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BACHELOR OF SCIENCE EDUCATION HONORS DEGREE IN MATHEMATICS



**INVESTIGATING THE EFFECTIVENESS OF ICT INTEGRATION IN THE
TEACHING AND LEARNING OF MATHEMATICS AT ORDINARY LEVEL AT
MUSHUNJE HIGH SCHOOL.**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS OF THE BACHELOR OF SCIENCE HONOURS DEGREE IN
MATHEMATICS EDUCATION**

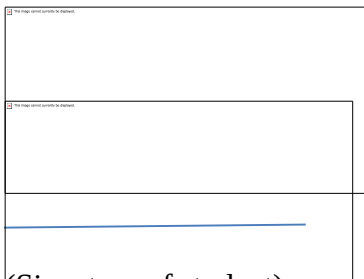
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Dedication

This study is dedicated to my parents Mr. and Mrs. Nyahwema, my children Karen, Duane, Aryan and my husband Everson Butau who have been my source of strength. I also dedicate this research to my friends at Bindura University.

Abbreviations/Acronyms

ICT- Information and Communication Technology

Abstract

This study aimed to investigate the effectiveness of integration in the teaching and learning of mathematics at ordinary level at Mushunje High School. A sample of 4 mathematics teachers and 20 form 4 learners were selected for the study. The study employed both quantitative and qualitative methods of data collection. The instruments used were questionnaire for teachers and tests for learners. The collected data shows that learners taught with ICT performed better than those taught without it. The results from the research show that ICT integration is very effective in helping learners to have a better understanding of concepts.

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Chapter 1

Introduction

1.0 Introduction

This chapter provided an overview of the study on the effectiveness of ICT integration in the teaching and learning of mathematics at ordinary level, with a particular focus on Mushunje High School. It outlined the background of the study and stated the problem that the research aimed to address. The objectives and questions that guided the study were clearly defined, and the significance of the research was highlighted, emphasizing its relevance to teachers, learners, schools and educational stakeholders. The chapter also addressed the limitations and delimitations of the study, offering a clear understanding of the scope and reach of the research conducted. Key terms relevant to the study were defined for clarity. Finally, an outline of the dissertation's structure was presented, guiding the reader through the content of the subsequent chapters.

1.1 Background of the Study

In this 21st century where we are now living in a global village, Information and Communication Technologies (ICTs) are playing an important role in assisting the teachers to shift from using traditional methods of teaching to technology based teaching methods. Technology integration nowadays has gone through innovations and transformed our societies that has totally changed the way people think, work and live (Grabe, 2007). As part of this, schools and other educational institutions which are curriculum (Ghavifekr, Afshari & Amla Salleh, 2012). ICT offers a lot of benefits such as providing learners with a variety of learning resources such as online textbooks, videos and simulations. ICTs are also helpful in a way that learning continue to take place even if the teacher is not present through online learning. When ICTs are used with proper planning, they can assist learners with a better understanding of mathematical concepts, develop the learners' critical thinking skills and offer different learning styles that make learning very interesting. When students use ICT in their research or in solving problems, their skills in Mathematics is much more developed (Kaushik, 2019).

The researcher is going to investigate on the impact of ICT integration in mathematics education at ordinary level. According to Bersin (2004) e-learning takes place through texts, videos, sounds and interactive graphics to improve quality learning. ICTs can allow learners to be active and allow them to explore information on the internet. The development of multimedia and information technologies as well as the use of the internet as a new technique of teaching has made radical changes in the traditional process of teaching and learning (Aigahtani; 2011). Use of ICTs in schools has brought variety of learning tools which include smart boards in classrooms. In Zimbabwe majority of tertiary institutions are learning online through the use of ICT tools rather than doing face to face lessons especially those who are on block programs. During weekends and holidays some secondary and primary schools continue to learn through the use of ICTs.

1.2 Statement of the Problem

The learners were having the misconception that it is difficult to pass mathematics because they were finding it difficult to grasp some certain concepts. The researcher decided to employ ICT teaching methods aiming to help the learners to have a better understanding of mathematical concepts. The researcher will be investigating the effectiveness of ICT integration in the teaching and learning of mathematics at ordinary level.

1.3 Research Questions

1. How does the integration of ICT tools affect mathematics instruction in ordinary-level classrooms?
2. What are the perceived benefits and challenges of using ICT in teaching mathematics?
3. What are the teachers' attitudes, skills, and readiness for incorporating ICT tools in mathematics instruction?

1.4 Research Objectives

1. Evaluate how the integration of ICT tools affect mathematics instruction in ordinary-level classrooms.
2. Examine the perceived benefits and challenges of using ICT in teaching mathematics.

3. Investigate the teachers' attitudes, skills, and readiness for incorporating ICT tools in mathematics instruction.

1.5 Assumptions

This research was based on various assumptions. The first assumption is related to the questions on the questionnaire. It is assumed that the questions were sufficient and appropriate in serving the purpose of the research. Another assumption is related in participating teachers. It was assumed that the participating teachers responded to the questionnaires sincerely.

1.6 Significance of the Study

This research is expected to benefit the researcher, the teachers, the learners the school and the stakeholders.

To The Researcher

The research will help the researcher to plan and implement on the use of ICTs to help learners to develop their mathematical understanding and skills more effectively and to make learning mathematics more enjoyable and engaging.

The Teacher

The teachers will be motivated to blend traditional teaching methods with technology based teaching methods. It will motivate the teachers to acquire sufficient ICT skills to use technology based teaching methods in the classroom.

The Learner

The research will help the learners to personalize their learning through the use of online resources and learn at their own pace focusing on the areas where they need most help. Moreover the learners will have access to wide range of mathematical resources such as online textbooks which will help them to develop their problem solving skills. It will also facilitate communication and collaboration among the learners, allowing them to share ideas and work together on projects.

The School

The schools will purchase more ICT tools like laptops and Wi-Fi to enable teachers to integrate the use of ICTs in the teaching and learning of mathematics. The school will provide the teachers with adequate training and support so that the teachers acquire the knowledge and skills on the use of ICT in teaching.

The Stakeholders

The research will raise awareness to the parents on the impact of ICT in teaching and learning therefore buying ICT gadgets for their children. The research will also raise awareness to the Ministry of Education in Zimbabwe therefore provide ICT tools into schools and to train teachers on ICT knowledge and skills.

1.7 Limitations of the Study

In carrying out the research, there are certain factors that limited the effectiveness of the research. These factors are lack of finances which left the researcher with only one option which is to conduct the research at one school. Another limitation was shortage of ICT tools, where the school does not have enough computers to use.

1.8 Delimitations of the Study

The research will be carried out at Mushunje High school located in Mutare district. Participants will be Form 4 learners and four teachers.

1.9 Definition of Key Terms

ICT (Information and Communication Technology)

ICT stands for Information and Communication Technology. According to Blueton (2002) ICT stands for information and communication technologies and are labeled as a diverse set of technological tools and devices used to communicate and create distribute, store and manage information.

Teaching as define by Chiromo (2010) is the engagement with learners to enable their understanding and application of knowledge, concepts and processes.

Learning is a process of acquiring new understanding, knowledge, behaviors, skills and values (Chiromo, 2010)

1.10 Summary

The integration of ICT in the teaching and learning of Mathematics has many advantages, but it also has some disadvantages that need to be addressed. If there is proper planning, enough training and support, ICT can enhance the teaching and learning of mathematics, leading to improved student outcomes and a more engaging and effective learning experience.

Chapter 2

Literature Review

2.0 Introduction

The purpose of literature reviews on the effectiveness of integrating ICT in teaching and learning of mathematics is to analyze factors influencing teacher ICT integration, such as pedagogical, content, and technical knowledge, and how these impact student outcomes. Studies highlight the critical role of teachers in deciding when, where, and how to use ICT, emphasizing that the presence of technology alone does not guarantee improved student outcomes. These reviews explore the need for teacher competency, curriculum alignment, and pedagogical changes to successfully integrate ICT, ultimately aiming to enhance student learning experiences in mathematics education.

2.1 The significance of the study

An investigation in the effectiveness of ICT integration in mathematics education is significant for several reasons. Firstly, ICT integration in mathematics education is one of the most effective ways of enabling students to interpret mathematical concepts, as it provides opportunities for students to enhance their interpretation, focus on problem-solving and reasoning.

Technology helps students to improve their mathematical thinking paths, increases the quality and quantity of realistic mathematical studies, and enhances their mathematics-related ideas. Thirdly, technology serves as an instrument that saves time, enhances, and focalizes mathematical activities. ICT integration in mathematics education is a crucial factor in preparing students for the modern job market, where digital literacy is becoming more important. Lastly, research has shown that the integration of ICT in mathematics education has become increasingly popular over time, indicating the popularity of this field. Therefore, understanding the effectiveness of ICT integration in mathematics education is essential for educators, policymakers, and researchers to ensure that students are equipped with the necessary skills for the 21st century.

2.2 Background and Context

The influence of e-learning is increasingly dominating the current educational style as the influence of technology increases dominating our day to day activities worldwide (Bass; 2006). The integration of ICT in teaching and learning of mathematics at the ordinary level is highly relevant in today's digital age. ICT tools such as computers, digital cameras, and interactive whiteboards can significantly enhance the teaching and learning experience, making it more engaging, interactive, and effective. However, for ICT integration to be successful in mathematics education depends on several factors which include teachers' ICT skills, availability of ICT resources, and support and training for teachers.

Studies have shown that teachers in developing countries face challenges in integrating ICT in their teaching due to lack of technical know-how, inadequate ICT tools, and large class sizes. Therefore, there is a need for targeted interventions to improve teachers' ICT skills and provide adequate ICT resources to support teaching and learning. The integration of ICT in teaching and learning of mathematics at the ordinary level is important as it prepares learners for the digital era and improving their learning outcomes. However, it requires a concerted effort to address the challenges faced by teachers in integrating ICT in their teaching, including improving their ICT skills, providing adequate ICT resources, and ensuring support and training for teachers.

Information and Communications Technology (ICT) is considered a powerful tool for educational change and reform (Goktas et al., 2009). Several previous studies have shown that the appropriate use of ICT can raise educational quality and connect learning to real-life situations and the learning environment into a learner-centered one (Sanchez & Education, 2011), learners are actively involved in the learning processes in ICT classrooms, and they are authorized by the teacher to make decisions, plans, and so forth (Lu et al,2010). In mathematics education, ICT also provides teachers with foundational tools and means to help teachers change teaching methods, support students in independent learning, and actively participate in the discovery of concepts and mathematics topics. As a result, students gain a deeper understanding of mathematical ideas. Therefore, it can be understood that the integration of ICT in mathematics education is the result of the ability to apply ICT to help students achieve better in mathematics. These potentials of ICT make classroom integration a promising practice, but its success depends

on various factors. Research on the use of ICT in mathematics education is also one of the ways to increase the effectiveness of the applications of ICT in mathematics education.

ICT integration in education, in mathematics helps in understanding of concepts by visualizing mathematical concepts and imparting 21st-century skills. Teachers need training so that they can effectively integrate ICT tools like GeoGebra and Desmos into lessons. Research emphasizes the positive impact of ICT on teaching and learning, highlighting challenges like limited resources and teacher training gaps. To improve, educators must enhance ICT skills, embrace professional development, and ensure adequate technology access in schools. This integration is vital for creating dynamic and effective learning environments in mathematics education.

2.3 Challenges or gaps in the existing literature.

The existing literature on the integration of ICT in education highlights several challenges and gaps. One major challenge is the inadequacy of ICT tools and resources, including insufficient, inaccessible, unreliable, and insecure ICT tools, which pose difficulties for teachers and students. Additionally, the lack of adequate resources, infrastructure, and technical assistance hinders the effective integration of ICT tools and resources in education.

Another challenge is the insufficient training and support for teachers, which leads to teachers being unprepared or unconfident in fully integrating ICT into their classrooms. Teachers need not only computer literacy but also skills in integrating computer use into their teaching/learning programs. Limited time and the difficulty in scheduling enough computer time for classes also hinder teachers' use of ICT in their teaching.

The lack of teachers' competency in integrating ICT into pedagogical practice is another challenge, with many teachers lacking the knowledge and skills to use computers and being unenthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices.

Furthermore, the inaccessibility of ICT resources is a widespread challenge, with poor resource organization, poor quality hardware, inappropriate software, or lack of personal access for

teachers being potential factors. Infrastructure barriers, such as insufficient broadband access, also hinder the use of ICT in teaching.

2.4 The impact of ICT on student achievement and engagement.

The impact of Information Communications and Technology (ICT) on student achievement and engagement is significant. The integration of ICT in teaching Mathematics is expected to promote understanding of abstract concepts like algebra, geometry, and trigonometry. The use of computer in Mathematics speeds up the graphing process but limits the sense of analyzing and reflecting on the relationships between data (Karadeniz & Thompson, 2017). Students believe that technology facilitates a greater understanding of course content, contributes to higher academic achievement, and better prepares them for the technology-dependent workforce. ICT can be used in various ways where it helps both teachers and students to learn about their respective subject areas. A technology- based teaching and learning offers various interesting ways which includes educational videos, stimulation, storage of data, the usage of databases, mind-mapping, guided discovery, brainstorming, music, World Wide Web (www) that will make the learning process more fulfilling and meaningful (Finger & Trinidad, 2002). The use se of videos will help learners to play them over and over again on their own time until they master the concept.(Kristanto, 2021) provides an example of the integration of the internet for learning, as learners use the internet and explore it in different ways and different directions. ICT integration in a mathematics lesson makes learners to enjoy the audio and visual activities and the interaction among themselves and it also draws the learners' attention towards learning. This will motivate learners to learn therefore making classroom management very easy for teachers. In addition, ICT provides the help and complementary supports for both teachers and students where it involves effective learning with the help of the computers to serve the purpose of learning aids (Jorge et al., 2003). ICT integration in mathematics makes difficult problems to be solved easily and quickly. (Aggarwal, 2020) states that ICT integration in mathematics can help mathematics teachers to express clearly what they want to express in the class and students to understand what the mathematics teachers have expressed through demonstration, visualization, and experimentation. The need for ICT integration in education is crucial, because with the help of technology, teaching and learning does not only happen in the school environment, but also can happen even if teachers and students are physically in distance. It promotes distance learning. However, ICT integration is not a one-step learning process, but it is a continual process of

learning that provides proactive teaching-learning environment (Young, 2003). Moreover, learners can be distracted by other applications during learning therefore disrupting learning. Despite these challenges, with mindful pedagogical strategies, instructors can overcome these barriers and use technology to enhance student engagement and success.

2.5 Benefits and challenges in successful ICT implementation.

There are some factors that hinder successful implementation of ICT which include lack of adequate ICT equipment mostly in the rural area schools where the learner computer ration is very high. Therefore, infrastructure and facility of ICT is then needed to supply to the schools throughout the nation. A key factor in use of ICT is sufficient computer labs and ICT equipment. This is to ensure that subject teachers are easily access to ICT tools whenever needed (Hennessy, Ruthven, & Brindley, 2005).

Technical difficulties are another major problem that hinders successful implementation of ICT. It is a source of frustration for learners and teachers and cause interruptions in the teaching and learning process. If there is lack of technical assistance and no repair on it, teachers are not able to use the computer for temporarily (Jamieson-Proctor et al., 2013). The effect is that teachers will be discouraged from using computers because of fear of equipment failure since they are not given any assistance on the issue. Türel and Johnson's study (2012) revealed that technical problems become a major barrier for teachers. These problems include low connectivity, virus attack and printer not functioning. However, there are a few exceptions. Schools in the countries like Netherland, United Kingdom and Malta have recognized the importance of technical support to assist teachers to use ICT in the classroom (Yang & Wang, 2012).

In addition, teachers' readiness and skills in using ICT are playing an important role in the use of ICT in education. Teachers need sufficient ICT skills to implement the technology and to have high confident level to use it in a classroom setting. Besides, teachers require insight into the pedagogical role of ICT, in order to use it meaningfully in their instructional process (Hennessy et al., 2005). According to Winzenried, Dalgarno and Tinkler (2010) teachers who have gone through ICT course are more effective in teaching by using technology tools as opposed to those that have no experience in such training. A school in Canada, some teachers admitted they were

reluctant ICT users because they worried they might get embarrassed that the students knew more about the technology than they did (Hennessy et al., 2005).

Moreover, technology-based teaching and learning can make many changes in school that requires for proper planning and policy making. Researchers and policymakers must both have the same insight about the future plan. Dudeney (2010) noted that national ICT policies can serve several crucial functions. They provide a rationale, a set of goals, and a vision of how education systems run if ICT is integrated into teaching and learning process, and they are beneficial to students, teachers, parents and the general population of a given country. The Ministry of Education should formulate main policies for ICT in education. There must be a policy which insists on all learners to be given opportunity to use ICT. This will aim to reduce the digital gap amongst the schools. There must be another policy which focuses on the role and function played by ICT in education. Besides that, another policy should stress on the use of ICT for accessing information, communication and as productivity tool (Chan, 2002).

As what has been discussed, there are many factors to enable the use of ICT in classroom teaching and learning. Begin with policy, followed by the supplement of all the ICT hardware and software facilities, continued by readiness and skills of teacher to integrate it into pedagogical process (Agbatogun, 2012). Therefore, to ensure successful ICT implementation, it is essential to consider the various factors that can hinder or facilitate the process and develop strategies to address potential barriers while leveraging facilitators to promote adoption and implementation. In short, all parties must cooperate in order to bring the nation to become a country advance in technology.

2.6 Effective strategies for integrating ICT in mathematics teaching.

Teachers should set clear objectives. They should identify crucial activities with clear mathematical aims and objectives, and plan for their integration in schemes of work. Teachers should also use appropriate software that supports learning and teaching of mathematics. Teachers must be provided support and training so that they get fully equipped with knowledge of using ICT in the classroom. Teachers should also make use of online mathematics resources and video games to support teaching and learning. For the effectiveness of ICT integration there

is need for regular evaluation whereby the teacher continually assess the effectiveness of ICT integration and make adjustments as needed.

2.7 Theoretical Framework

The education system has adopted the constructivists learning theory where learners construct their new knowledge based on their previous knowledge and experiences assuming the surrounding environmental conditions around the learning situations. Through this learning theory, learners are actively involved in their learning activities, constructing their own new knowledge. The ICT integrated learning is therefore highly recommended for facilitating individually constructed knowledge by supporting the teachers' professional development, the students' benefit thereafter promoting organizational learning (McKenny,2001). William (2004) supports constructivists' idea that knowledge is rather individually constructed and socially negotiated by learners themselves based on prior knowledge. .This study is therefore in line with the constructivism theoretical framework, assuming that conventional learning might be enhanced by ICT integration. It is assumed that ICT integration will contribute to construct new knowledge prior to the existing ones, and initiates and facilitates learning where learners are actively involved in the process. This is aims to improve learner's performance at a better level. In addition the ICT integration is presumed to bring new trend of learning, changing the role of the teacher into coaching status while the students are actively involved in self-regulated learning, constructing their own new knowledge.

2.8 Summary

The chapter focused on literature review on the effectiveness of ICT integration in the teaching and learning of mathematics. The impact of ICT integration was discussed and the factors that hinder successful implementation of ICT was also highlighted the effective strategies that can be used to implement ICT integration successfully.

Chapter 3

Research Methodology

3.0 Introduction

The methods of data collection are going to be discussed in this chapter. The selected research instruments are questionnaires and test instrument. The chapter also discusses the advantages and disadvantages of selected instruments. The population, sample and sampling procedures are examined in this chapter.

3.1 Research Design

Heyden (2009) says that a research design refers to an overall strategy that the researcher uses to integrate the different components of the study in a coherent and logical way. According to Healey (2007), research design refers to a plan for selecting objects, research sites and collecting procedures to answer the research questions. Above all, the research design is the design which is intended to describe the procedures for carrying out the research. The research design shows individual which will be studied and when, where and under which circumstances will they be studied, (Healey 2007). In this study, the researcher settled for mixed design approach that is both quantitative and qualitative. (Bell and Waters 2014) state that mixed method research design will allow in-depth understanding of the study and also enhances the gathering of relevant detailed data. Thus, through the use of mixed methods there is better understanding of the problem.

Qualitative design focuses on gathering of mainly verbal data than measurements. Healey (2007) asserts that it is used to gain an understanding of underlying reasons, opinions and motivation. Heyden (2009) supported that it is used to uncover trends in thought and opinions and drive deeper into the problem. The author added that qualitative research approaches are based on analytic methods which take account of complexity detailed and context. Quantitative research on the other hand is used to quantify attitudes, opinions and behaviors. Gay (2005) states that quantitative designs focus more on counting and classifying features and constructing statistical models and figures in line with what is being observed. According to Gay (2005), quantitative approach has the advantage that it is cheaper to implement and is

standardized so comparisons can be easily made and the size of the effect can usually be measured.

3.2 Population, Sample and Sampling Procedures

3.2.1 Population

Population in research means the aggregate or total of individuals that have one or more characteristics in common that are of interest to the researcher. Target population according to Osuala (2005) can be defined as all the members of a real hypothesis set of people to which the researcher generalizes the results. In general, target population refers to individuals who have common, a particular trait which makes them to be recognized as a group.

In this research, the population is secondary school learners at Mushunje high School who had different backgrounds. The school is located in Bocha, Mutare rural in Manicaland Province. The researcher will focus on the secondary level learners whose age range from 13-15 years. All these learners will be doing mathematics.

3.2.2 Sample and Sampling Procedures

According to Mertens (2013), sampling is way of selecting a number of subjects from the defined population for the purpose of presenting data. The sample becomes the group that represents the total population under the study. Babbie (2009) asserts that a sample is a group selected from larger population with the aim of yielding information about the population as a whole. . The sample enables the researcher to generalize the findings from the research sample to the population as a whole. The study will be carried out at Mushunje High School with form 4 learners. The class has an enrollment of twenty learners. The researcher will make use of a sample of twenty learners for this study. The researcher is going to use simple random sampling to come up with two groups. Random sampling was preferred by the researcher as all the participants stand an equal chance of being selected for the study without much bias (Leedy, 2019). Small cards will be written "yes" or "no" which will determine the group in which the learners will be during the study. Group number one will be for the learners who will learn through the use of ICT whilst group two will be for the learners who are going to learn through the traditional classroom method. Through the use of random sampling technique twenty small cards will be placed in a box for learners to pick. Ten will be labeled

"yes" and the other ten will be labeled "no". Learners who will pick cards labeled "yes" will be placed in group 1 and those who will pick cards labeled "no" will be placed into group 2. The researcher will also select of two topics from the syllabus which will be used for the study so that the researcher can explore on the effectiveness of ICT integration in the teaching and learning of mathematics at ordinary level.

3.3 Methods of Data Collection

Cohen and Manion (2007) describe research instruments as tools that are used to collect data. The researcher will be using questionnaires and tests as research instruments to collect data.

3.3.1 Questionnaire

Creswell (2013) defines a questionnaire as a document containing questions designed to solicit information appropriate for data analysis. Popper (2019) also objectifies that questionnaires are contain questions related to the research's sub-problems, and are mainly purported to collect information that is useful in satisfying research objectives.

Advantages of Questionnaires

They are familiar with respondents (Creswell, 2013). This entails that the majority of respondents are acquainted with questionnaires and how they are filled in. Popper (2004) adds that they are easy to both construct and respond to. Thus, data collection through questionnaires can be done easily, and without much hassle.

They can be most appropriate when soliciting for sensitive information (Salmons, 2016). Where respondents may be reluctant to divulge personal secrets which may not suit oral interviews, focus group discussions, or observations, questionnaires can be the most suitable research tools.

They enable the researcher to collect data very quickly (Creswell, 2013). Questionnaires can be gives to a large group of respondents and within a short period of time, the required data can be gathered. Moreover, questionnaires enable the researcher to collect data from respondents who may be far away through posting or mailing (Leedey, 2019)

Disadvantages of Questionnaires

They are unsuitable when respondents are illiterate (Leedy, 2019). Where the participants cannot read or write, then the use of questionnaires is unsuitable. This implies that they are discriminatory research tools, as they exclude illiterate respondents. In this study all respondents were able to read and write.

They do not allow for probing respondents in case of ambiguity (Sweetman et al., 2015). Where incidences of ambiguous questions arise, questionnaires do not allow researchers to further probe for clarification. (Popper (2019) also agrees that sometimes respondents may offer interesting responses requiring further elaboration, and this is unattainable with questionnaires.

3.3.2 Test instrument

According to Creswell (2011), a test is an instrument that measures and evaluates the performance of an individual in a given task. A test is administered under given standard situation, for example, in a specified time limit which applies to everyone taking that test. It also involves the assignment of a numerical value to the performance of the individual.

Advantages of test instrument

According to Cohen and Mansion (2007), test instrument has the following advantages:

- It is easy to apply and score.
- All kinds of information can be measured.
- It is easily applicable at all levels and stages of education.
- Reliability and content validity are high since it is possible to ask many questions in the exam.
- The exam results are objective since they do not vary from evaluator to evaluator.
- It provides a variety of statistical applications.

Disadvantages of test instrument

According to Cohen and Mansion (2007), test instrument has the following disadvantages:

- It does not improve the ability of expression.
- It measures knowledge and remembering and is limited in measuring information that is at the level of synthesis and evaluation.
- It is not used much in the measurement of advanced behaviors.
- Most of the test time is spent on reading choices and finding the right answer.

3.4 Data Presentation and Analysis Plan

Quantitative and qualitative approaches were used to analyze data for this research. Babbie (2009) defines quantitative analysis as the numerical representation and manipulation of the instruments for the purpose of describing and explaining the phenomena that those instruments reflect. Osuala (2005) defines qualitative study as a systematic process of describing, analyzing and interpreting insights discovered in everyday life. graphs and statements. The collected data will be presented in tables and graphs so that the researcher can analyze the data. The data will be analyzed making use of discussions. The researcher will analyze the participant's responses on the questionnaire so as to explore on the effectiveness of ICT integration in the teaching and learning of Mathematics at ordinary level. From the learners' performance the researcher will be able to analyze which teaching method is effective either ICT methods or the traditional classroom method. From the two groups the learners that will have the highest performance pass rate will show the method that can produce best results thus showing the effectiveness of the method.

3.5 Ethical Consideration

Ethics are defined by Bell (2018) as acceptable standards governing research conduct and influence the welfare of human being. In an effort to stand by ethics, the researcher will guarantee participants confidentiality and participants kept anonymity so that they air out their views freely. The researcher will also acknowledge the work of other authors and researchers. The researcher will also ask for permission from the responsible authority at Mushunje High School before conducting the research.

3.6 Summary

This chapter discusses the methods and techniques that will be used by the researcher to collect data for this study. The researcher is to employ the descriptive survey research design in which questionnaires and tests will be used to collect data for the study. The chapter discusses the advantages and disadvantages of the research design and research tools used, and techniques adopted to lessen the challenges they pose. The population, sample, sampling procedures of the study as well as ethical issues prioritized were examined.

Chapter 4

Data Presentation, Analysis and Discussion

4.0 Introduction.

The chapter's focus is to gather data and then determine whether there is evidence for the effectiveness of ICT integration in the teaching and learning of mathematics at ordinary level. This chapter focuses on data presentation, analysis and interpretation. The presented data is obtained from a test and questionnaires. The data is presented in the form of tables, graphs and discussions. This chapter will address the research questions in chapter 1, basing on the data that was collected. Moreso, the findings will also be discussed.

Table 1 Performance of learners taught with the use of ICT.

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>J</u>
<u>13</u>	<u>17</u>	<u>9</u>	<u>14</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>11</u>	<u>18</u>	<u>15</u>

Figure 1Performance of learners taught with the use of ICT.

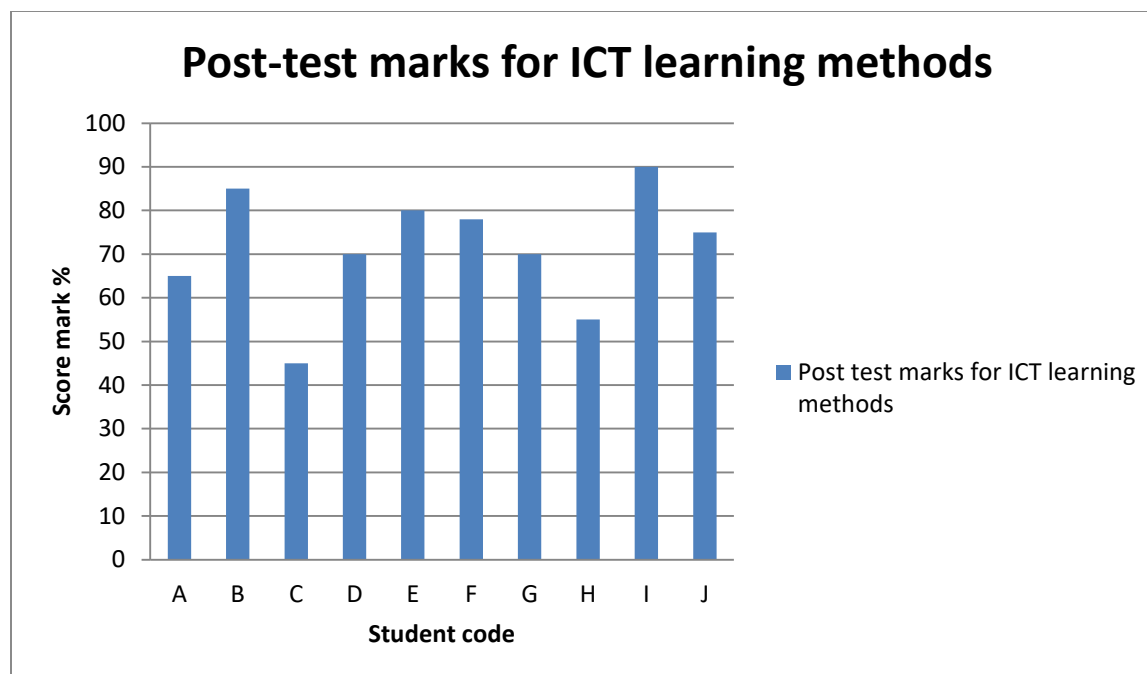
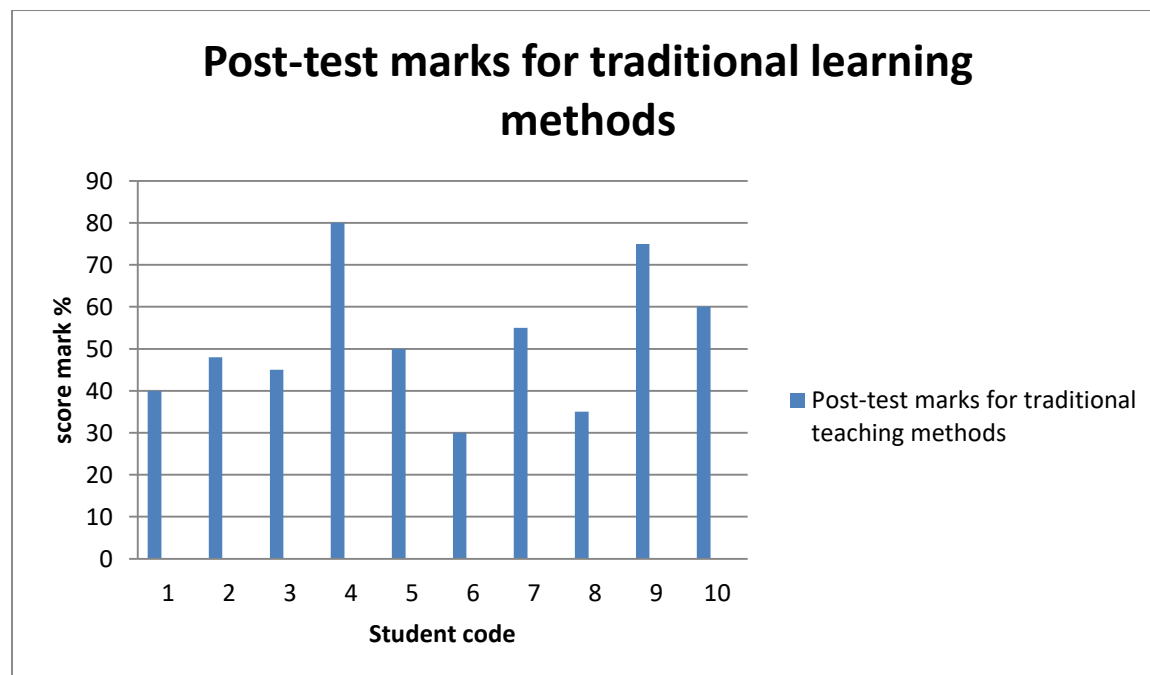


Table 4.1 and figure 4.1above shows the performance of learners who were taught with the use of ICT. The results show that majority of the learners passed the test except for student C who got 9 out of 20, which is a mark below 50 %. Student I got 18 out of 20, student B got 17 out of 20. It is that the use of ICT helped the learners to understand the concept very well. During the lessons the researcher found that the learners were concentrating and were paying attention during the lesson.

Table 2 Performance of learners taught without the use of ICT.

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
<u>8</u>	<u>9</u>	<u>9</u>	<u>16</u>	<u>10</u>	<u>6</u>	<u>11</u>	<u>7</u>	<u>15</u>	<u>12</u>

Figure 2 Performance of learners taught without the use of ICT



The above graph and table shows the performance of learners taught without the use of ICT. The graph shows that only four learners passed the test. Out of 20 marks, student 4 got 16, student 7 got 11, student 9 got 15, and student 10 got 12. 40 % of the learners understood the concept and passed the test while 60% of the learners failed the test. The results show that majority of the learners did not understand the concept well.

Table 3. Comparison of performance between learners taught with ICT and without ICT.

	Without ICT	With ICT
Fail [below 50%]	6 (60%)	1 (10%)
Good [50-69%]	2	2
Very Good [70-79]	1	4
Excellent [above 80%]	1	3

From the results from the table above, it is evident that the learners taught without ICT have a lower performance than those taught with ICT. From the table 4.3, 6 of the learners have marks below 50% in Mathematics while those who were taught using ICT tools have only one learner who scored less than 50%. The table also shows that 9 learners which is the majority of the learners taught with ICT got marks more than 50%. From the results we can conclude that the use of ICT improved the learners' understanding of the topic. This is in line with Kaushik (2019) who stated that when students use ICT in their research or in solving problems, their skills in Mathematics are much more developed. It can be noted that learners who were taught using ICT tools did well compared to learners who made use of face-to-face lessons. This may be due to the reasons that those who used ICT tools had videos which they could play over and over again which made them to easily grasp concepts. As supported by Holmes and Gardner (2006) who argues that through e-learning tools learners have access to lesson content unlimited number of times. Thus, dedicated learners can go through their learning materials over and over again so as to be able to grasp concepts.

Table 4 To what extend do you agree that the use of ICT in mathematics lessons has increased learners' engagement and motivation.

Strongly agree	<u>3</u>	75%
Agree	<u>1</u>	25%

Disagree	<u>0</u>	0%
Strongly disagree	<u>0</u>	0%

The results from the table would want to examine the effectiveness of ICT integration for learners motivation. The table above shows that the use of ICT promotes active learning and engaging lessons. 75% of the teachers strongly agree that the use of ICT in their lessons increases their motivation and promotes their engagement in learning. It is evident that the use of ICT motivates learners and improving their concentration during the lessons. This concur with (Kristanto, 2021) who stated that ICT integration in a mathematics lesson makes learners to enjoy the audio and visual activities and the interaction among themselves and it also draws the learners' attention towards learning. This will motivate learners to learn therefore making classroom management very easy for teachers.

Table 5 The main challenges teachers have experienced with the use of ICT in mathematics lesson.

Technical issues	4
Lack of access to ICT devices or resources	4
Lack of ICT skills	3
Electricity	1

From the table above, it shows some main challenges that are faced by teachers and learners when using ICT tools in mathematics lessons. It shows that fifteen learners identify technical issues as the major challenge experienced with the use of ICT. Eleven learners also started lack of access to ICT devices or resources as another major challenge experienced with the use of ICT. This is where there is a shortage of computers and computer laboratory. This is in line with Türel

and Johnson's study (2012) who revealed that technical problems become a major barrier for teachers. These problems include low connectivity, virus attack and printer not functioning. 3 teachers mentioned lack of ICT skills as a challenge in the use of ICT in teaching and learning. This is supported by Winzenried, Dalgarno and Tinkler (2010) reviewed in chapter 2 who argued that teachers who have gone through ICT course are more effective in teaching by using technology tools as opposed to those that have no experience in such training.

Table 6 The effectiveness of ICT integration in improving learners' understanding of mathematical concepts.

Highly effective	75%	3 teachers
Moderately effective	25%	1 teacher
Not effective	0%	0 teachers

The results from the table shows that out of 4 teachers, 3 teachers find the use of ICT in teaching mathematics highly effective in improving the learners understanding of mathematical concepts. One out of 4 teachers find the use of ICT in teaching mathematics moderately effective in improving learners understanding of mathematical concepts. No teacher found the use of ICT not effective. This maybe because the teachers observed that learners performed better when they use ICT in the teaching of mathematics. (Aggarwal, 2020) states that ICT integration in mathematics can help mathematics teachers to express clearly what they want to express in the class and students to understand what the mathematics teachers have expressed through demonstration, visualization, and experimentation.

4.3 Chapter Summary

The chapter focused on data presentation through the use of tables, graphs and discussions. The research questions have been answered and the research findings have been discussed in relation to literature. The next chapter will focus on the summary and conclusion of the study. Also, the chapter will look at recommendations and areas of further research.

Chapter 5

Summary, Conclusions and Recommendations

5.1 Focus of the Chapter

This chapter will discuss on the study in relation to the research questions. In an effort to assess the implications of the results and make conclusions the discussions will be done in relation to the background of the study and literature review. The researcher will give a summary as well as conclusion of the study, recommendations and possible areas of further research.

5.2 Summary of the Study

In this research, the researcher's study focused on the effectiveness of ICT integration in the teaching and learning of Mathematics at ordinary level at Mushunje High school. Chapter one of the study highlighted the background of the study where the researcher pointed that the need for the research arises as learners perceive mathematics as a difficult subject that cannot be passed easily. The researcher decided to employ the 21st century teaching methods thus ICT integration in teaching and learning of mathematics since we are now living in a global village where technology integration nowadays has transformed our societies that has totally changed the way people think, work and live. Therefore learners need to be prepared so that they will be able to work in this modern day society.

The researcher also looked at the statement of the problem and the main research question being:

1. How does the integration of ICT tools affect mathematics instruction in ordinary-level classrooms?
2. What are the perceived benefits and challenges of using ICT in teaching mathematics?
3. What are the teachers' attitudes, skills, and readiness for incorporating ICT tools in mathematics instruction?

Furthermore, the researcher looked at the significance of the study as also providing relevant stakeholders on the effectiveness of ICT integration and adding more knowledge to already existing knowledge. The key terms were defined which are ICT, teaching and learning. Moreover, delimitations of the study was mentioned which was Mushunje High School in Mutare Rural district.

Chapter two reviewed literature on what is ICT integration. Various sources were used so as to allow the researcher to analyze on the effectiveness of ICT integration in the teaching and learning of Mathematics at ordinary level taking into consideration the findings of other researchers.

In chapter three the research methodology of the study was discussed. The researcher used a mixed method approach comprising of the use of both qualitative and quantitative methods which allowed for in-depth understanding of the study. A sample of twenty learners was used and was divided into two groups through the use of simple random sampling. The researcher used tests and questionnaires as methods of data collection.

In chapter four, the data collected was presented; analyzed and discussed. The collected data was presented in tables and graphs. From the data that was collected and presented by the researcher it is evident that ICT integration is very effective in the teaching and learning of Mathematics although there are some challenges which need to be addressed.

During the study the researcher faced some constraints which include shortage of computers at the school. The school had only one computer laboratory. Most of the time when the researcher wanted to use the computer laboratory; it would be occupied by other teachers and learners.

5.3 Conclusions

The results of this study show that ICT integration in teaching and learning is more effective as compared to traditional methods because, use of ICT tools promotes an active learning environment that is more interesting and effective for both teachers and learners. The results are in line with a research findings by Macho (2005) that proved using ICT in education would enhance students' learning. All the teachers in this study agreed that the use of ICT helps to improve classroom management as students become well-behaved and pay attention during the lessons. Moreover, this study proved that students learn more effectively with the use of ICT as

designed lessons are more engaging and interesting. The participants agreed that integrating ICT can foster learners' learning. Since the learners who were taught with ICT tools performed better than those who were taught without it, it can be concluded that there is a strong connection between ICT integration in the teaching and learning process on the learners' performance in mathematics at Mushunje High school.

5.4 Recommendations

From the data collected and analyzed in this study the researcher came up with the following recommendations to improve and promote learners' performance in mathematics.

The Ministry of Education in Zimbabwe should provide all schools and teachers with computers so that ICT integration in teaching and learning is employed in schools.

Teachers need to embrace the use of ICT in the teaching of Mathematics for its effectiveness as it allows learners to learn through the use of videos, audios, word documents, PowerPoint and PDFs thus allowing learners to grasp concepts as they will be having a variety of learning materials.

There is need for the Ministry OF Education in Zimbabwe or school authorities to train teachers on how to use ICT tools in the teaching and learning such that teachers can acquire knowledge and skills that help them to fully make use the ICT tools for their own benefit as well as for the benefit of the learners. This will also help the teachers to meet the demand of the 21st century teaching skills.

5.5 Areas of Further Research

During the study, the researcher noted that teachers faced different challenges when teaching classrooms. Since the research was done in a rural school, the results cannot be generalized in all the schools therefore a further research can be done on comparison on the effectiveness of ICT integration in using ICT therefore further research can be done on the challenges faced by teachers when using ICT in their teaching and learning in rural and urban schools. This is because most urban schools have adequate computers in their schools and the learners also have their own laptops and cellphones. Most urban schools have access to Wi-Fi in their schools so ICT integration in teaching and learning might have a different impact as compared to the rural areas where most schools have shortage of computers and little or no access to Wi-Fi.

5.6 Chapter summary

This chapter focused on the summary and conclusions of the study in relation to the background of the study and research questions. Some recommendations and areas of further research were also discussed in this chapter.

Appendix 1 Letter from the University



Appendix 2 Permission letter from the school



Appendix 3 Questionnaire for teachers

Greetings, I am Caroline Nyahwema and I am a student of Bindura University of Science Education. I am carrying out a research on the effectiveness of ICT integration in the teaching and learning of mathematics. May you kindly complete this survey? It takes 10 to 15 minutes. The survey is anonymous and information will be used solely for the purpose of study. Thank you.

Section A: Demographic data

1. Age

.

- ☐ Less than 20
- ☐ 21-40
- ☐ 41-50
- ☐ Above 50

2. Gender

.

- ☐ Male
- ☐ Female

3. Qualification

.

- ☐ Certificate
- ☐ Diploma
- ☐ Degree
- ☐ Other:

4. If other above specify

5. Service years

- ☐ Below 2years
- ☐ 2-5years
- ☐ 6-15years
- ☐ Above 15years

Section B: Research questions

6. What challenges are you facing in teaching mathematics using ICT tools?

- ☐ Technical issues
- ☐ Lack of access to ICT devices or resources
- ☐ Lack of ICT skills
- ☐ Electricity

7. To what extent do you agree that the use of ICT in mathematics lessons has increased learners' engagement and motivation (tick all that apply)

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

8. How effective is ICT Integration in improving learners understanding mathematical concepts?

- ☐ Highly effective
- ☐ Moderately effective
- ☐ Not effective

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