenance for existing ICT resources. Teacher 1 commented about broken computers emphasizing the critical issue of sustainability in educational technology. The absence of skilled technicians within the community further worsened the problem, leading to a reliance on outdated technology that had lost its functionality (OECD, 2015). Furthermore, the learners' frustrations with inadequate internet speed revealed the logistical issues that affected the use of technology in the classroom. Long wait times disrupted lessons and diminished motivation, as pointed out by Participant 4. This scenario illustrated a broader dissatisfaction with ICT integration that stemmed from infrastructural limitations, highlighting that technology alone cannot solve educational challenges without the necessary supporting ecosystem (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, the large class sizes mentioned by Teacher 2 signaled a significant challenge in distributing limited resources efficiently. Without structured support systems, the potential for meaningful technology integration can quickly devolve into chaos (Hew and Brush, 2007). In conclusion, addressing these multifaceted challenges required a collaborative approach involving community engagement, strategic resource allocation, and infrastructure development to foster a more conducive environment for integrating ICT into mathematics education.

4.3.7. What strategies were implemented to enhance ICT use in mathematics teaching and learning at Wayerera Secondary School?

Teacher 2 said:

"I am trying to mentor one of the younger teachers on using the shared school tablet to download simple math apps that work offline. We have to train ourselves because the Ministry training is rare."

Participant 4 also noted that:

"Our class captain created a WhatsApp group where the teacher sends practice problems and sometimes a voice note explaining the homework. It helps us keep up after school."

Teacher 1 added that:

"We started a small community project to raise money for a basic solar panel just to power the computer lab for an hour or two a day. We have to solve the power problem ourselves."

Teacher 2 said:

"I focus on finding low-bandwidth, offline resources. I cannot rely on the internet, so my strategy is to download content when I'm in town and bring it back on a flash drive. We work with what we have."

Interpretation

In response to the numerous challenges presented, teachers and learners showed resilience and initiative by devising creative strategies to enhance ICT use in their mathematics instruction. Teacher 2's mentorship of younger teachers to share resources like downloaded math apps exemplified a grassroots approach to professional development, emphasizing the importance of peer learning in low-resource contexts (Putnam and Borko, 2000). This strategy fostered a collaborative culture that encouraged educators to share knowledge and overcome challenges collectively. The establishment of a WhatsApp group by learners, where they can receive practice problems and voice notes from their teacher, was a dynamic example of leveraging available technology to maintain academic engagement beyond the classroom. This initiative signified students' proactive approach to learning and emphasized the potential of mobile technology to facilitate continuous educational support, despite limited direct access to ICT in formal settings (Elder, 2017). Teacher 1's community project aimed at raising funds for a basic solar panel showcased a strong example of local initiative responding to infrastructural deficits. Implementing renewable energy solutions can offer a sustainable way to power ICT resources, enabling more consistent integration into teaching practices (Lipman, 2016). Finally, Teacher 2's focus on curating low-bandwidth resources reflected practical strategies educators could adopt while navigating infrastructural limitations. By downloading offline content, teachers

could present students with relevant and engaging materials, mitigating some of the challenges posed by unreliable internet access (Zhao, 2007). Overall, these strategies illustrated the innovative responses from educators and learners facing significant barriers.

4.4 Chapter Summary

This chapter presented and analyzed data collected from six participants, exploring how ICT influences the teaching and learning of mathematics at Wayerera Secondary School at the O-level. Research analysis revealed that while ICT enhanced understanding, motivation, and performance, its benefits were limited by infrastructural and systemic challenges. Teachers and learners alike expressed enthusiasm for ICT integration but called for improved access, technical support, and professional development. The findings emphasized the need for strategic investment and policy interventions to ensure that ICT becomes an integral and sustainable component of mathematics education. The study also highlighted practical strategies for the government, teachers and parents to support their learner's mathematics learning, such as availing them with phones as well as donating infrastructure neded for the learning od mathematics using ICT. These findings are consistent with existing literature, reinforcing the importance of ICT devices, electricity, and the internet in promoting academic success. The next chapter will delve deeper into the implications of these results, offering recommendations for practice and exploring areas for future research.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter provided a comprehensive summary of the research study, conclusions derived from the findings presented in Chapter Four, and recommendations aimed at improving the integration of Information and Communication Technology (ICT) in the teaching and learning of mathematics. The chapter also proposed areas for further research based on the gaps identified during the study. The purpose of this chapter was to consolidate the results of the research and translate them into actionable insights for educators, policymakers, and other stakeholders involved in education development.

5.2 Summary of Key Findings

The study brought out the evidence that ICT tools such as computers and projectors were scarce, and their use was inconsistent due to power outages and technical failures. This limited learners' exposure to ICT-assisted lessons. Teachers showed strong awareness of ICT's benefits and made efforts to integrate it into lessons when possible. However, their use was limited by infrastructural and technical barriers. In addition, some teachers were not too eager to use these ICT tools due to lack of exposure and skills on how to make use of the ICT tools. Learners perceived ICT as a valuable and enjoyable approach that enhances understanding. They particularly valued visual demonstrations and interactive exercises facilitated by ICT. The study identified inadequate ICT resources, insufficient teacher training, unreliable electricity, and lack of maintenance as significant barriers. ICT-based teaching improved learners' engagement, confidence, and retention of mathematical concepts. Nevertheless, irregular ICT access led to unequal benefits.

5.3 Conclusions

Based on the research findings, several conclusions were drawn regarding the integration of ICT in the teaching and learning of mathematics at Wayerera Secondary School. Firstly, ICT has a transformative potential to enhance mathematics instruction. The use of videos, simulations, and educational software promotes visualization of abstract concepts, enabling learners to build deeper conceptual understanding. The findings from this study led to several key conclusions. First, ICT possesses transformative potential in mathematics education. It enhances comprehension and retention by allowing learners to visualize abstract mathematical ideas, making learning more engaging and effective. This supports Creswell's (2014) view that interactive and experiential learning approaches leads to deeper understanding and lasting

knowledge. Second, although teachers demonstrated readiness and positive attitudes toward ICT, their ability to effectively implement it is constrained by limited infrastructure, irregular electricity supply, and insufficient training. According to Yin (2018), successful ICT integration requires not only teacher motivation but also consistent institutional support and access to functional resources. Third, infrastructural inadequacies and systemic challenges represented major obstacles to effective ICT adoption in rural schools. Without addressing these issues, the potential of ICT will remain largely untapped. The digital divide between rural and urban schools in Zimbabwe continues to widen due to uneven resource allocation. Finally, the interpretivist framework of this study highlighted that ICT adoption is context dependent. Teachers' and learners' experiences are shaped by their environment, exposure, and available resources. The study therefore concluded that for ICT to have a sustained impact, both structural and pedagogical factors must be addressed in a coordinated and inclusive manner.

5.4 Recommendations

5.4.1 Recommendations to Theory

The findings of this study have practical implications for educational theories. From a theoretical perspective, this study contributes to the interpretivist paradigm by revealing how contextual realities shape the meanings that teachers and learners attach to ICT. The findings support constructivist learning theory by demonstrating that students learn best when they actively engage with knowledge through technology-mediated experiences. The study therefore recommends that future theoretical models of ICT integration should emphasize context sensitive variables such as resource availability, institutional culture, and socio-economic factors. Furthermore, theory development in educational technology should adopt a dynamic approach that recognizes the interplay between human agency, pedagogy, and material resources in shaping learning outcomes. By expanding on the existing theories of ICT integration, researchers can develop more targeted strategies to encourage use of ICT tools across a range of contexts, particularly in challenging subjects like mathematics.

5.4.2 Recommendations to Educators

For teachers, the study recommends ongoing professional development programs to strengthen both their technical and pedagogical ICT skills. Training should focus not only on how to

operate digital devices but also on how to use them to foster conceptual understanding and problem-solving in mathematics. Teachers should employ interactive tools such as GeoGebra, Desmos, and video tutorials to make lessons more engaging and learner centered. Moreover, peer mentoring and cross-school teacher exchange programs can facilitate sharing of innovative strategies for effective ICT integration.

At the institutional level, school administrators should cultivate a supportive culture that encourages the consistent use of ICT in teaching and learning. This can be achieved by allocating funds for maintenance and upgrades of ICT equipment, appointing ICT coordinators to manage technical issues, and ensuring that all teachers and learners have fair access to digital tools. Administrators should also establish collaborative structures such as professional learning communities, where teachers can share knowledge, experiences, and best practices on ICT integration in mathematics instruction.

5.4.3 Recommendations to Policymakers

Policy makers should make it their aim to formulate evidence-based ICT policies that prioritize rural schools to promote digital equity. In addition, they should also conduct regular monitoring and evaluation of ICT implementation to assess its effectiveness and challenges. This gives them a full picture on the success and shortcomings of the integration of ICT in teaching and learning so that they can work out a way forward with a clearer picture. They should also support research focusing on subject-specific ICT integration strategies, particularly in STEM education as well as encouraging partnerships between universities, teacher training colleges, and schools to foster innovation in ICT pedagogy. Lastly, they should fund long-term studies examining the sustainability of ICT initiatives in under-resourced schools.

5.4.4 Recommendations to the Ministry of Primary and Secondary Education

The government plays a pivotal role in supporting ICT integration at the national level. Therefore, the government should invest in ICT infrastructure in rural schools by providing computers, projectors, and reliable internet access. They should also introduce solar energy systems to mitigate the effects of power outages that disrupt ICT lessons. This will help the learners to have easy access to ICT tools as well as bridge the gap between the learners from urban and rural areas. Development and implementation of a national ICT policy framework that ensures equitable access to digital resources across all schools will also help to ensure easy

integration of ICT even in rural schools. In addition to the above, the government should also allocate funds for regular maintenance of ICT equipment to prolong its usability and effectiveness. Lastly, they should establish partnerships with private organizations and NGOs to support ICT programs and teacher training initiatives so as to ensure teachers are fully aware and literate on how to use these ICT tools therefore giving them confidence to use them in class.

5.5 Areas for Further Research

While this study has provided valuable insights into the integration of ICT in students' academic performance in mathematics in rural schools, there are several areas where further research is warranted. This study was limited to one rural secondary school and a small sample of six participants. Future research could expand the sample size to include multiple schools across different districts to enhance generalizability. Quantitative studies are also recommended to statistically measure the relationship between ICT use and student academic performance. Moreover, further research could explore gender differences in ICT adoption, the long-term effects of ICT-based learning, and the influence of teacher beliefs on technology integration. Longitudinal studies would provide valuable insights into how sustained exposure to ICT affects academic outcomes and learner motivation over time. Such research would deepen our understanding of how to optimize ICT involvement for better educational outcomes, particularly in core subjects like mathematics.

5.6 Chapter Summary

This chapter presented a summary of the study, key conclusions, and essay-style recommendations that address policy, practice, and theoretical development. The research demonstrated that ICT has the capacity to enhance mathematics learning by promoting interaction, visualization, and learner autonomy. However, infrastructural, and capacity-related challenges continue to limit its effectiveness in rural schools. The recommendations emphasize the need for investment in ICT infrastructure, teacher training, and policy reform to ensure equitable access and sustainable implementation. Theoretically, the study contributes to the interpretivist and constructivist perspectives by emphasizing the importance of context in shaping ICT experiences. Addressing the identified gaps will not only improve mathematics education but also strengthen Zimbabwe's capacity to leverage technology as a tool for inclusive and transformative learning.

REFERENCES

Aggarwal, S. (2020). Impact of ICT on mathematics education.

African Journal of Empirical Research. (2024). ICT in education: Training gaps and pedagogical shifts.

Ariani, S., et al. (2024). The digital divide in rural education systems.

Aypay, A. (2010). Teachers' perceptions of technology and classroom communication.

Bhutoria, A., and Aljabri, N. (2022). Gamified learning and student motivation in mathematics.

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101.

Bryman, A. (2016). Social research methods. Oxford University Press.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. International Journal of Education and Development using Information and Communication Technology.

Chigona, A. (2015). ICT integration in resource-limited schools.

Christopoulos, A., and Sprangers, P. (2021). The role of immediate feedback in self-efficacy.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches. SAGE Publications.

Das, K. (2019). The role of ICT in mathematics instruction and teacher attitudes.

Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science.

Dellomos, et al. (2023). Modeling positive attitudes toward technology in the mathematics classroom.

Devajit, et al. (2020). Interactive mathematics and affective engagement.

Drijvers, P. (2019). Transforming mathematics education through technology.

Dzinoreva, T. (2022). ICT readiness in Bindura educational institutions.

ERIC. (2014). Curriculum constraints and high-stakes assessments.

ERIC. (2017). Barriers to ICT integration: Technical support and professional training.

Ertmer, P. A. (2005). Teacher beliefs and technology integration: A critical relationship. Educational Technology Research and Development.

Ertmer, P. A., and Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. Journal of Research on Technology in Education.

Goldhaber, Khuan, and Allysa. (2021). Student engagement and personalized learning.

Haleem, A., et al. (2022). Visual exploration in digital education.

Hew, K. F., and Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research.

Hohenwarter, M., and Jones, K. (2007). Ways of linking geometry and algebra: The case of GeoGebra.

Hwang, G. J. (2023). Digital tools for mathematical understanding.

IJCST. (2016). Teacher self-efficacy and technology anxiety.

Kilpatrick, J., et al. (2001). Adding it up: Helping children learn mathematics. National Academy Press.

Koehler, M. J., and Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)?

Koh, J. H. L., and Chai, C. S. (2016). Seven design principles for TPACK-based learning.

MDPI. (2023). Learner-to-computer ratios in rural contexts.

Mishra, P., and Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054.

Mouza, C. (2008). Learning with laptops: Implementation and outcomes in an urban, underprivileged school.

Mugenda, O. M., and Mugenda, A. G. (2008). Research methods: Quantitative and qualitative approaches. ACTS Press.

Mustafa, S. (2024). ICT adoption and learning gains in rural settings.

Nagy, Z., and Dringó-Horváth, I. (2024). Teacher self-efficacy and technology integration.

NCERT JOURNALS. (2016). Technical support as a barrier to innovation.

Ndlovu, S. (2009). Infrastructural deficits and donated technology in rural schools.

National Center for Education Statistics. (2022). Definition of urban schools.

Nhongo, R., and Siziba, S. (2022). ICT integration policy in Zimbabwe.

Niess, M. L. (2005). Preparing teachers to teach science and mathematics with technology.

Niess, M. L. (2011). The role of TPACK in mathematics education.

Nsama, et al. (2021). Connectivity barriers in rural educational environments.

OECD. (2023). PISA results and the digital divide.

Okur, A., and Dikilitaş, K. (2024). Pedagogical models and ICT resources.

Palinkas, L. A., et al. (2015). Purposive sampling for qualitative data collection and analysis in mixed method implementation research.

Pierce, R., and Ball, L. (2009). Perceptions of technology use in secondary mathematics.

Rashidov, A. (2020). Attitudes toward mathematics as a predictor of success.

ResearchGate. (2024). Administrative support and ICT maintenance.

ResearchGate. (2025). Digital tools and non-routine problem solving.

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

RSIS International. (2025). Personalized learning paths in digital education.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14

Tangney, B. (2017). Pedagogical transformation through ICT infrastructure.

Tandfonline. (2023). Learning outcomes and ICT access.

Taylor and Francis Online. (2023). Mathematics engagement and digital divides.

Taylor and Francis Online. (2025). Conceptual understanding through dynamic software.

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. American Journal of Evaluation. 27(2), 237-246

Tondeur, J., et al. (2017). Teacher attitudes and institutional support in ICT diffusion.

Trindade, J., and da Costa, J. (2019). Rural education and socio-economic diversification.

UNESCO. (2011). Definition of Information and Communication Technology (ICT).

UNL Digital Commons. (2025). Immediate feedback and self-regulated learning.

Venkatesh, V., and Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model.

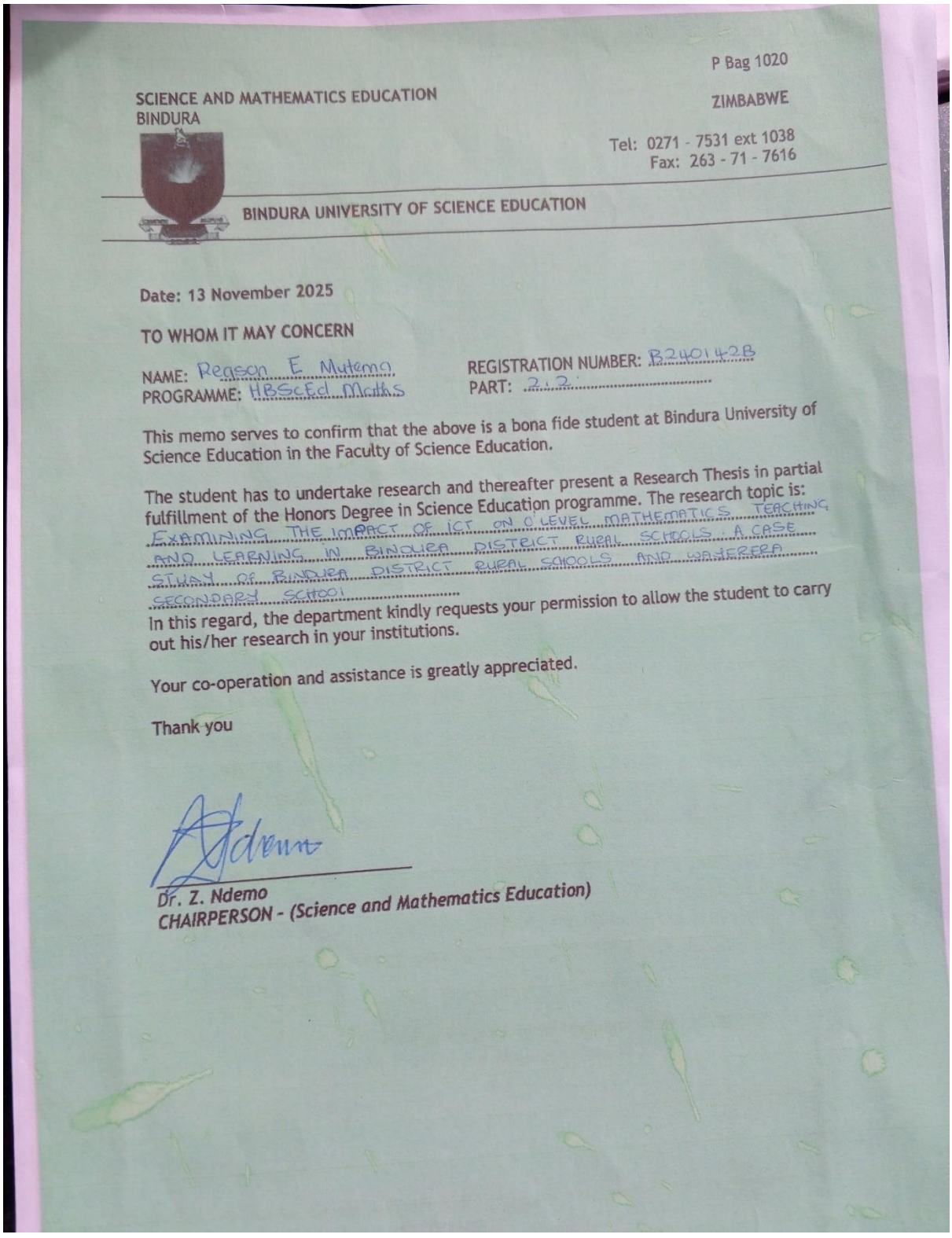
Yildiz, M., and Arpaci, I. (2024). The effect of dynamic software on coordinate geometry.

Yin, R. K. (2018). Case study research and applications: Design and methods. SAGE Publications.

Zezekwa, N., and Mudavanhu, Y. (2008). The digital divide in Zimbabwean rural schools.

APPENDICES

Appendix 1: Introductory letter from Bindura University of Science Education



SCIENCE AND MATHEMATICS EDUCATION
BINDURA

P Bag 1020
ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 13 November 2025

TO WHOM IT MAY CONCERN

NAME: Reason E Mutema REGISTRATION NUMBER: B2401428
PROGRAMME: HBScEd Maths PART: 2.2

This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Thesis in partial fulfillment of the Honors Degree in Science Education programme. The research topic is: EXAMINING THE IMPACT OF ICT ON O'LEVEL MATHEMATICS TEACHING AND LEARNING IN BINDURA DISTRICT RURAL SCHOOLS A CASE STUDY OF BINDURA DISTRICT RURAL SCHOOLS AND WAFERRA SECONDARY SCHOOL

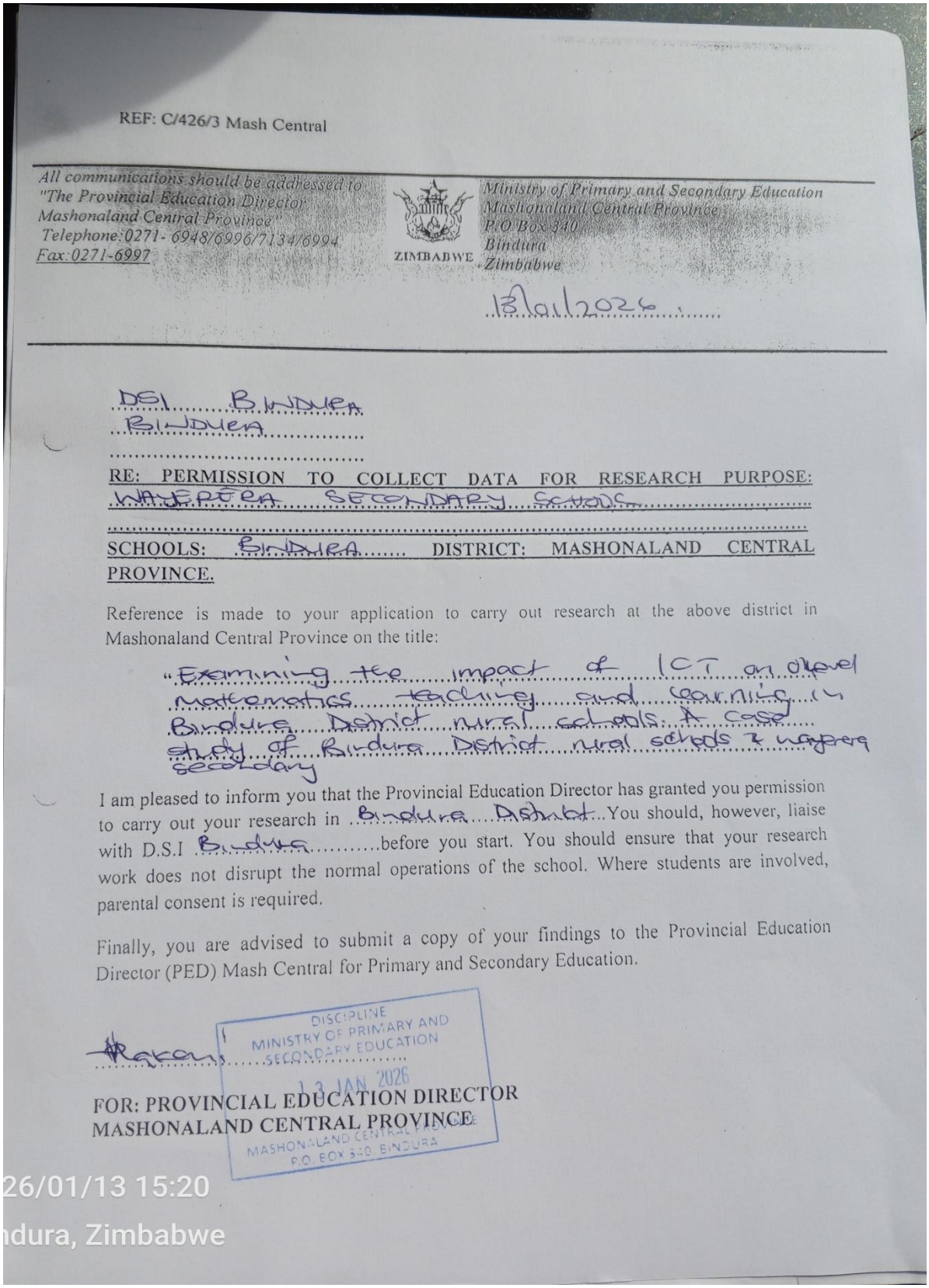
In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

Dr. Z. Ndemo
CHAIRPERSON - (Science and Mathematics Education)

Appendix 2: Approval letter for responsible authority



REF: C/426/3 Mash Central

All communications should be addressed to "The Provincial Education Director" Mashonaland Central Province
Telephone:0271- 6948/6996/7134/6994
Fax:0271-6997

ZIMBABWE

Ministry of Primary and Secondary Education
Mashonaland Central Province
P.O Box 340
Bindura
Zimbabwe

13/01/2026

DSI BINDURA
BINDURA

RE: PERMISSION TO COLLECT DATA FOR RESEARCH PURPOSE: WAYFERERA SECONDARY SCHOOLS

SCHOOLS: BINDURA DISTRICT: MASHONALAND CENTRAL PROVINCE.

Reference is made to your application to carry out research at the above district in Mashonaland Central Province on the title:

"Examining the impact of ICT on Olevel Mathematics teaching and learning in Bindura District rural schools: A case study of Bindura District rural schools & wayferera secondary

I am pleased to inform you that the Provincial Education Director has granted you permission to carry out your research in Bindura District. You should, however, liaise with D.S.I Bindura before you start. You should ensure that your research work does not disrupt the normal operations of the school. Where students are involved, parental consent is required.

Finally, you are advised to submit a copy of your findings to the Provincial Education Director (PED) Mash Central for Primary and Secondary Education.

DISCIPLINE
MINISTRY OF PRIMARY AND SECONDARY EDUCATION
13 JAN 2026
MASHONALAND CENTRAL PROVINCE
P.O. BOX 340 BINDURA

FOR: PROVINCIAL EDUCATION DIRECTOR
MASHONALAND CENTRAL PROVINCE

26/01/13 15:20
ndura, Zimbabwe

Appendix 3: Learner interview guide

Target Participants: O-level Mathematics Students

Objective: To determine the impact of ICT on student motivation, attitudes, performance, and to identify challenges from their perspective.

Access and Usage: What kind of digital tools (computers, phones, calculators) do you use during your mathematics lessons, and how often do you use them?

Engagement and Motivation: How does using technology, such as watching a math video or using a computer, make you feel about learning mathematics compared to just using a chalkboard and textbook?

Conceptual Understanding: Can you describe a time when a digital tool helped you understand a difficult math topic (like volumes or geometry) better?

Self-Regulated Learning: Do you ever use your parents' phones or the school computers to look up math definitions or tutorials on your own?

Perceived Competence: How confident do you feel using computers for math, and do you think your teachers are comfortable using technology in class?

Challenges: What are the biggest problems you face when trying to use technology for schoolwork (e.g., electricity, internet, broken computers)?

Suggestions: If you could change one thing about how math is taught using technology at your school, what would it be?

Appendix 4: Teacher interview guide

Target Participant: O-level Mathematics Teachers

Objective: To assess teacher ICT competencies, attitudes, integration practices, and institutional challenges.

Current Integration: To what extent do you currently incorporate ICT tools (like projectors, software, or mobile apps) into your mathematics teaching practices?

Attitudes and Beliefs: What is your personal view on the role of ICT in mathematics? Do you believe it genuinely improves student understanding or is it sometimes a distraction?

Competency and Training: How would you describe your level of comfort with subject-specific software (e.g., GeoGebra, Desmos)? Has your professional training adequately prepared you to teach math concepts using technology?

Impact on Pedagogy: How does the availability (or lack) of ICT change your teaching strategy? For example, do you use more visual or exploratory methods when you have access to a projector?

Infrastructural Barriers: How do external factors like power outages, lack of internet, or student-to-computer ratios affect your ability to plan and deliver ICT-integrated lessons?

Institutional Support: What kind of support do you receive from the school administration regarding technical maintenance, funds for software, or time for ICT lesson planning?

Future Strategies: What specific resources or training do you feel are most critical to improving mathematics learning through ICT in this rural context?