BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

Assessing the Impact of ICT Integration in the Teaching and Learning of Mathematics in Chigara Cluster of Chikomba District

BY

CAIN MUTUPO

(Student Number: B225865A)

SUPERVISOR: DR L.H.N MUTAMBARA

A Dissertation Submitted to Bindura University of Science Education in Partial Fulfilment of the Requirements for the Bachelor of Science Education Honours in Mathematics

YEAR December 2024

APPROVAL FORM

The undersigned certify that they have read and recommended to Bindura University of Science Education for the acceptance of a project titled, "Assessing the impact of ICT integration in the Teaching and Learning of Mathematics in Chigara Cluster of Chikomba District", by Cain Mutupo in partial fulfilment of requirements of Bachelor of Education Honours Degree in Mathematics.

SUPERVISOR DATE

29/12/2024

CHAIRMAN DATE

…… ……..

STUDENT DATE

Cain Mutupo 29/12/24

Project Coordinator. Date

.....,..... .....

Department Chairperson. Date

....

RELEASE FORM

NAME OF AUTHOR: **CAIN MUTUPO**

TITLE OF PROJECT:

Assessing the impact of ICT integration in the Teaching and Learning of mathematics in Chigara Cluster of Chikomba District.

DEGREE FOR WHICH DISSERTATION WAS PRESENTED:

BACHELOR OF SCIENCE HONOURS IN EDUCATIONAL MATHEMATICS

YEAR THIS DEGREE WAS COMPLETED: **2025**

SIGNED: C. Mutupo **DATE: 29/12/24**

PERMANENT ADDRESS: House Number: 1218, Northwood, Chivhu

DEDICATION

This research project is dedicated to the Pedzisa, Mutupo and Dube family members for the continuous support and encouragement in this study. These include mothers, fathers, brothers, sisters, in-laws, uncles and aunts in these families as well as friends in the entire community where I stay and work.

ACKNOWLEDGEMENTS

I would like to express my greatest appreciation to my supervisor Dr L.H.N Mutambara, for her unwavering support. Moreover, I appreciate the assistance of the Ministry of Primary and Secondary Education (MoPSE) through its varied personnel in different offices of authority and Government of Zimbabwe for allowing me to be one of the beneficiaries of the Teacher Capacity Development (TCD) programme. Thumbs up to the respondents of the sampled schools in Chigara Cluster of Chikomba District who made this study a success story.

Furthermore, I am grateful to the District Schools Inspector (DSI), Mr Kwenda and his entire team at Chikomba District, the members of staff of Choukudza Primary School (2024) who assisted me in administering the surveys and questionnaires.

Lastly, l would like to give my profound appreciation to my relatives and friends for their continuous support and encouragement. You have always been there for me. I thank you. God bless you abundantly.

ABSTRACT

The purpose of the study was to assess the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District. It was hypothesised that there was no significant difference in the academic achievement of mathematics learners in Chigara Cluster of Chikomba District who use ICT integrated teaching methods compared to those who use traditional teaching methods. In pursuit of these hypotheses, the researcher wanted to assess whether this was true despite the fact that other learners pass mathematics and others fail. Mixed methods research design was used. Surveys from five (5) school administrators and five (5) mathematics teachers as well as teacher questionnaires were designed to probe on the availability and use of ICT infrastructure in the teaching-learning of mathematics in schools. School administrators and teachers of seven schools in Chigara Cluster of Chikomba District were the targeted population of which five of these schools were sampled representing 71.4%, which allowed for the generalisation of the research findings in Chigara Cluster of Chikomba District. After an analysis of these collected data, this research revealed that organisation of staff development sessions by school administrators and attending to them at different levels was commendable. Moreover, the teachers and school administrators' awareness of ICT infrastructure would assist them to choose the best ICT tools when teaching various mathematics concepts. However, schools in Chigara Cluster of Chikomba District lack ICT infrastructure. It is imperative to revisit policy frameworks on financing schools in resettlement areas like the Chigara Cluster of Chikomba District.

TABLE OF CONTENTS

CONTENTS **PAGE**

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Introduction

This first chapter introduces the reader into this study on assessing the use of ICT tools to enhance mathematics teaching-learning in Chigara Cluster of Chikomba District. In addition, the chapter dwells more on the background of the research, statement of the problem, purpose of the study, hypothesis and objectives of the study. It furthermore looks into limitations, delimitations and significance of the study on how the use of ICT has been of benefit to the teaching and learning process of mathematics using the aforesaid tools.

1.2 Background of the Study

ICT can be considered as a vehicle which can elevate the education system to an optimum technology-driven world. It improves the teaching-learning process of the e-generation in as much as it improves the achievement efficiencies of classroom instruction. The Zimbabwean education system follows a 9-4-2-3 model where nine (9) years are spent at primary level and four (4) years are spent at secondary level. These levels are considered as basic education and are mandatory for all children of school-going age (Education Act, 25:04 as amended). It should also be noted that at all these basic education levels, mathematics education is an mandatory; thus, all learners are required to sit for the examinations and pass to obtain a full certificate at both Grade Seven (7) and Ordinary Level, which is also known as Form Four (4).

As a facilitator who has been in service for some time under the Ministry of Primary and Secondary Education, the researcher wondered how the teaching-learning process of mathematics can be enhanced using varied ICT tools in Chigara Cluster. According to Isaacs (2007), the National ICT policy was developed by the Zimbabwean Government in 2005

triggered by the Harvard University e-readiness survey. The President's Office initiated the launch to provide schools with computer-related equipment, but not all rural schools managed to acquire them. Furthermore, Education Sector Analysis (2021) reiterates that the coming of Covid-19 pandemic resulted in more harm than good in as much as the teaching-learning process could take place. The chasm between learners who had educated parents as well as access to technology and learning tools and those who did not has never been more apparent. This chasm, which hampers the teaching and learning of mathematics using ICT tools, is extremely high in Chigara Cluster. This is worrisome, especially when a vast of these ICT tools could be used in the teaching-learning process.

Furthermore, methods being used in the teaching-learning of mathematics in Chigara Cluster of Chikomba District need to be explored if the cherished learning improvement is to be attained. It is therefore imperative to note that mathematics tends to be taught using the traditional chalkboard method (Aggarwal & Bal Gupta, 2020; Kaur, 2023) hence the use of new technologies including infrastructure need to be explored in-depth as echoed by the Nziramasanga (1999) which recommended the promotion of using computers for the teaching-learning in all educational institutions.

Globally, various initiatives were put in place to ensure that teachers being trained acquired the necessary ICT skills. Isaacs (2007) posits that non-governmental organisations, for example, assisted in colleges such as Vlaame Vereniging voor Ontwikkelingssamenwerking enTenchnische Bijstand (VVOB) and College Information Technology Enhancement Programme (CITEP). This was done so that it would be necessary to educate learners to be successful and contribute to the workplace and communities by integrating the traditional teaching-learning methods hand in glove with the use of ICT tools. In contemporary times, ICT is considered a vital means in promoting new methods of tutoring in the teaching-

learning process. United Nations (2022) reiterates that technological innovations have a common goal anchored in solid scientific knowledge of mathematics skills, thus, such skills can be acquired through science, technology, engineering and mathematics (STEM). The researcher sought to assess the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

The Zimbabwean policy Vision 2020 was meant to transform the system into a knowledge-based society while its mission was to fast-track the development and utilisation of ICTs to support economic growth and development. This could only be achievable when the Ministry of Primary and Secondary Education was supported to impart knowledge to its partners. The government got assistance and the incorporation of non-governmental organisations brought innumerable initiatives like the African Virtual University (AVU). Such programmes aimed at the teaching of mathematics and science with the incorporation of ICT tools. Isaacs (2007) reiterates that the key objective was to contribute to the progression of more and high quality teaching personnel through the use of flexible, open, distance, and e-learning (ODeL) methodologies at an affordable cost for diploma, undergraduate and graduate levels.

1.3 Statement of the Problem

Various ICT tools are a necessity in the teaching and learning process of different learning areas across the heritage-based curriculum. In Chigara Cluster of Chikomba District, the major aim of using such tools is to accomplish the unsurpassed learning experiences for the learners as well as the teachers. Effective operation use of ICT tools mainly depends on the approaches chosen in the teaching and learning situation of mathematics. The researcher sought to carry out an assessment of the impact of ICT integration in mathematics teaching-learning. In brief, the study therefore assessed the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

1.4 Objectives

By the end of the research study, the researcher should be able to:

i) assess the current level of ICT infrastructure in schools around Chigara Cluster of Chikomba District.

ii) investigate the current state of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District.

iii) assess the impact of ICT integration on the academic achievement of mathematics learners in Chigara Cluster of Chikomba District.

iv) identify the benefits and challenges of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District.

1.5 Research Questions

The research sought to answer the following questions:

i) What is the current level of ICT infrastructure and resources available for mathematics teaching-learning in Chigara Cluster of Chikomba District?

ii) How do mathematics teachers in Chigara Cluster of Chikomba District currently use ICT in their teaching practices?

iii) What is the impact of ICT integration on the academic achievement of students in Chigara Cluster of Chikomba District in terms of improved grades, understanding and retention of mathematical concepts?

iv) What are the benefits and challenges of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District as perceived by teachers and students?

1.6 Hypothesis

H_0: There is no significant difference in the academic achievement of mathematics learners in Chigara Cluster of Chikomba District who use ICT integrated teaching methods compared to those who use traditional teaching methods.

H_1: There is a significant difference in the academic achievement of mathematics learners in Chigara Cluster of Chikomba District who use ICT integrated teaching methods compared to those who use traditional teaching methods.

1.7 Significance of the Study

1.7.1 To the researcher and other teachers

This study assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District is significant in that it contributes to the extant body of knowledge previously carried out on the effective teaching-learning practices in mathematics education. In this regard, teachers in Chigara Cluster would also be enriched with more knowledge to their pre-existing knowledge and thereby adding current ways of imparting knowledge to learners. The study provides insights into the various means of ICT integration thereby enhancing learner outcomes and teacher effectiveness in the teaching of mathematics. The publication of the findings obtained from this study would enhance delivery of any ICT workshops either at cluster or district levels. This would consequently assist teachers to improve their teaching methods and in a way improve the performance of learners in Chikomba District with Chigara Cluster. Furthermore, assessment methods may be improved using ICT tools.

1.7.2 To policy makers

To the policy-makers, this study reiterates the importance of investing in ICT infrastructure and teacher training programs to modernise the teaching-learning process. The study proffers practical recommendations for teachers, schools and educational institutions to improve the teaching-learning of mathematics in Chigara Cluster of Chikomba District. The government as a whole ought to use these results when designing the curriculum to incorporate the use of ICT tools. This may again impact on the designing of the assessment criteria demonstrating that assessment goes hand in glove with the methods of using various ICT tools.

1.7.3 To other stakeholders

Schools do not exist in a vacuum; thus, it has multiple stakeholders who have a part to play in as much as the teaching and learning process of mathematics is concerned. Such stakeholders include parents and well-wishers who are likely to benefit from the outcomes of the study assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District. After such enlightenment on the methods of using ICT tools in the teaching-learning of mathematics, stakeholders could make determinations to improve the readiness of various ICT tools such as white boards, laptops, projectors, tablets, among other things in schools.

1.8 Assumptions of the Study

For the study to be generalisable, certain assumptions were made with regards to learners, teachers, other stakeholders and facilities. These include:

i) Schools in Chigara Cluster have access to adequate technological infrastructure such as computers, internet connectivity and software, which is functional.

ii) Mathematics teachers have received adequate training and support to effectively integrate ICT in their lessons and are motivated to exploit the ICT tools thereby enhancing their value to learner outcomes.

iii) All learners in Chigara Cluster have equal access and opportunities to use computers and the internet outside the school to reinforce their learning.

iv) The curriculum is aligned to the ICT integration and teachers are exhausting appropriate digital tools.

v) Learners in Chigara Cluster are fully engaged and motivated to learn mathematics through ICT.

vi) Parents are supportive of the integration of ICT tools in the teaching-learning process and encourage learners to use the technology for learning.

vii) The teaching-learning environment in Chigara Cluster is inclusive, equitable and allows all learners to benefit from ICT integration.

viii) There is adequate availability of technical support to address technical issues that may arise due to ICT integration

ix) Data collected on learner performance and teacher feedback is accurate and reliable.

1.9 Delimitations of the Study

The study of assessing the impact of ICT integration in mathematics teaching and learning was delimited to both primary and secondary schools in Chigara Cluster of Chikomba District. The use of ICT tools and resources such as computer software, online resources and multi-media materials would be noted in the sampled schools. Similarly, the researcher would take note of the effects on learning outcomes together with academic achievement, motivation and attitudes towards mathematics of teacher attitudes and other forces affecting

the teaching-learning of mathematics in Chigara Cluster. A lot of experiences and perceptions of primary and secondary schools teachers would deepen the insight of the study.

1.10 Limitations of the Study

There is a probability of interference of some variables with the study assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District. As a result, the study had a small sample size that limited the geographical scope, which may not be representative of all primary and secondary schools. This was also similar to the reliance on self-reported data from teachers who may be subject to bias. Moreover, the focus of the study has short-term effects which may not capture the long term impacts of ICT integration and the lack of control over the extraneous variables like the differences in teacher expertise and school resources. Last but not least, there is limited generalisability to other learning areas except mathematics.

1.11 Definition of Terms

i) **Computer**: A machine that automatically admits stores and processes data to produce information. Muvikana (2018) defines a computer as a programmable electronic device that stores, retrieves and processes data in binary form in accordance with the instructions set to it in a variable program.

ii) **ICT tools** refer to the latest technology or devices and concepts used in information communication and technology among learner-teacher interaction such as flipped classrooms, mobile applications and clicker devices (.igi-global.com dictionary, n.d). Muvikana (2018) defines information communication and technology (ICT) as an umbrella term that refers to multiple software and hardware components like computers, projectors, internet, video and digital cameras, which can be used to assist in the twenty-first (21^{st}) century teaching and learning practices.

iii) **ICT infrastructure** (technology infrastructure) refers to what enables an institution such as a school to build and run the applications that unpin business, that is, the teaching-learning of mathematics (**accenture.com**, n.d.).

iv) **ICT integration** refers to the effective use of technology to enhance and support teaching-learning processes (Koehler & Mishra, 2019).

v) **A cluster** is a group of schools that are located in the same proximity to each other and share common characteristics such as similar socio-economic profiles, geographic location and educational needs (MoPSE, 2017).

1.12 Summary of Chapter

The chapter dealt with the background of study, statement of the problem, hypotheses and objectives of assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District. It further went on to highlight the significance of the study, assumptions, delimitations and limitations of the study as well as defining the key terms of the research study. Chapter two (2) delves into the literature review pertinent to assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Chapter two (2) looks into the gaps which were noticed by this researcher in order to carry out this study. This chapter also discusses the issue of availability of ICT infrastructure and resources and how they are used in the teaching and learning of mathematics practices in Chigara Cluster, especially in comparison with findings from previous studies. Furthermore, the chapter focuses on the impact of ICT integration on academic achievements of students as well as the benefits and challenges of ICT integration in mathematics teaching and learning.

2.2 Theoretical Framework of ICT Infrastructure

The study of assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District adopts a social constructivist perspective. Vygotsky (1978) echoes that in social constructivism, learning is a socially meditated process which involves the construction of meaning through interactions with others as well technology referred to as ICT infrastructure in this study. This implies that the study is grounded in Technological Pedagogical Content Knowledge (TPACK) that posits that operative technology integration in teaching requires a deep understanding of the interplay between technology and pedagogy where teachers have the ability to integrate ICT infrastructure into Mathematics teaching practices, (Singh & Kumar, 2023).

Teachers as key stakeholders the implementation of the mathematics syllabus should be aware of pedagogical knowledge where they should be able to understand how to teach the subject effectively. The teaching of mathematics must incorporate the use of ICT infrastructure, (World Bank, 2020). ICT integration improves theoretical understanding by providing visual representations of mathematical concepts for easier understanding and increased interactive engagement.

2.3 Current Level of ICT Infrastructure and Resources Availability

The Nziramasanga Commission (1999) recommended that the education system should embrace the use of computers and other ICT infrastructure in all the spheres of the teaching and learning process. Muvikana (2018) postulates that the government of Zimbabwe adopted the ICT policy in 2005 to enhance the promotion of the aforementioned initiative thus led to the National ICT policy 2022-2027. The government got assistance from multiple non-governmental organisations to promote the incorporating ICT tools in the teaching-learning of mathematics. Papanthymou and Darra (2023) argue that the knowledge of the curriculum

should be connected with complete programs that are designed for teaching all subjects including mathematics, that is, with varied educational materials being available.

The role of information communication and technology (ICT) infrastructure can be used in the promotion of national development by incorporating them in the teaching and learning process both in urban and rural areas of Zimbabwean schools. The implementation of ICTs has the latent to empower communities and countries at all levels (Bankole, 2015), especially in mathematics. The twenty-first (21^{st}) century is supposed to offer plenty of practical methods if learners are to achieve the benefits of learning. There should be a major paradigm shift between how mathematics was taught and learnt in the traditional classroom and in the contemporary classrooms.

However, it was imperative for the researcher to assess the implementation of ICT integration in schools around Chigara Cluster and observe if both teachers and school administrators are aware of the ICT infrastructure. Moreover, the researcher wanted to assess whether these resources were being used in the teaching-learning process. According to Ayodele (2019), ICT infrastructures allow for high-speed internet, and it give schools the ability to be able to manage its teaching-learning territory glowing. The hub of information infrastructures in the twenty-first (21^{st}) century teaching-learning is the capacity to associate to the internet at any given school in the Chigara Cluster. Presently, the foremost approaches of the internet connectivity are satellite and linking to maritime fibre optic cables (Meta, AI). The world of education has a paradigm change, thus, moving from traditional teaching to an amalgamation of both the online mode and traditional teaching-learning where learners discover some facts and learn at any time anywhere (Akinoso, Agoro & Alabi, 2020). However, the major question may be to ask whether these ICT tools are available in schools in Chigara Cluster to assist both teaching-learning process.

2.3 Teachers' Current Use of ICT in Mathematics Teaching and Learning Practices.

A good mathematics teacher must have knowledge of diverse teaching strategies and these should be applied according to the needs of the learners (Akinoso et al., 2020). The use of ICT in the teaching-learning processes of mathematics assists teachers in shunning traditional methods of teaching hence promotes technology based teaching-learning process. Chagwiza and Mutambara (2019) argue that ICT integration should be done in a way which complements traditional teaching methods rather than replacing them completely. In support (Akinoso et al., 2020) argue that the world has moved to be a global village in which both the teachers and learners can reach out to several parts of the world and have an ideal of their education system, get access to any concepts online, study through video lectures from different parts of the globe and either ask or submit questions when they require necessary clarification. The integration of ICT tools and techniques has a potential for a better quality of teaching-learning process in the education system (Jing Wen & Maat, 2020).

Teachers are the key stakeholders for successful knowledge transfer to both learners and the community. For mathematics teachers to provide global education to learners, teachers must incorporate and allow communication, collaboration, critical thinking and creative problem solving to reflect in the teaching-learning of mathematics (Akinoso et al., 2020). It therefore implies that mathematics teachers should provide an environment that suits learners to develop all skills as echoed by (Akinoso et al., 2020) so that we get a holistic learner who can critically solve problems. To provide such an environment, teachers require constant professional development, as Papanthymou and Darra (2023) reiterate. This is the professional progress that teachers accomplish and gain more experience in relation to their educational endeavours thereby developing critical thinking in evaluating their teaching methods. According to Ghavifekr and Rosdy (2015), the current digital era regards teachers

as key stakeholders when they use ICT tools in their daily teaching-learning process. Chagwiza and Mutambara (2019) argue that ICT integration requires adequate training and support for mathematics teachers. This begs the question: Were the teachers in Chigara Cluster well-trained in the use of ICT in the teaching of mathematics? Information communication technology aids to build better communication between learners and teachers where learners can get feedback from their teachers as quickly as possible. Graham, Stols and Kapp (2020), opine that technology can be uniquely used when an educational institution has adequate resources and investment for ICT adoption. In this regard, do schools in Chigara Cluster have adequate resources to invest in ICT infrastructure? Are teachers in Chigara Cluster well versed in the use ICT in the teaching of mathematics?

Jing Wen and Maat (2020) reiterate that the readiness of teachers to utilise particular technology is determined by their attitudes, intention and perception. Using ICT promotes knowledge sharing and communication among teachers and learners, which is essential for increased impetus for learning mathematics. Constructive mathematics teaching-learning is supported by ICT where learners can appreciate mathematical concepts by exploring the contemporary technologies.

2.4 Impact of ICT Integration on Academic Achievement

Information communication technology (ICT) helps teachers to sharpen their intellectual ideas, which they can use to transform students' prior knowledge, aptitudes and skills hence linking materials with mathematical concepts, address common understandings and introduce more advanced ideas (Raj Joshi, 2017). ICT skills help teachers to teach mathematical facts, concepts, skills, knowledge and assists learners to attain their mathematical understanding more effectively. Furthermore, ICT skills help to nurture the capability of learners and teachers. However, the study sought to explore whether schools in Chigara Cluster were

using ICT tools in their teaching-learning process to improve academic achievement. Information communication technology (ICT) is crucial in the teaching-learning of mathematics as it influences the mathematics education that is taught and enhances learning achievements (Raj Josh, 2017). A paradigm shift in pedagogy by using ICT tools in Chigara Cluster would therefore motivate teachers to use current teaching-learning methodologies to develop learners' conceptual understanding, procedural articulacy and premeditated competencies in mathematics. ICT skills would make mathematics teaching healthier and increase the achievement of learners in Chigara Cluster of Chikomba District.

2.5 Benefits and Challenges of Using ICT Integration in the Teaching-Learning of Mathematics

The use of ICT infrastructure has a multiple of benefits and challenges to both teachers and learners. In support of this, Raj Josh (2017), reiterates that the use of technology is also helpful for mathematics teachers in the study of assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

2.5.1 Benefits of using ICT integration in mathematics teaching-learning process

ICT can advance the effectiveness of teaching, learning and management of schools and teachers' professional development. Raj Joshi (2017) echoes this view by insisting that ICT assists teaching in a more effective way through raising the arithmetical and logical skills in mathematics of learners as they use interactive technology such as projectors, varying types of computer and the internet. According to Chagwiza and Mutambara (2019), ICT facilitates the use of concrete media and applications, thereby making mathematics more relevant and interesting to learners. Appropriate use of computers matches the ability of learners and teachers, which leads them to efficiently comprehend the different mathematical notions.

Furthermore, ICT tools assist teachers to focus on either more truthful or domineering problems, supple strategies, exploration and sense-making with multifarious representations, mathematical meaning and clarification of concepts (Dillon & Boyd, 2023). Teaching mathematics improves learners' erstwhile knowledge and skills, integrate their mathematical concepts, clarify corporate understandings and upsurge innovative ideas amongst both teachers and learners. According to Chagwiza and Mutambara (2019), ICT provides a wealth of mathematical resources such as online tutorials, videos and other educational software that assist problem solving. Mathematics problem solving involves four (4) steps, namely understanding the problem, devising a plan or solution, implementing the plan and looking back or examining the solution (Raj Joshi, 2017).

By using ICT tools, learners can improve upon the rote learning method which fosters repetition in their learning process; thus, the use of technology by teachers inculcates effectiveness of teaching-learning process thereby making learning easy. Chagwiza and Mutambara (2019) echo in support that ICT provides personalised learning experiences for learners by catering for their individual needs and abilities, that is, if they harness the infrastructure properly. This helps to grasp the concept of altered mathematical aspects at the same time increases the creativeness and achievement of students. This study sought to establish whether teachers and school administrators in Chigara Cluster were aware of these benefits of using ICT in the teaching-learning of mathematics.

2.5.2 Challenges of using ICT integration in mathematics teaching-learning process

Multiple factors can hamper the use of ICT integration in the teaching-learning process of mathematics. (Raj Joshi, 2017) identifies these factors as policy, infrastructure, human resources, software and hardware, and technical variables. The introduction of ICT as a subject in schools has seen more teachers being deployed in schools. These are regarded as

ICT human resources who just teach this subject only in school ignoring the integration of IT in other learning areas.

There has been a long-time debate on how to use ICT in the teaching of mathematics by educators. As observed by Dillon and Boyd (2023), schools are not ready to adopt technology and this has suggestively affected the ratio of personal computers to the numbers of the students and teachers in schools. Chagwiza and Mutambara (2019) assert that most schools in rural areas face a challenge in accessing technological resources and internet connectivity. The lack of technological tools such as computers means a technological gap is retained, especially in the teaching-learning process for less resourced schools like those in Chigara Cluster of Chikomba District. The adoption of ICT in the teaching-learning process is therefore minimal in less resourced schools that have little access to computers which are the main tools for the integration of mathematical software and the internet. As reported by Dillon and Boyd (2023), a large number of schools in the rural areas in the twenty-first (21^{st}) century are still ill-equipped with application programmes, mathematics software and digital content. In light of their report, this researcher sought to discover the situation in Chigara Cluster.

2.6 Summary of Chapter

The chapter has reviewed other studies on the integration of ICT in the teaching of mathematics in various countries. From the various previous studies, the researcher noted various gaps that this study sought to assess. First, in the previous studies it was not clear whether teachers were well versed with the use ICT in the teaching of mathematics. Secondly, the previous studies did not establish whether schools were using ICT tools in their teaching-learning process to improve academic achievement. Thirdly, previous studies could not establish whether teachers and school administrators were aware of benefits of using ICT

in the teaching-learning of mathematics. Lastly, this study sought to discover whether rural schools in Chigara Cluster of Chikomba District were prepared to embrace the teaching and learning using the ICT tools in the teaching-learning of mathematics. The next chapter will dwell on the research philosophy, research design, data collection instruments and how the sample will be selected in Chigara Cluster of Chikomba District.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Chapter three (3) describes the methodology and methods used by the researcher to carry out a study on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District. It furthermore dwells on the pragmatist research methodology as well as the mixed methods, qualitative and quantitative research designs.

3.2 Research Philosophy

3.2.1 Pragmatism

The research philosophy of pragmatism is referred to as an approach which suggests that there are multiple ways of interpreting the world. This was relevant in this research study to investigate reality of how *ICT is being integrated in the teaching and learning of mathematics in Chigara Cluster* and the combinations of different approaches further provided a wider understanding of the phenomena under investigation. Kaur (2023) reiterates that pragmatism involves research designs that incorporate operational decisions based on what works best in finding answers for the questions under investigation. This approach allowed the researcher to conduct innovative and dynamic ways of finding solutions to the study of assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

The study on assessing the impact of ICT integration in Mathematics teaching and learning in Chigara Cluster of Chikomba District was based on the key principles of pragmatism as echoed in Maarouf (2019). This places emphasis on actionable knowledge, the recognition of the interconnectedness between experience, knowing and acting together with the view of inquiry as an experiential process. In relation to the study, the researcher explored the

knowledge which mathematics teachers had in relation to the use of ICT infrastructure and software in teaching mathematics and how learners responded to these methods. Moreover, the study examined the relationship between the experience of teachers and learners in using such a modus operandi in transferring knowledge to learners and how learners could assist each other and give feedback to teachers thereby showing new knowledge having been acquired. Maarouf (2019) argues that pragmatism is a coherent, integrated paradigm which conceptualises ontological, epistemological and axiological stances in a way that combines both quantitative and qualitative paradigms.

3.3 The Research Design

Muvikana (2018) opines that a research design is a preconceived plan according to which data are collected and analysed to assess a research problem. The research on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District used the mixed method approach, that is, use of both quantitative and qualitative research designs. To assert this approach, Maarouf (2019) argues that pragmatism is a lucid, integrated hypothesis which conceptualises its ontological, epistemological and axiological standpoints in a way that conglomerates both quantitative and qualitative paradigms. The researcher thus selected these to study a predetermined set of questions.

3.3.1 Quantitative research paradigm

Creswell (2014) opines that quantitative research is a method that can be used to seek either empirical or experimental support for the research hypothesis by exploring the totality of the situation of the teaching and learning of mathematics using ICT infrastructure on the measurement of quantity or amount and observation. It is based on objectivism and positivism hence its named scientific research (Creswell, 2016). Fischler (2023) echoes that, in education, quantitative research is what the researcher decides to study, asks explicit and

narrow questions hence collect computable data from the participants, in this case, mathematics teachers and school administrators of the sampled schools in Chigara Cluster. The researcher further analysed these numbers using statistics and conducts inquiry in an unbiased and objective manner. With this research paradigm, there is only one reality, which is objective and is separate from the perceptions of the researcher. The researcher is independent of the phenomenon of assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District and is neither affected nor affect the study. Moreover, the main objective of quantitative research is to measure the causal relationship using a free-value framework (Maarouf, 2019). In this case, it can be noted that it is a confirmatory and deductive, thus, information gathered can be tested and theories are hypothesised by assessing the relationship (Creswell, 2014) between the impact of ICT integration in mathematics teaching and learning. The researcher used strategies of enquiry such as surveys and predetermined instruments of collecting data like questionnaires.

3.3.2 Qualitative research design

Qualitative research design is a method of enquiry employed in different academic disciplines and non-profit making organisations. These include schools in Chigara Cluster of Chikomba District where the researcher tries to assess the impact of ICT integration in Mathematics teaching and learning in Chigara Cluster of Chikomba District and either take relative action or interaction on the grounded views of respondents who are school administrators and teachers in the area under study (Creswell, 2014). This means that it depends on the collection and analysis of qualitative data collected. Maarouf (2019) describes it as exploratory, thus, an inductive approach which aims to explore and gain a deeper understanding of the meanings that individuals or groups attach to the social phenomena such as assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District. The study focuses on the way individuals interpret and make

sense of their experiences in order to gain an understanding of the social reality of the participants by exploring their behaviours, perspectives, feelings about how mathematics is being taught and their experiences *in Chigara Cluster of Chikomba District*.

Participants were also requested to answer the question: *Do teachers have relevant qualifications to teach Mathematics using ICT infrastructure?* Wimmer and Dominick (1991) together with Creswell (2016) concur that the uniqueness of the characteristics of interpretivism is the association of data categories from surveys and questionnaires. To enhance such characteristics, the researcher should practise theoretical sampling of different groups so that there is maximising of similarities and differences in information.

3.3.3 Specific research methods

The study on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District used the mixed methods, that is, quantitative and qualitative methods. These methods proved beneficial to the researcher because of the researcher belief in statistics and the grounded theory could be used to explore phenomena, which could provide sufficient, reliable and valid information (Leedy, 2005). Quantitative research may be used to get large volumes of data at one (1) goal, which can be used for evaluation of the concept under assessment (Cohen & Manion, 2011; Creswell, 2014).

3.3.4 Triangulation of research designs - Mixed methods

Creswell (2016) refers to triangulation as a process which includes the use of multiple and varied methodologies together with research designs that researchers use in the study of phenomena. Triangulation provides diverse ways of gathering data about the same phenomenon, and thereby increasing the credibility by strengthening confidence in varied conclusions which can be drawn from the study (Patton, 2002; Madhlangobe, 2009).

Chagwiza and Mutambara (2019) posit that triangulation increases validity and reliability. Data may be collected using field methods such as administering questionnaires and surveys. These are done to seek convergence in qualitative and quantitative research designs. In support of this view, Du Plooy (2021) suggests that an attempt by researchers to use multiple data collection sources helps to increase reliability of results thereby compensating the shortfalls of the other methods.

3.4 Study Population

Study population refers to a group of respondents or objects in the research study who have similar characteristics in one or more ways and form the subject of the study (Muvakana, 2018). In this research study, the population reflects well-defined groups and sub-populations (Chimedza, Chipoyera & Mupambireyi, 2001) who were school administrators and teachers who teach mathematics in both primary and secondary schools in Chigara Cluster.

3.5 Study Sample

Brink (2021) defines a study sample in a research as a subset of a population and advises that the researcher should determine the type of population, its accessibility and the best method it can be sampled. The researcher used stratified random sampling technique to determine the participants. These included five (5) school administrators and five (5) mathematics teachers of the sampled schools out of seven schools in Chigara Cluster composed as follows: five (5) primary schools and two (2) secondary schools, thus, three (3) primary schools and two secondary schools made the sample in this study included school administrators and mathematics teachers of the sampled schools in Chigara Cluster. Muvikana (2018) reiterate that the selected small group (sample of people) are known as respondents. Respondents are people who give data which to be used for analysis of the research study. Creswell (2016) posit that a sample is a subset of the whole population which the researcher works on so that

conclusions can be drawn. These conclusions exhibit the characteristics of the population of the impact of ICT integration in mathematics teaching and learning in Chigara Cluster.

Equal opportunities were given to all schools in Chigara Cluster to participate in the research study on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District. Use of yes/no cards was done in such a manner that sixty percent (60%) participates to allow for a proper generalisation of the results across the cluster because of proper representation.

3.6 Research Instruments Used in the study

The researcher used pragmatist research paradigm spirit and mixed methods research design methodologies. Furthermore, the researcher used a questionnaire that had both open and closed questions and surveys in the data collection. These were used to generate and solicit information to respond to questions on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District. These were designed in accordance to the research sub-questions as outlined in Chapter 1. This entailed the triangulation of the data collected and each had its own merits and demerits. The choice of the instruments ensured that adequate data would be collected and generated. According to Best and Khan (2023), triangulation give a more detailed and balanced picture of the impact of ICT integration in mathematics teaching and learning.

3.6.1 Questionnaire and survey design

The researcher used the questionnaire in order to capture data to answer the research question. De Vos, Strydom, Fouche and Delport (2018: 166) define “a questionnaire as a set of questions on a form which is completed by a respondent in respect of a research study.” Leedy (2018) adds that a questionnaire is a common instrument for data observing beyond

the reach of the researcher, thus, the questionnaire represented the researcher in the areas beyond reach. Chimedza, Chipoyera and Mupambireyi (2001) argue that the questionnaire should not be too long and complicated, and data captured using such an instrument should be easy to capture and transfer to computer packages and short instructions should also be available. In this regard, the researcher should avoid leading questions but rather use simple, clear and concise questions.

However, the questionnaire requires honesty on the part of the respondents so that accurate conclusions and recommendations are conveyed. Muvikana (2018) argue that the questionnaire does not permit either probing or editing of questions once distributed. Furthermore, it cannot be determined whether the required respondents are the ones who really participated or not. In light of the above shortfalls of the questionnaire, the researcher opted on checking for validity using surveys for school administrators. The surveys authenticated data collected from the questionnaire questions to ensure that there was correlation of information from mathematics teachers in Chigara Cluster as well as their school administrators.

3.6.2 Development of questionnaire and survey questions

These are superintendent questions which the researcher used to amass information from school administrators and teachers of sampled schools. The questionnaire for teachers was used as a source of getting further information from the respondents. These qualitative data sources allowed the researcher to understand the lived experiences of participants therefore increasing an understanding of participants' views that gave researchers knowledge about using effective interventions of the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District (Mishna, 2004; Marshal; Rossman, 2006; Madhlangobe, 2009).

3.7 Data Collection

The study on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District used a questionnaire and a survey as its research instruments. The questionnaire administered provided the researcher with first-hand data on the state of ICT infrastructure in schools around Chigara Cluster of Chikomba District. Brink (2021) argues that researchers should identify alternative procedures of collecting data and should be able to evaluate the merits and demerits of each. The researcher used the questionnaire because they enhance an efficient way to attain information about an extensive range of research problems (Khoaene, 2022). Each question tries to find out more information on the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

Surveys are used when the researcher wants to gather data from a large number of respondents and when it is impractical to meet all of them face to face. Surveys can both be formal where the results are subject to statistical reliability and validity (Muleya, 2018). Surveys involve the collection of information from the sample of individuals through their responses to questions because of its versatility, efficiency and generalisability. Merits of the survey data is that it can be collected from voluminous respondents at a stumpy cost.

3.7.1 Administration of the questionnaire and survey

The researcher used one research assistant to assist in administering both the questionnaire and survey. These were designed to capture all the necessary unavailable information on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

3.8 Data Analysis and Presentation

Data analysis is chiefly determined by the research methodology that the researcher used, that is, survey and grounded theory which produced varied brands and amounts of data. Muleya (2018) posit that surveys habitually encompass the use of multivariate analysis for the determination of associations between variables. The main objective of data presentation is to digest data and present it in a specific form hence still giving a correct understanding of collected data. Survey data was scrutinised using tables, bar graphs and pie charts of information on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District.

3.8.1 Tables and figures

Tables and figures were used to make it easy for varied data to be on a single place. Tabulated data enhanced reduced amount of text which simplifies the interpretation of relationships between variables and helped to explain the study phenomenon. Chimedza, Chipoyera and Mupambireyi (2001) assert that tables are easily understood by many people. The major merit of tables and figures is that it enables the easiest and most effective ways of presenting huge amounts of information, and excel packages make the design and manipulation of tables is easy (Muleya, 2018).

3.8.2 Bar graphs and pie charts

Bar graphs and pie charts show the comparisons of maxima and minima levels clearly and have proven to be easy to interpret and highlight underlying patterns. According to Crawshaw and Chambers (2018), bar graphs have bars of equal width and can be either vertically or horizontally constructed; thus, the patterns can be seen more clearly with some form of pictorial representation.

Pie charts are simple diagrams that used for comparisons of limited amounts of information how mathematics teachers use ICT in their teaching practices.

3.9 Ethical Considerations

According to Du Plooy (2021:45), "Ethics involve the assessment, based on '*moral*' values, of courses of action, directed by individual, social and cultural values and experiences." This researcher adhered to some ethical rules, regulations and principles guiding research. The researcher thus sought permission to gather information from the sampled schools in Chigara Cluster and respondents were selected based on the number of mathematics teachers to pupil ratio. Letters from Ministry of Primary and Secondary Education (MoPSE) head office, provincial and district offices were relayed to different portfolios for permission to do research. The researcher explained to the respondents the purpose of the research. During the data generation and collection for the study on assessing the impact of ICT integration in mathematics teaching and learning in Chigara Cluster of Chikomba District, the researcher ensured that participants felt free to volunteer their lived experiences regarding the research study.

3.10 Measures Taken to Minimise Errors and Counter Check Findings

Sampled participants represented more than sixty percent (60%) of the entire population for the findings to be generalised. Drawing of a sample of the population is a way to make sure that there is a representative of the population (Du Plooy, 2021; Creswell, 2016). The sample should be a larger part of the population if the researcher wants to cross analyse variables (Muleya, 2018). This was observed with the aid of use of stratified random sample in this study in Chigara Cluster.

3.11 Summary of Chapter

Chapter three (3) focused on research paradigm, that is, the pragmatist perspective. Also, the research designs, namely mixed methods (qualitative and quantitative) and the population sample were discussed, and the researcher explained how these were selected. Furthermore, the chapter limned data gathering instruments, namely the questionnaire and survey and the presentation of data using tables, pie charts and graphs. Lastly, the chapter described ethical considerations and the measures used to minimise errors together with counter check the findings. Chapter four (4) focuses on data analysis and presentation.

CHAPTER 4: DATA PRESENTATION AND ANALYSIS

4.1 Introduction

Chapter four (4) presents data, and analyses it as shown in the graphs, tables and pie charts. Surveys of school administrators and teachers were indicated as bar graphs, line graphs and pie charts. Questionnaire responses by teachers are also discussed to triangulate the teacher survey responses.

4.2 Survey Responses from School Administrators

Section 4.1 of data presentation and analysis shows responses from school administrators' from surveys carried out by the researcher. These will answer questions on the availability of ICT infrastructure in schools, their ability to use ICT infrastructure in carrying out supervision, organisation of staff development workshops for Mathematics teachers to empower them into the use of ICT in the teaching-learning process among many others. As recommended by (Nziramasanga, 1999) that all educational institutions should embrace use of computers for teaching and learning, figure 4.2.1 indicates the situation in schools in Chigara Cluster of Chikomba District.

4.2.1 Availability of ICT infrastructure in schools

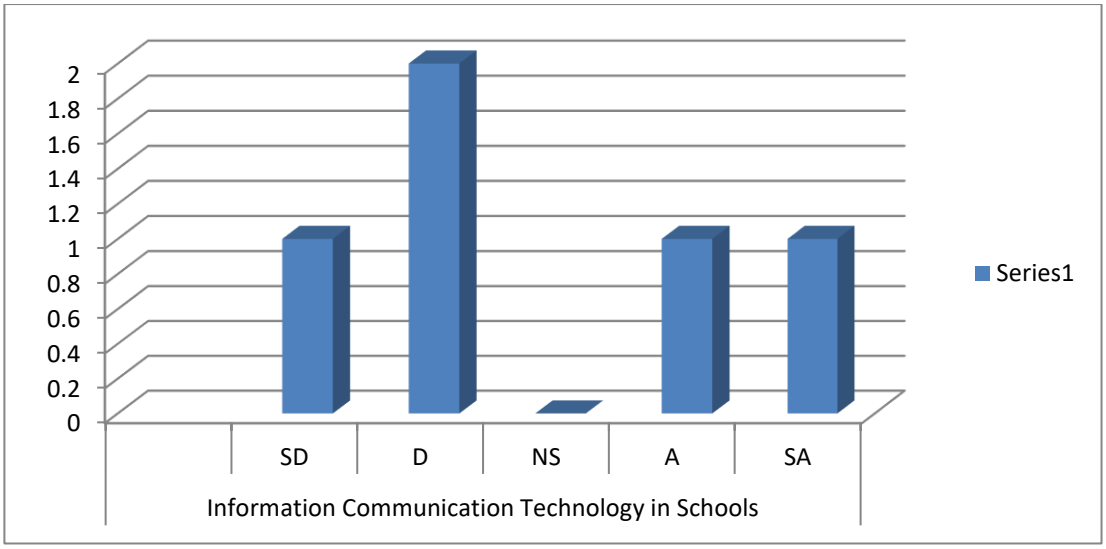

Figure 4.1: Availability of ICT infrastructure in schools

In a sample of five school administrators, the bar graph indicates that one (1) school administrator strongly disagrees to the notion that schools have ICT infrastructure and just two (2) disagree to the notion. Furthermore, one (1) school administrator either agrees or strongly agrees to the notion. This implies that since three (3) out of the five participants either strongly disagree or disagree, the researcher concluded that schools in Chigara Cluster of Chikomba District did not have adequate ICT infrastructure.

4.2.2 Adequacy of ICT infrastructure in schools

The survey shows that two (2) school administrators strongly disagreed that schools had adequate ICT infrastructure and the second pair disagreed to the question on adequacy of such infrastructure. One (1) participant strongly agreed to the item under assessment. Since eighty percent (80%) of the participants disagreed to the item that schools in Chigara Cluster of Chikomba District have adequate ICT infrastructure the researcher concluded that these schools have inadequate ICT infrastructure. The execution of ICTs has the embryonic to

empower communities and countries at all levels (Bankole, 2015), thus, this empowerment will be shuttered in Chigara Cluster of Chikomba District.

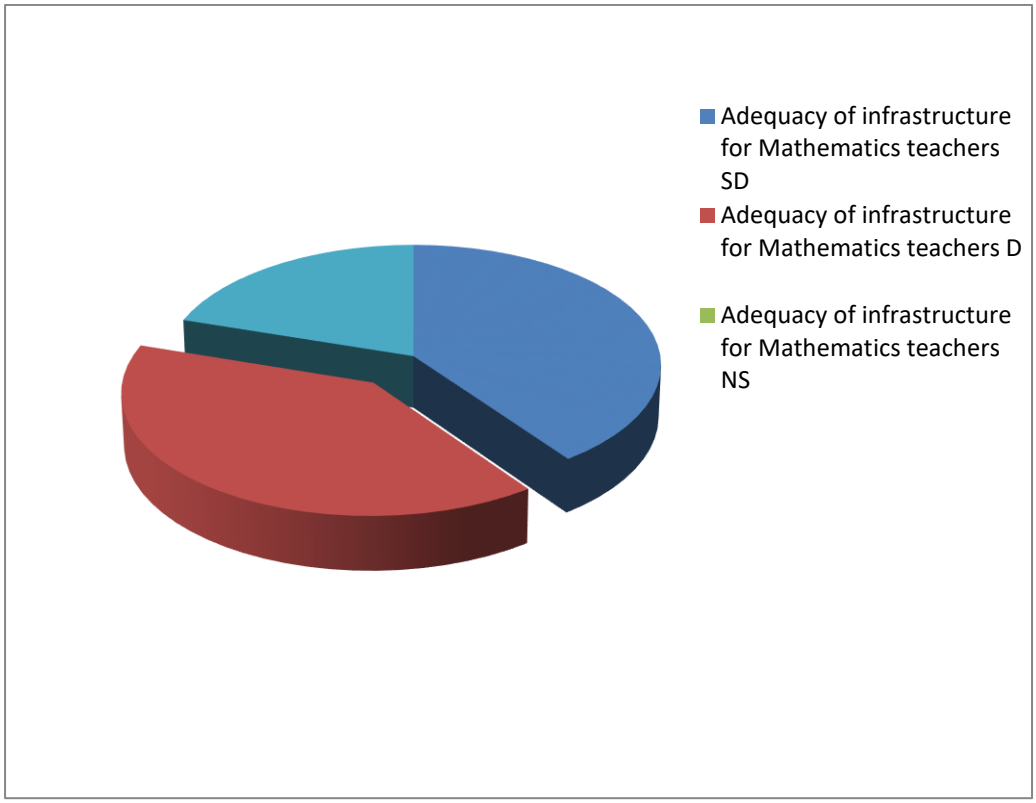

Figure 4.2: Adequacy of ICT infrastructure in schools

4.2.3 Use of ICT infrastructure in mathematics teaching by teachers

The sample size was five (5) and two fifths (2/5) of the participants disagreed that they use ICT infrastructure to teach mathematics concepts. Contrary, three fifths (3/5) either agreed or strongly agreed that mathematics teachers use any ICT infrastructure to teach any topic. The researcher concluded that, even though there is inadequate ICT infrastructure in schools, mathematics teachers used ICT tools to teach learners in schools in Chigara Cluster of Chikomba District. This was in agreement with what (Dillon and Boyd, 2023) echoed by

saying that ICT tools assist teachers to focus on either more truthful or officious problems, exploitations and sense making with diverse representations and classifications.

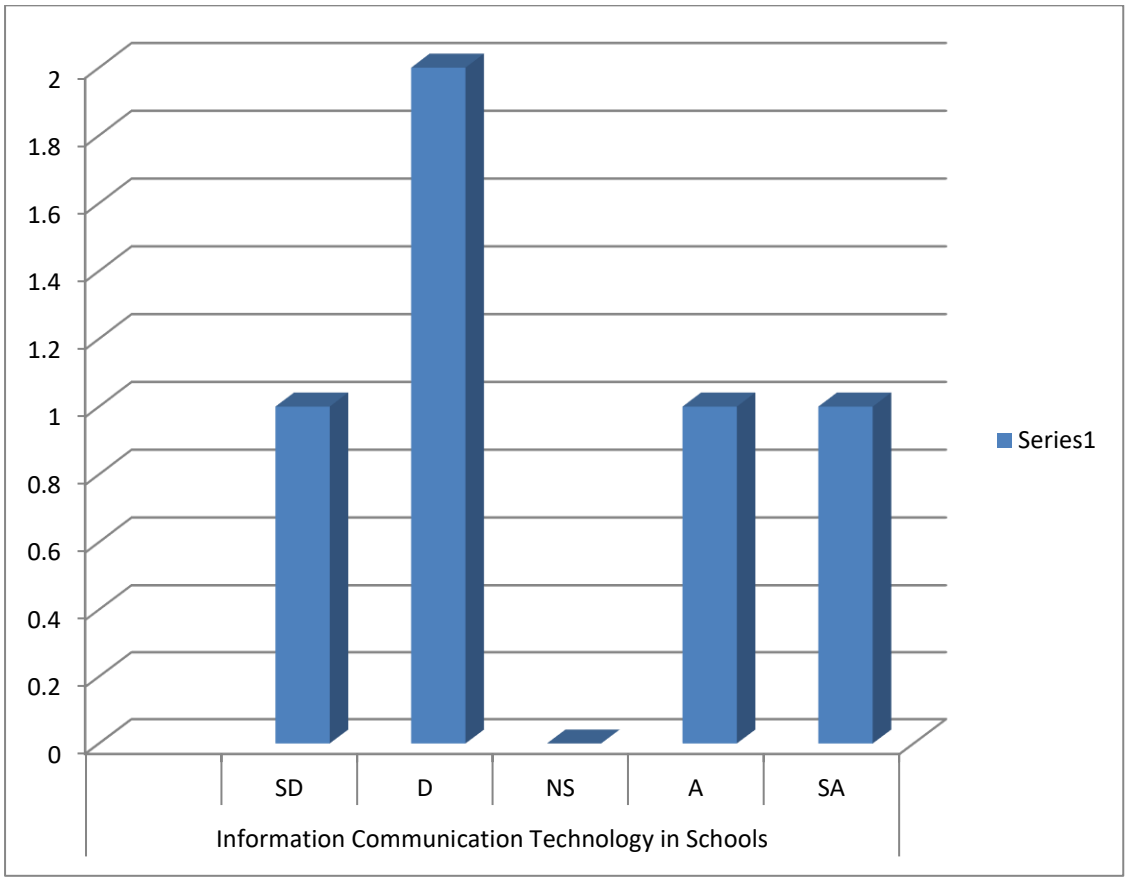

Figure 4.3: Use of ICT infrastructure in mathematics teaching by teachers

4.2.4 Organisation of staff development sessions for mathematics teachers to teach using ICT infrastructure.

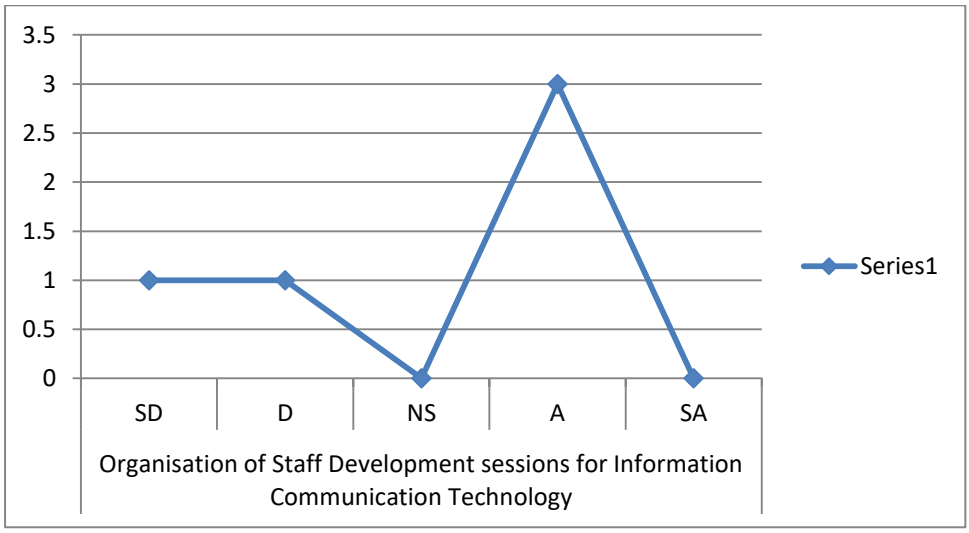

Figure 4.4: Organisation of staff development sessions for mathematics teachers to teach using ICT infrastructure

The researcher, as shown in Figure 4.4 found out that one (1) school administrator strongly disagreed to organising staff development sessions for mathematics teachers to teach learners using ICT infrastructure. Similarly, one (1) school administrator disagreed to the notion in question. Conversely, three (3) school administrators agreed that they organised staff development sessions for mathematics teachers in Chigara Cluster of Chikomba District to teach using ICT infrastructure. Despite the shortage of ICT infrastructure in schools in Chigara Cluster, it can be concluded that school administrators make an effort to make sure that mathematics teachers teach using ICT infrastructure since 0.6 of the participants agreed. This has been supported by (Akinoso et'al, 2020) who postulated that mathematics teachers should have knowledge of diverse teaching strategies which must be applied to learners using differentiated learning.

4.2.5 Staff development sessions for ICT integration in teaching mathematics

The researcher observed that one (1) school administrator strongly disagreed that there were no more than three (3) staff development sessions done for ICT integration and also that one (1) school administrator disagreed to the notion. In the same vein, two (2) school administrators agreed that more than three (3) staff development sessions were done, and that one (1) school administrator strongly agreed that there were more than three (3) staff development sessions that were held. The researcher therefore concluded that there are more than three staff development sessions that are done on ICT integration in the teaching of mathematics in Chigara Cluster of Chikomba District and there is an agreement with (Jing Wen and Maat, 2020) that ICT tools when integrated with other techniques promote a better quality teaching-learning process.

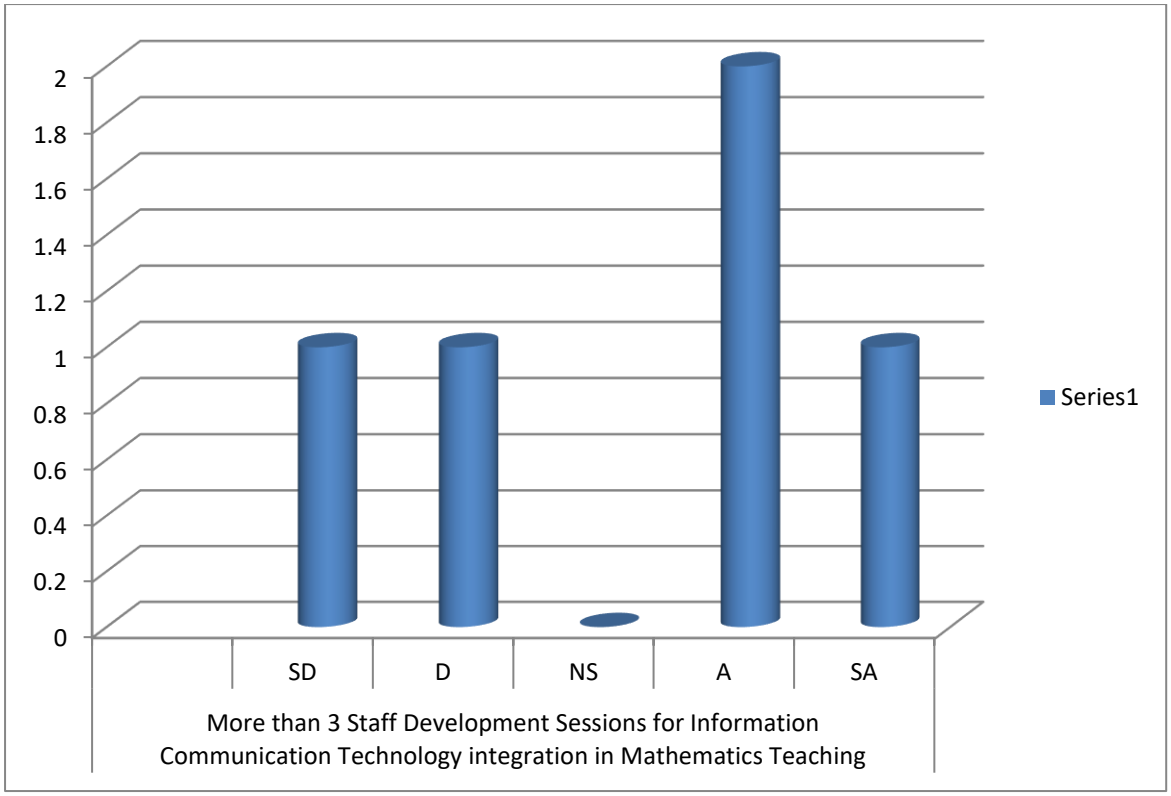

Figure 4.5: Staff development sessions for ICT integration in teaching Mathematics

4.2.6 School administrators attend staff development sessions for supervision purposes

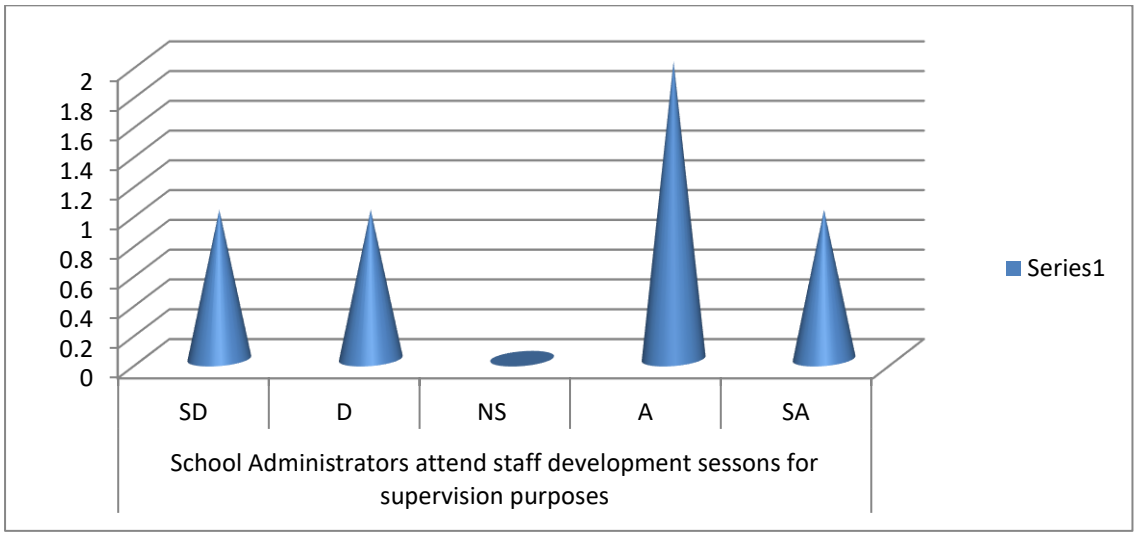

Figure 4.6: School administrators attending staff development sessions for supervision purposes

One fifth of the school administrators strongly disagreed that they attended to staff development sessions and an additional one fifth disagreed. In the contrary, two fifths (2/5) agreed that they attended to these staff development sessions and also one fifth (1/5) agreed that they attended the staff development sessions. The researcher therefore concluded that, since three fifths (3/5) of the respondents either agreed or strongly agreed, then, it implied that school administrators attended the staff development sessions on ICT integration in the teaching of mathematics for supervision purposes. World Bank (2020) posits that the use of ICT infrastructure in supervision and teaching-learning process of mathematics enhances both teacher knowledge and student achievement.

4.2.7 Staff development sessions are done at various levels

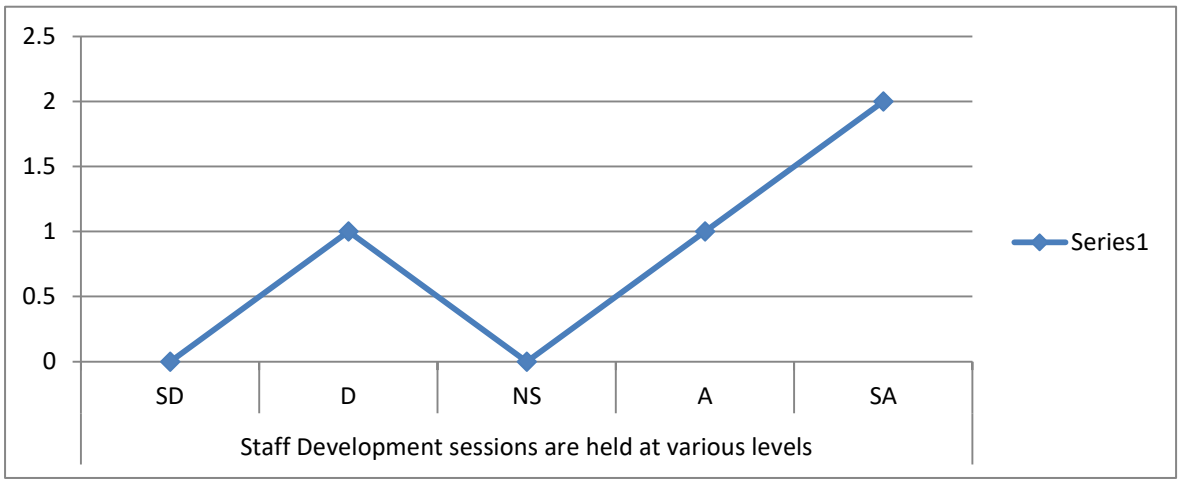

Figure 4.7: Staff development sessions are done at various levels

The data gathered by the researcher, as indicated in Figure 4. 7, show that one (1) school administrator disagreed that staff development sessions for ICT integration in the teaching of mathematics were done at different levels. Rather, one (1) participant agreed to the question and two (2) strongly agreed that staff development sessions were done at different levels. According to the data gathered, it can be concluded that staff development sessions are done at different levels on the teaching of mathematics using different ICT tools, and these were integrated in schools in Chigara Cluster of Chikomba District. Bankole (2015) echoes that facilitation mathematics staff development sessions by different personnel at different levels ensure effective knowledge transfer which assist both learners and teachers.

4.2.8 Level of computer literacy and use of ICT infrastructure to supervise Mathematics teachers

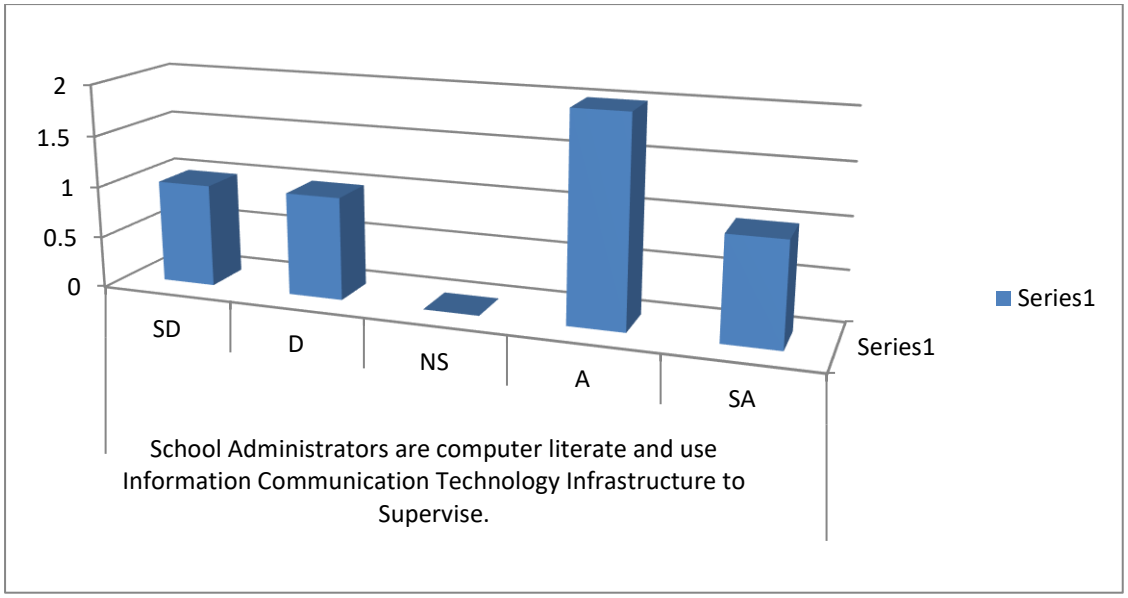

Figure 4.8: Level of computer literacy and use of ICT infrastructure to supervise mathematics teachers

The bar graph shows that one (1) school administrator strongly disagreed on the use of ICT infrastructure, and neither is it used in the supervision of mathematics. Furthermore, one school administrator also disagreed on the use of ICT infrastructure to supervise mathematics teachers. Two teachers agreed to the view that they were ICT literate and they used ICT infrastructure to supervise teachers. Moreover, one (1) teacher agreed to be ICT literate and used ICT infrastructure to supervise teachers. It can be concluded that three (3) out of the five school administrators used as respondents in this survey are ICT literate and can use ICT infrastructure to supervise their mathematics teachers which implies that (Ayodele, 2019) refers to as allowing schools the ability to improve the teaching-learning process.

4.2.9 Benefits of using ICT infrastructure in mathematics teaching in schools

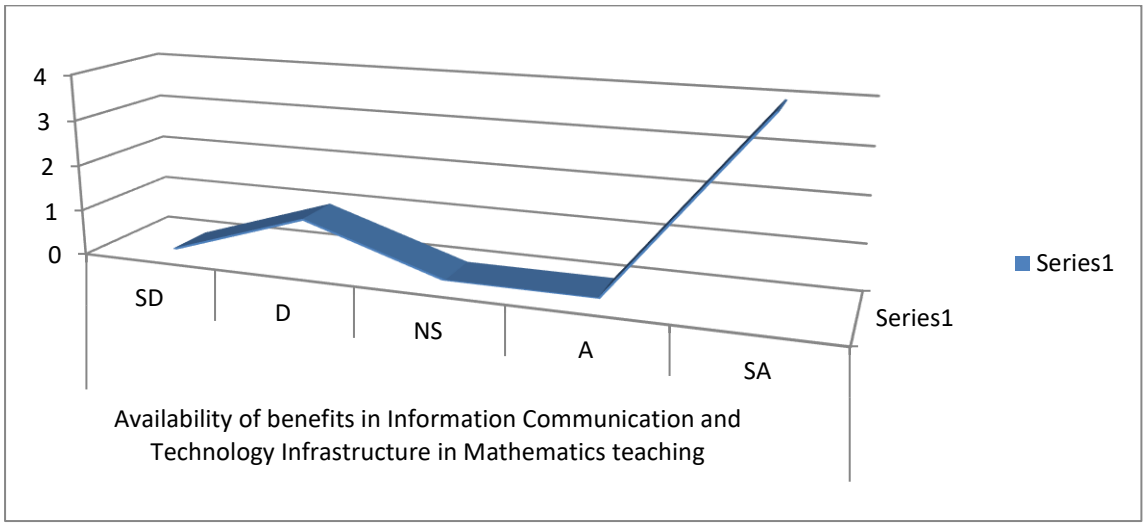

Figure 4.9: Benefits of using ICT infrastructure in mathematics teaching in schools

The researcher noted that one (1) school administrator disagreed that there are benefits of using ICT infrastructure in the teaching of mathematics in schools. Of the participants used in the research study, four (4) of them strongly agreed that there are benefits of using ICT infrastructure in the teaching of mathematics in schools. It can be concluded that the integration of ICT infrastructure in the teaching of mathematics has benefits in schools in Chigara Cluster of Chikomba District. Chagwiza and Mutambara (2019) reiterate that ICT facilitates the use of concrete media and applications thereby making Mathematics more relevant and interesting.

4.3 Survey Responses for Teachers

Section 4.3 analyses survey responses given by five (5) teachers on their assessment on the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District. These answered questions on their proficiency in ICT infrastructure, their awareness, use of ICT infrastructure in the teaching-learning process among many others.

4.3.1 Teacher awareness of ICT infrastructure

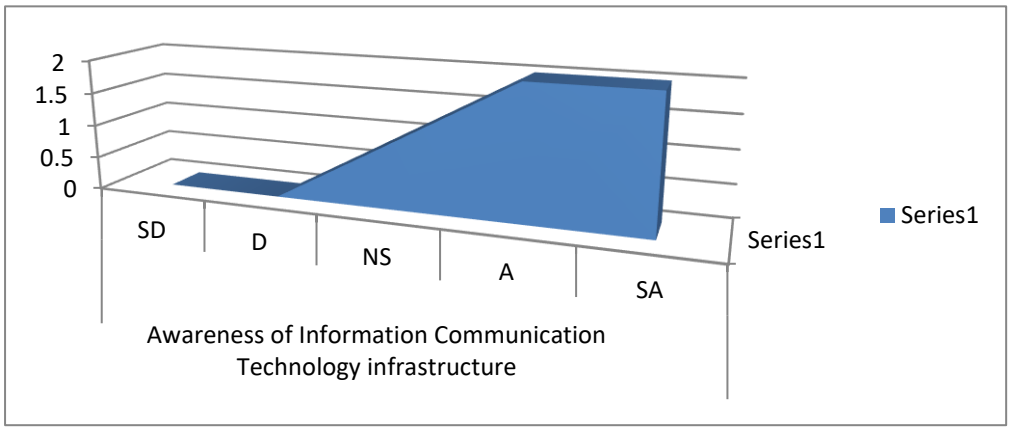

Figure 4.10: Teacher awareness of ICT infrastructure

Figure 4. 10 indicates that twenty percent (20%) of the teachers involved in the survey were not sure if they were aware of any ICT infrastructure and forty percent (40%) agreed that they were aware of ICT infrastructure. The remaining forty percent (40%) strongly agreed that they were aware of ICT infrastructure. From these indications, it can be concluded that eighty percent (80%) of teachers in Chigara Cluster of Chikomba District were aware of ICT infrastructure hence answering to the provisions of the ICT policy of 2022-2027 which is a cross-cutting measure to reduce rural-urban divide in all spheres.

4.3.2 Adequacy of ICT infrastructure in schools

In trying to find out whether schools in Chigara Cluster of Chikomba District had adequate ICT infrastructure, the researcher found out that 0.2 of the participants strongly disagreed that there was adequate ICT infrastructure and 0.8 disagreed. As shown on Figure 4.11, five

sampled respondents disagreed that there was inadequate ICT infrastructure, it can be concluded that schools in Chigara Cluster of Chikomba District have inadequate ICT infrastructure to enable teachers to integrate ICT in the teaching of mathematics, the National ICT policy 2022-2027 emphasizes on continuous efforts to invest on ICT infrastructure development and enhance smart education.

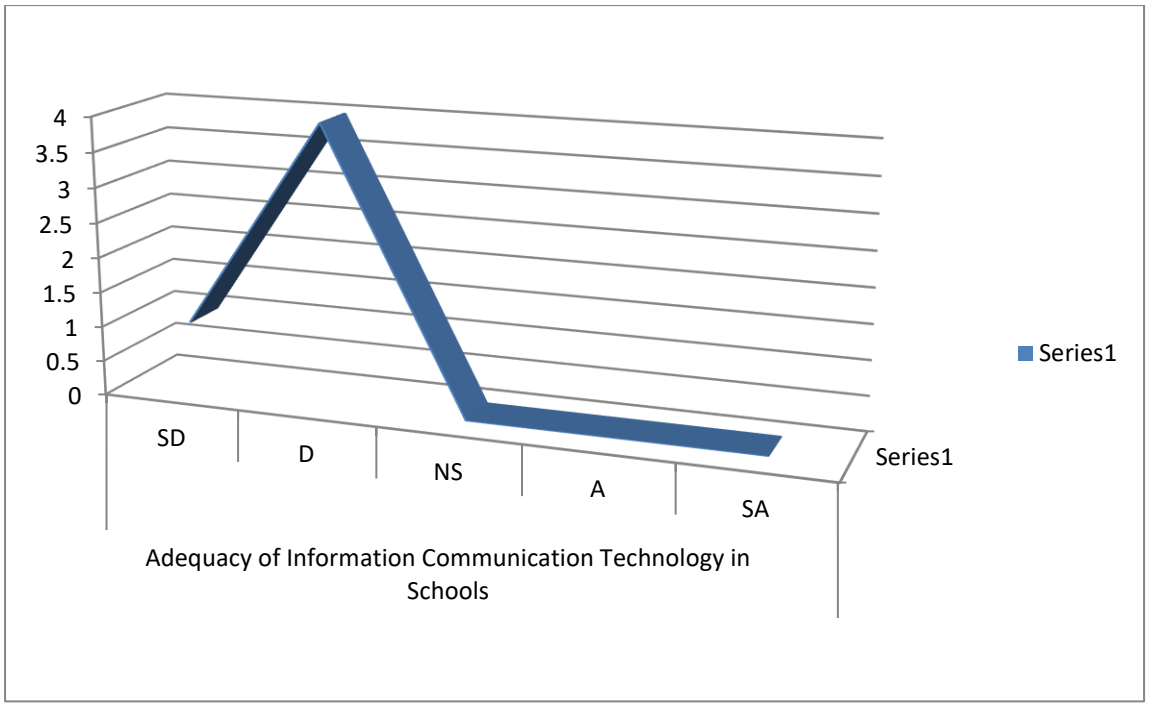

Figure 4. 11: Adequacy of ICT infrastructure in schools

4.3.3 Methods of teaching mathematics using ICT infrastructure

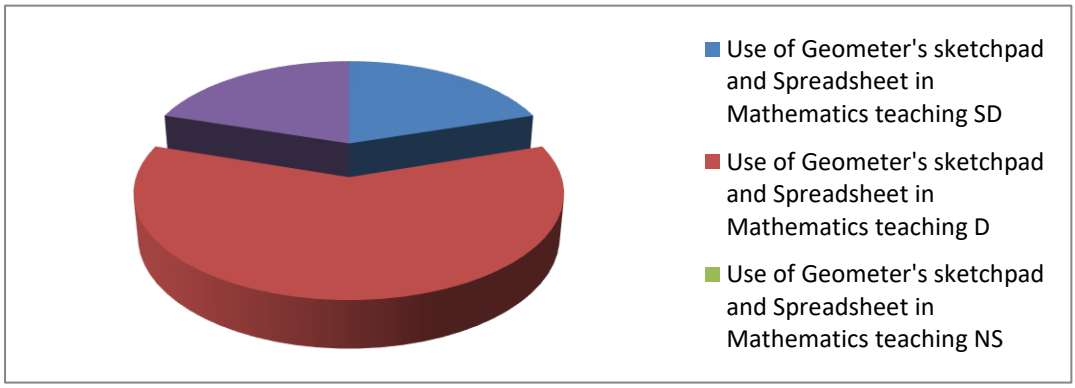

Figure 4.12: Methods of teaching mathematics using ICT infrastructure

In trying to assess which teaching methods they used in mathematics teaching, twenty percent (20%) strongly disagreed to using the Geometer's Sketchpad and Spreadsheet. In the same vein, sixty percent (60%) of the participants disagree to ever using the two methods using ICT infrastructure. As shown on Figure 4.12, the remaining twenty percent (20%) of the participants agreed to using the Geometer's sketchpad and spreadsheet in teaching mathematics. By this token, it can be concluded that eighty percent (80%) of the participants in the study of assessing the impact of ICT integration in the teaching-learning of mathematics in Chigara Cluster of Chikomba District neither use Geometer's Sketchpad nor Spreadsheet in the teaching of mathematics. This implies that teachers should be trained to gain more knowledge of diverse teaching strategies, (Akinoso et'al, 2020).

4.3.4 Teachers' attendance of staff development sessions in ICT to teach mathematics

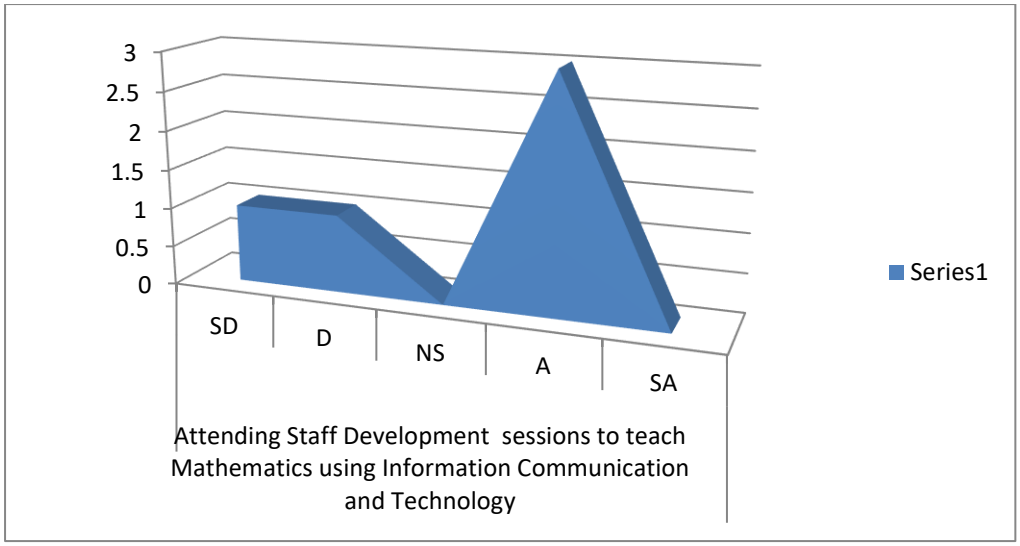

Figure 4.13: Teachers' attendance of staff development sessions in ICT to teach mathematics

Figure 4.13 shows that one (1) respondent strongly disagreed that they attended staff development sessions and another respondent also disagreed to this view. Three (3) mathematics teachers who were part of this survey agreed that they attended to staff development sessions in ICT to teach mathematics. The researcher concluded that mathematics teachers in Chigara Cluster of Chikomba District attended to ICT staff development sessions to assist them teach mathematics which is vital for knowledge transfer to enable the teaching-learning process (Akinoso et'al, 2020).

4.3.5 Teaching mathematics using ICT infrastructure

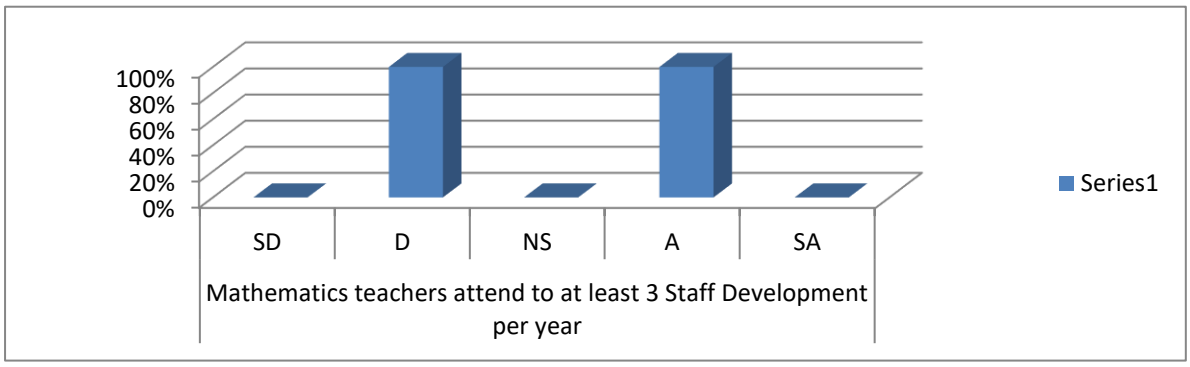

Figure 4.14: Teaching mathematics using ICT infrastructure

Figure 4.14 shows that forty percent (40%) of the participants disagreed that they attended at least three (3) staff development sessions per year to integrate ICT infrastructure in mathematics teaching. On the other hand, sixty percent (60%) of the participants agreed that they attended to more than three (3) ICT staff development sessions to help them in their mathematics teaching. The researcher therefore concluded that multiple teachers in Chigara Cluster of Chikomba District attended more than three (3) staff development sessions per year in the teaching of mathematics using ICT infrastructure. These staff development sessions enhance teachers with a wealth of mathematical resources such as where to find online tutorials and sharing of educational software, (Chagwiza and Mutambara, 2019).

4.3.6 Attendance of staff development sessions in different levels

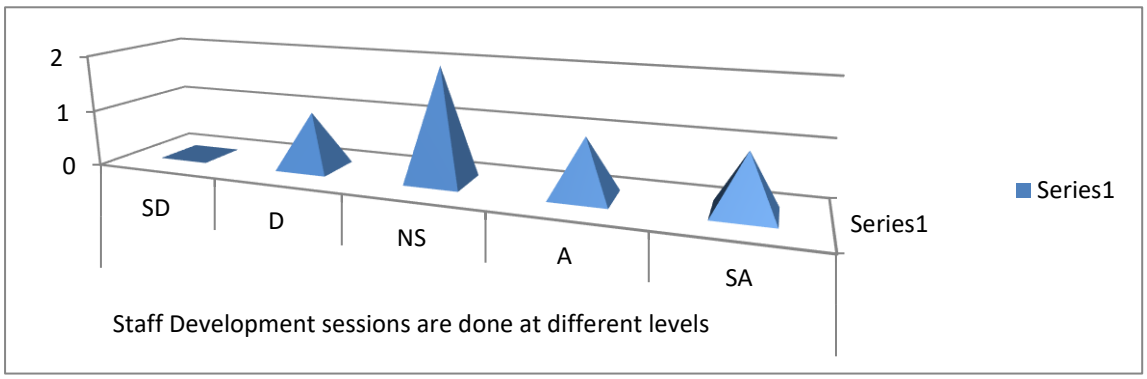

Figure 4.15: Attendance of staff development sessions in different levels

Figure 4.15 shows that 0.2 of the respondents disagreed that they attended staff development sessions at various levels. Some of the respondents, that is, (0.4) were not sure as to whether they attended ICT staff development sessions at different levels. The remainder of the five sampled respondents (0,2), either agreed or strongly agreed to attend staff development sessions at different levels. The researcher concluded that the staff development sessions in Chigara Cluster of Chikomba District were done at not more than one level. Akinoso et'al (2020) thus argues that teachers who attend to such staff development workshops develop their knowledge and skills to enhance student learning in the classroom.

4.3.7 Mathematics facilitators attend staff development sessions

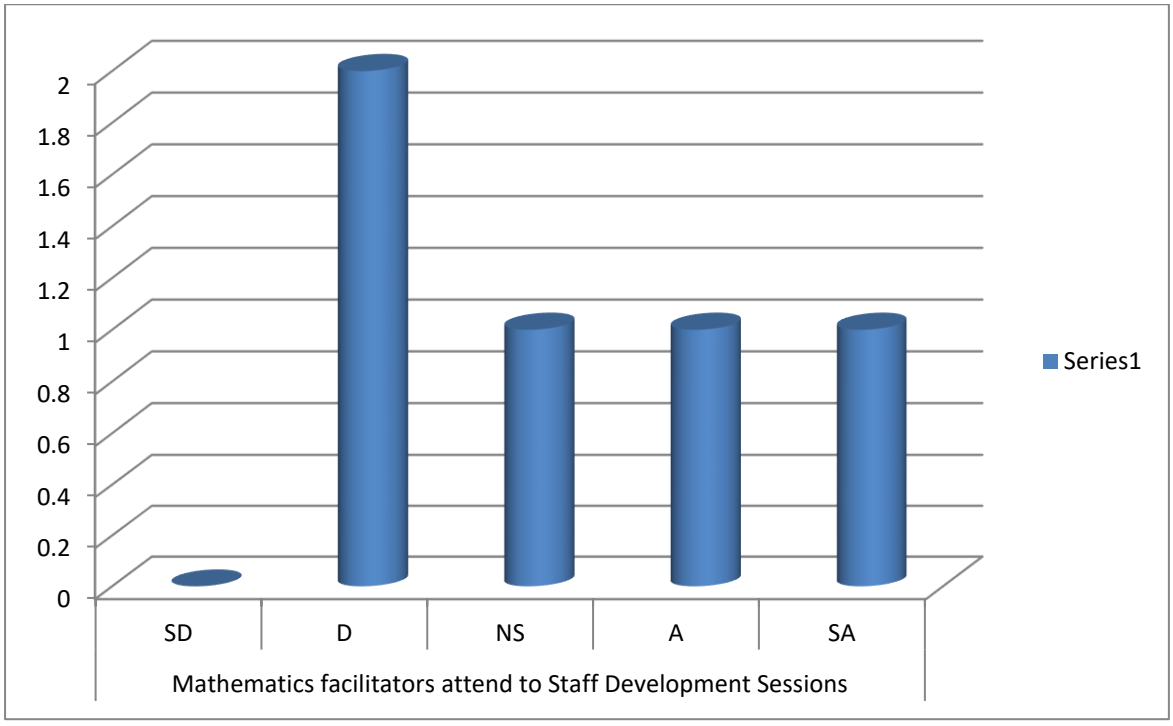

Figure 4.16: Mathematics facilitators attend staff development sessions

As shown on Figure 4.16, two (2) facilitators disagreed that they attended staff development sessions and one (1) participant was not sure. One (1) participant either agreed or strongly agreed that they attended Mathematics staff development sessions as facilitators. The researcher concluded that these staff development sessions may not have been held in Chigara Cluster of Chikomba District, but rather at school level. Brown (2017) argues that these staff development sessions increase teacher awareness on new teaching methods like choosing the correct ICT tool in teaching varied mathematics concepts and hence learner achievement can be realised.

4.3.8 Teachers' ICT literacy and use of its infrastructure in mathematics teaching

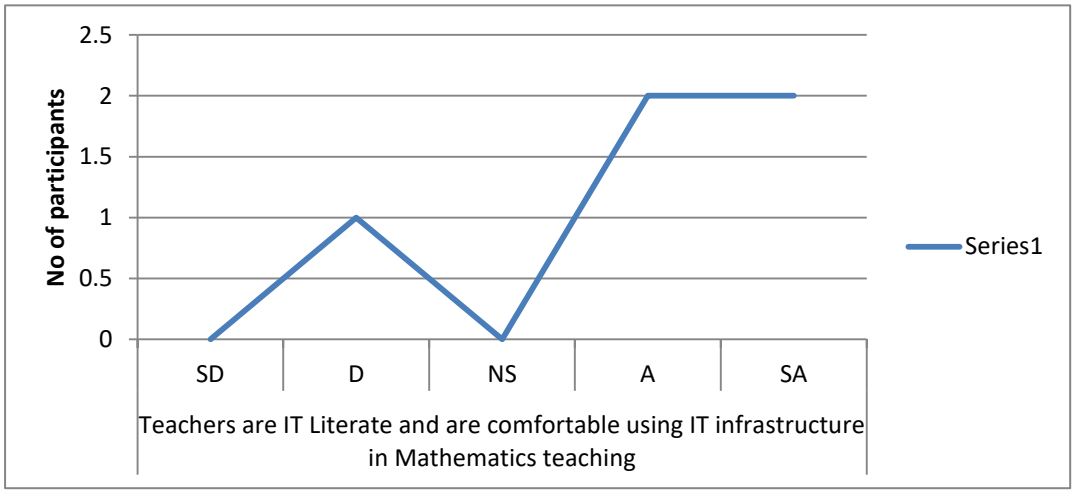

Figure 4. 17: Teachers' ICT literacy and use of its infrastructure in mathematics teaching

The researcher noted that one (1) mathematics teacher was ICT illiterate and uncomfortable exploiting ICT infrastructure in mathematics teaching. As shown in Figure 4.17, two mathematics teachers either agreed or strongly agreed that they were ICT literate and could use ICT infrastructure in the teaching of Mathematics. It can be concluded that most

mathematics teachers in Chigara Cluster of Chikomba District were ICT literate and could teach the subject using ICT infrastructure. This implies that teachers in Chigara Cluster of Chikomba District assist learners to gain more knowledge as they teach using ICT tools as echoed by (Dillon and Boyd, 2023).

4.3.9 Benefits of delivering mathematics lessons using ICT infrastructure

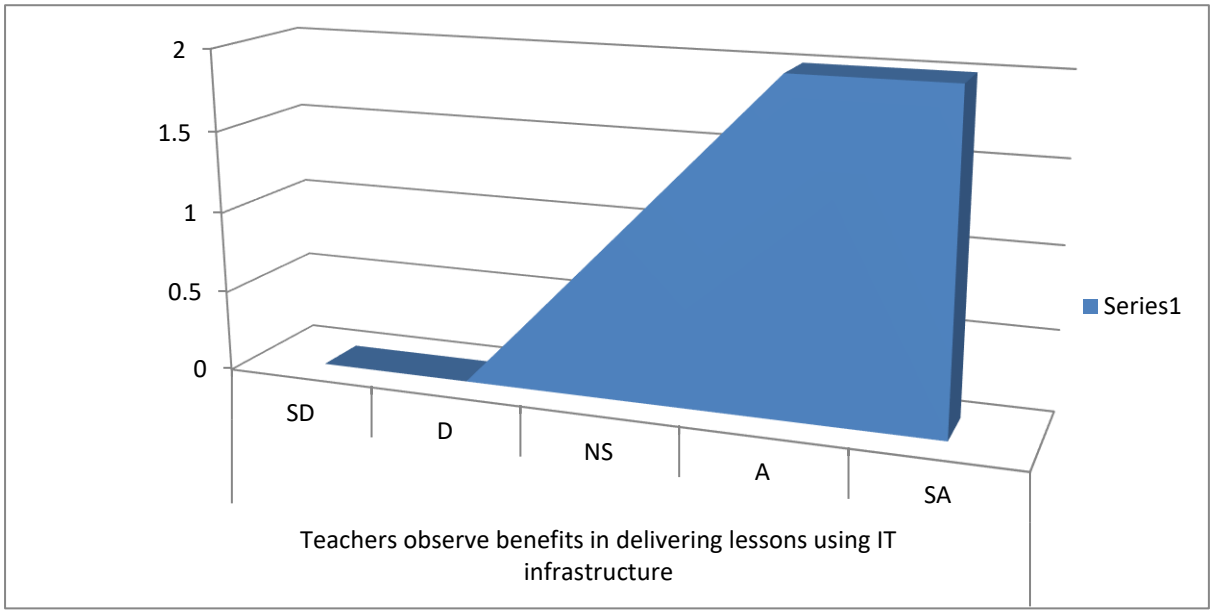

Figure 4. 18: Benefits of delivering mathematics lessons using ICT infrastructure

No participants either strongly disagreed or disagreed to benefits of delivering lessons using ICT infrastructure and one (1) participant was not sure as to whether there were benefits or not. Four (4) participants agreed that there were benefits in using ICT infrastructure in delivering mathematics lessons. The researcher concluded that mathematics teachers in Chigara Cluster of Chikomba District observed that there were benefits in integrating ICT infrastructure in the teaching of mathematics. Chagwiza and Mutambara (2019) reiterate that

ICT provides personalised learning experiences for learners by providing for their individual needs and abilities when they harness these infrastructures properly.

4.4 Questionnaire Responses for Teachers

This highlights teachers' questionnaire responses to assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District.

4.4.1 Section A: Teacher responses

Response 1: The respondent was a male adult aged forty-six (46) who taught mathematics up to ordinary level for the past seven (7) years.

Response 2: The respondent was a male adult who teaches grade three (3). He was aged twenty-six (26) and had five (5) years teaching experience

Response 3: The respondent was a thirty-seven male adult teaching grade six and had an experience of ten (10) years.

Response 4: A female teacher aged thirty-seven and taught mathematics up to ordinary level and had two years teaching.

Response 5: The respondent is a female adult aged fifty (50) who taught all subjects and had been in the teaching service for the past twenty-four (24) years.

4.4.2 Section B Teacher Questionnaire Responses

4.4.2.1 Teacher awareness of ICT infrastructure

Response 1: The participant was *aware of ICT infrastructure*. Also, the participant knew *laptops, projectors, interactive whiteboards and smartphones as basic ICT infrastructures*. Of the stated ICT infrastructures, *the school had a laptop*.

Response 2: Respondent was *aware of ICT infrastructure and* stated *cell phones, laptops, printers, routers and satellites.* The respondent said that *the school owned a cell phone* that was used in the teaching-learning process of mathematics.

Response 3: The participant was *aware of ICT infrastructure* and mentioned *firewalls, servers, routers and network cables. The school did not own any of the stated ICT infrastructure.*

Response 4: Participant did not answer any of the given questions. This implies that the teacher and the school did not have ICT infrastructure.

Response 5: The respondent was *aware of ICT infrastructure* and identified *hardware, software, networking, data storage and cloud services*. The respondent was aware of classes of ICT infrastructure. The participant responded *that a laptop was software*. It can therefore be concluded that most teachers in Chigara Cluster of Chikomba District were not aware of ICT infrastructure hence their use is somehow compromised as this was advocated for their use for teaching and learning (Nziramasanga, 1999).

4.4.2.2 Staff development sessions on use of ICT infrastructure in Mathematics teaching

Response 1: The participant *agreed to attend staff development sessions concerning use of ICT infrastructure in mathematics teaching* and argued that these *sessions were done once per term at cluster level.* The respondent was *absolutely sure of being ICT literate and comfortable using it in mathematics teaching-learning process*.

Response 2: According to data gathered, the participant *was positive of attending staff development sessions once per term at cluster level.* The participant was *ICT literate and comfortable using ICT in mathematics teaching-learning process.*

Response 3: The thirty-seven (37) year old male participant *was unaware of any staff development sessions during the school term*. The participant acknowledged having a *fair knowledge of ICT literacy and felt comfortable in using ICT infrastructure* in the mathematics teaching-learning process.

Response 4: A thirty-seven (37) year old female participant left the question unanswered thereby demonstrating that *there were no staff development sessions*. *These were not done during any school term at any level. The* participant *was neither ICT literate nor comfortable using it in the mathematics teaching-learning process*.

Response 5: The participant was a fifty (50) year old female with twenty-four (24) years of teaching experience *and acknowledged to getting ICT staff development sessions and these were done twice per term at school, cluster and district*. The participant indicated that *she was ICT literate and was comfortable using it in the mathematics teaching-learning process*.

It can be concluded that staff development sessions were done at various levels, but other schools in Chigara Cluster of Chikomba District did not attend after invitations to these staff development sessions. Those schools which members did not attend should be made aware of the benefits of such staff development workshops as instituted by Chagwiza and Mutambara (2019) that ICT offered a wealth of Mathematical resources which made teaching and learning much easier and enjoyable.

4.4.2.3 Benefits of Mathematics teaching-learning process using CT infrastructure

Response 1: The participant *acknowledged to getting benefits of teaching mathematics using ICT infrastructure*. The benefits include *getting updated information about technological advancement, interaction with experienced teachers worldwide and play back frequency*. Of

course, the participant *disagreed to facing challenges in teaching mathematics using ICT infrastructure*.

Response 2: The respondent *acknowledged that there were benefits of mathematics teaching using ICT infrastructure*. These benefits include *providing learners with quick and accurate feedback which could assist as a motivator for them and agreed that there are challenges such as shortage of ICT infrastructure in schools*.

Response 3: The participant *acknowledged to getting benefits of teaching mathematics using ICT infrastructure*. These benefits include *easy access for research purposes, promotes personalise learning and reduce textbook and resource costs*. The participant *neither agreed nor disagreed to challenges faced by teachers in mathematics teaching-learning process using ICT infrastructure.*

Response 4: The respondent *neither answered parts (a) and (b) nor parts (c) and (d*). This implies that the respondent *neither knew of benefits of ICT infrastructure in the mathematics teaching-learning process nor challenges the teachers face in mathematics teaching-learning process using ICT infrastructure*.

Response 5: The respondent *acknowledged that there were benefits of mathematics teaching-learning using ICT infrastructure and that ICT enhances engagement and interest, learners improve their visualisation of concept and personalised learning experiences*. Despite the benefits, the respondent *agreed that teachers faced challenges in implementing the teaching-learning process using ICT infrastructure*. Challenges they faced include *lack of infrastructure, quality of content and resources, resistance to change and teacher and preparedness.*

From these responses, the researcher concluded that, although there are benefits in mathematics teaching-learning process, teachers in Chigara Cluster of Chikomba District faced challenges such as shortage of infrastructure and staff resistance to change. To support this observation by Dillon and Boyd (2023), schools are not ready to adopt technology and this has suggestively affected the ratio of personal computers to the numbers of the students and teachers in schools especially in the rural areas like Chigara Cluster of Chikomba District.

4.5 Summary of Chapter

Chapter four (4) analysed and discussed research findings. The data was gathered from the sample which was designed to assess the impact of integrating ICT infrastructure in the teaching-learning process of schools in Chigara Cluster of Chikomba District. Findings from surveys of both school administrators and teachers were discussed. In order to establish findings on assessing the impact of integrating ICT infrastructure in mathematics teaching-learning process, teacher questionnaire responses were also discussed and these revealed whether the teachers integrated ICT infrastructure in their teaching thereby reducing weaknesses discovered in survey responses. Chapter five (5) represents the summary and conclusions of the whole study.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

As the heading of this chapter implies, Chapter five (5) highlights the summary, findings and presents conclusions deducted. The researcher outlines the recommendations for improving ICT infrastructure in schools in Chigara Cluster of Chikomba District to enhance its integration into mathematics teaching-learning process. From the findings, one can draw the various conclusions from the data gatherings and discussions from the five (5) sampled schools. The researcher close this chapter by making recommendations and recommend areas for future studies that the researcher is also determined to conduct as further extension of understanding of the phenomenon.

5.2 Research Summary

The purpose of this research study was to assess the impact of integrating ICT infrastructure in the mathematics teaching-learning process in Chigara Cluster of Chikomba District. Chapter one (1) outlined the problem of assessing the impact of integrating ICT infrastructures in mathematics teaching-learning process in Chigara Cluster of Chikomba District. The assumption was that there is no significant difference in the academic achievement of mathematics learners in Chigara Cluster of Chikomba District who use ICT integrated teaching methods compared to those who use traditional teaching methods. I sought to understand the best methods of mathematics teaching-learning in Chigara Cluster of Chikomba District.

Literature review focused on the current level of ICT infrastructure of schools in Chigara Cluster of Chikomba District. The Nziramasanga (1999) recommended that the education structures should clasp the use of computers and other ICT infrastructure in the teaching-

learning progression in all the spheres. The researcher noted that school administrators should ensure that schools get equipped to be able to integrate ICT infrastructure in the teaching-learning process. Mutambara and Chagwiza (2019) argue that ICT integration should be done in a way that complements traditional teaching methods rather than replacing them completely. In addition, Jing Wen and Maat (2020) reiterate that integration of ICT tools and techniques have a potential for a better quality of teaching-learning process in the education system in support. Raj Joshi (2017) echoes that ICT contributes teaching in a more effective way in nurturing the learners' arithmetical and logical skills in mathematics through using interactive technology such as projectors, varying types of computer and the internet. According to Chagwiza and Mutambara (2019), ICT accelerates the use of concrete media and presentations, thereby making mathematics more relevant and interesting to learners.

The research methodology of assessing the impact of integrating IT infrastructure in mathematics teaching-learning process used the pragmatist theory of thinking, thus, a combination of interpretivism and positivism methodologies. The researcher used the mixed research method in order to triangulate the findings. It involved both the qualitative and quantitative research designs where surveys for school administrators and teachers as well as questionnaires were used. The questionnaire explored teachers experiences to triangulate (cross-pollinate) what they had said in their surveys. This research study sample was five (5) out of seven (7) schools in Chigara Cluster of Chikomba District. Creswell (2016) is of the view that a sample should be a correct representation of the population: seven (7) schools, and in this case a sample of five (5) schools which is 71.4% of the population in Chigara Cluster of Chikomba District.

Data presentation was done by using graphs and pie charts for both surveys for school administrators and teachers. These were divided into three (3) major sections, that is, *4.1 which are survey responses from school administrators, 4.2 which has survey responses for teachers and 4.3 teacher questionnaire responses*. This was done to answer the major question on assessing the impact of ICT integration in mathematics teaching-learning in Chigara Cluster of Chikomba District.

5.3 Conclusions

i) Teachers in Chigara Cluster of Chikomba District were aware of ICT infrastructure.

ii) Both school administrators and teachers made an effort to organise and attend staff development sessions.

iii) There was inadequate ICT infrastructure in schools in Chigara Cluster of Chikomba District.

iv) Both teachers and learners benefitted from integrating ICT infrastructure to the traditional teaching methods. As echoed by Mutambara and Chagwiza (2019), ICT integration should be done in a way which complements traditional teaching methods rather than replacing them completely.

As a researcher, in trying to establish what prior studies found about the impact of ICT integration in mathematics teaching-learning, I had to answer the broad question and its sub-questions to fulfil the stated objectives. I also discovered certain recommendations about ICT infrastructure that needed to be taken into consideration for rural schools in Chigara Cluster of Chikomba District. This calls for deep insights for further research. Recommendations listed below enrich this study and assists in extending the findings.

5.4 Recommendations

5.4.1 Recommendations for further practice

i) Organising staff development sessions by school administrators for ICT integration improves teacher-learner performance in mathematics.

ii) Attending to staff development sessions at different levels by both teachers and school administrators capacitates them both for teaching and supervision purposes.

iii) School administrators and teacher awareness of ICT infrastructure enables them to choose the best tools to use for each mathematics topic to assist learners.

5.4.2 Recommendations for further research

Findings from this research study require further studying on the following areas:

i) Ways of improving the state of ICT infrastructure in schools.

ii) Effects of policy in school development in resettlement areas such as Chigara Cluster of Chikomba District.

iii) Revisiting policy frameworks on the ways of funding education in resettlement areas.

REFERENCES

Aggarwal, M., & Bal Gupta, S. (2020). *Tools of ICT learning and teaching of Mathematics* (Volume 15). Available Online @ www.journalimcms.org.

Akinoso, S. O., Agoro, A. A. & Alabi, O. M. (2020). Effect of station rotation mode of instructional delivery for mathematics in the era of advancing technology. *JISTE, 24*(2),1-13. Available on doi:10.15640/jehd.v9n2a1

Ayodele, O. (2019). *Information infrastructures: The conduit power of ICTs in Africa*. University of Johannesburg, SA.

Bankole, F. (2015). ICT infrastructure and its impact on national development: A research direction for Africa using analytics. Available online www.researchgate.net/publication/285588706.

Best, J. W. B. & Khan, V. (2023). *Research in education*. Boston: Allyn and Bacon.

Brink, H.I.(2021). *Fundamentals of research methodology for health care professionals*. University of SA.

Brown, T. A. (2017). Teacher professional development and student achievement: *A systematic review. Journal of Educational Research, 110(4), 419-433*. Available on doi: 10.1080/00220671.2016.1264055

Chagwiza, C., & Mutambara, J. (2019). Investigating the use of questionnaires and surveys in assessing the integration of ICT in mathematics teaching, *Journal of Mathematics Teacher Education, 22(3), 249-273*

Cohen, L. & Manion, L. (2011). *Research methods in education*. London: Groom Helm.

Crawshaw, M., & Chambers, M. (2018). Using digital tools to support mathematics learning. *Teaching Mathematics and its Applications, 37*(3), 131-144

Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches.* Sage Production.

Creswell, J. W. (2016). *Research design: Qualitative, quantitative and mixed approaches* (2nd edn.), Sage Production.

Dillon, P., & Boyd, R. (2023). Using digital technologies to enhance mathematics learning. *Journal of Educational Computing Research, 68*(4), 439-456

Du Plooy, G. M. (2021): *Introduction to communication course 2: Communication research*. UNISA.

Fischler, A. S. (2023). *Quantitative research methods*. Nova Southern University.

Gemma, R. (2018). *Introduction to positivism, interpretivism and critical theory*. Available online oro.open.ac.uk/49591.

Government of Zimbabwe. (2007). *The Zimbabwe national ICT policy framework*. Harare, Zimbabwe.

GoZ / Ministry of Primary and Secondary Education (MoPSE). (2007). Education Act (25:04). Harare: Government Printers.

Graham, L., Stoops, J., & Kapp, P. (2020). Using ICT to enhance mathematics education. *Mathematics Teacher Education and Development Journal, 22*(1), 53-72

Hoyles, C, Kieran, C., Rojano, T., Sacristan, A. I., & Trigueros, M. (2020). Reflections on digital technologies in mathematics education across cultures. *Proceedings 42nd Meeting of N.A., PME-NA.*

Isaacs, S. (2007). *ICT in education in Zimbabwe: Survey of ICT and education in Africa: Zimbabwe country report*. Available Online @ http//:www.infodev.org.

Josh, R. (2017). Integrating ICT in mathematics classrooms: A study of teacher perceptions. *Journal of Mathematics Teacher Education, 20*(2), 149-172

Kaur, P (2023). Role of ICT for mathematics teaching. *Haryana, 14,* Available online @ www.csjournals.com.

Khoaene, T. (2022). The impact of ICT on mathematics achievement: A systematic review. *Journal of Educational Technology Development and Exchange, 14*(1), 1-22

Leedy, P. D. (2018). Practical research: Planning and design. Washington, D.C.: Macmillan.

Maarouf, H. (2019). *Pragmatism as a supportive paradigm for the mixed research approach: Conceptualising the ontological, epistemological and axiological stances of pragmatism*. Giza.

Madhlangobe, L. (2009). *Culturally responsive leadership in a culturally and linguistically diverse school: A case study of practices of high school leaders*. Texas: San Marcos.

Ministry of Primary and Secondary Education (2017). *MoPSE school improvement framework*. Harare: Government Printers.

Muleya, S. (2018). *Planning strategies used to solve social and economic challenges faced by orphans and vulnerable children in accessing education at Secondary level: A case for Beitbridge District in Matabeleland South in Zimbabwe*. Harare: University of Zimbabwe.

Muvikana, S. (2018). *Methods of using ICT tools in the teaching of mathematics at junior level in Makoni District primary schools*. Gweru: Midlands State University.

National ICT Policy (2022-2027). Government Printers. Zimbabwe

Nziramasanga, C. T. (1999). *Zimbabwe report of the presidential commission of inquiry into education and training*. Harare: Government Printers.

Papanthymou, A. & Darra, M. 2023). *Defining quality in primary and secondary education*. University of the Aegean, Rhodes, Greece. Available online @ doi.org/10.5539/ies.v16n2p128.

Singh, R., & Kumar, V. (2023). *An Emperical Study on the Impact of Gamification on Learning Outcomes. Proceedings of the 2023 International Conference on Learning and Teaching, 123-130. doi:10.1145/3574567.3574593*

UNICEF. (2021). *Education sector analysis: Methodological guideline* (Volume 3). UK.

United Nations (2022). *Policy paper: Science, technology, engineering and mathematics (STEM) as an enabler for development and peace.* OSAA.

Vygotsky, L. S. (1978). Interaction between learning and development. *Readings on the Development of Children, 22-27*

World Bank. (2020). ICT in Education: *A Review of the Literature. World Bank Publications*

Online literature

accenture.com, n.d.

www.ncbi.nlm.nih.gov>articles>P...

www.nottingham.ac.uk.

APPENDICES

Appendix 1: Questionnaire for Teachers

My name is Mutupo Cain, a teacher at Choukudza Primary School in Chikomba District, Mashonaland East Province. I'm studying a Bachelor of Science Education Honours majoring in Mathematics at Bindura University of Science Education. May l have permission to carry out a research to assess the impact of ICT integration in Mathematics teaching and learning in Chigara Cluster of Chikomba District.

Instructions for Completing the Questionnaire

a. For **confidentiality** reasons, do not write your **names** on these sheets.
b. Use **point form** to answer questions when you wish to give **more than one** response.
c. Use the **given spaces** to answer the questions.
d. If you feel you **cannot** answer any question leave it **blank**.
e. Follow **instructions** that are given under some questions which are in ***italics***.
f. **All answers** that you provide will only be used for the purposes of writing this thesis.
g. Only the **researcher** and the **supervisor** have access to the answers that you have provided.

Section A

Gender: _____

1. Age: _____
2. Subject Taught: _____
3. Level: _____
4. Experience in Service: _____

Section B

1. *Tick the appropriate Box*

   a. Are you aware of any ICT infrastructure? Yes ☐ No ☐

   b. State any five (5) basic ICT infrastructures you are aware of?

   _____

   _____

   _____

   c. Of the stated ICT infrastructures, which ones do you use at your school in the teaching-learning process of Mathematics?

   _____

   _____

2. a. Do you get staff development sessions concerning use of ICT in the teaching of Mathematics? ☐ Yes ☐ No

   b. How often are these sessions being offered at your school per term?

   _____

Tick the appropriate box

c. The sessions are done at: i. Cluster ☐ ii. District ☐ iii. Province ☐ iv. School ☐

   d. Do you hire facilitators on staff development sessions?

   _____

   e. Are you ICT literate and comfortable using it for your teaching?

   _____

   _____

   _____

3. *Choose either Agree or Disagree*

a. Do you think there are benefits of teaching Mathematics using ICT infrastructure in teaching Mathematics?  

Agree Disagree

If you ticked Disagree in the previous question, skip the next question below.

b. May you please highlight three benefits of teaching Mathematics using ICT infrastructure?

_____

_____

_____

Tick the appropriate box in the question below

c. Do you face challenges teaching Mathematics teaching Mathematics using ICT infrastructure? Agree  Disagree 

If you have ticked Agree in the previous question, answer the question below.

d. What challenges do you face in implementing the teaching-learning process of Mathematics using ICT infrastructure?

_____

_____

_____

_____

Appendix 2: Survey for School Administrators

My name is Mutupo Cain, a teacher at Choukudza Primary School in Chikomba District, Mashonaland East Province. I'm studying a Bachelor of Science Education Honours majoring in Mathematics at Bindura University of Science Education. May l have permission to carry out a research to assess the impact of ICT integration in Mathematics teaching and learning in Chigara Cluster of Chikomba District?

Instructions for completing the Survey

a. For **confidentiality** reasons, do not write your **names** on these sheets.
b. Tick the **appropriate box** for the required response.
c. If you require cancelling a given response, put **a circle** and **tick the desired one**.
d. Ticking of **more than one box** in any given question results in that answer being **void**.
e. **All answers** that you provide will only be used for the purposes of writing this thesis.

h. Only the **researcher and supervisor** have **access** to the answers that you have provided.

Instructions for completing the Survey

a. For **confidentiality** reasons, do not write your **names** on these sheets.
b. Tick the **appropriate box** for the required response.
c. If you require **cancelling** a given response, put **a circle** and **tick the desired one**.
d. Ticking of **more than one box** in any given question results in that answer being **void**.
e. **All answers** that you provide will only be used for the purposes of writing this thesis.
a. Only the **researcher and supervisor** have **access** to the answers that you have provided.

Instructions for completing the Survey

a. For **confidentiality** reasons, do not write your **names** on these sheets.
b. Tick the **appropriate box** for the required response.
c. If you require **cancelling** a given response, put **a circle** and **tick the desired one**.
d. Ticking of **more than one box** in any given question results in that answer being **void**.
e. **All answers** that you provide will only be used for the purposes of writing this thesis.
b. Only the **researcher and supervisor** have **access** to the answers that you have provided.

Survey for Teachers

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. I have ICT infrastructure in my school.					
2. ICT infrastructure is adequate for Mathematics teachers.					
3. Mathematics teachers use any ICT infrastructure to teach any topic.					
4. I organise staff development sessions for Mathematics teachers to teach using ICT infrastructure.					
5. There are more than three (3) staff development sessions for ICT integration in teaching Mathematics.					
6. I attend these staff development sessions for supervision purposes.					
7. The staff development sessions are held at various levels					
8. I'm ICT literate and use ICT					

infrastructure to supervise.					
9. There are benefits in having ICT infrastructure in teaching Mathematics in my school.					

	Strongly Disagree	**Disagree**	**Not Sure**	**Agree**	**Strongly Agree**
1. I'm aware of ICT infrastructure.					
2. ICT infrastructure in our school is adequate.					
3. I use Geometer's Sketchpad and Spreadsheet in teaching Mathematics.					
4. I attend staff development meeting sessions in ICT to teach Mathematics.					
5. I attend to at least three staff development sessions per year in Mathematics.					
6. I attend to staff development sessions at various levels.					
7. I attend staff development sessions as a facilitator.					
8. I am ICT literate and comfortable using ICT infrastructure in teaching Mathematics.					
9. I observe benefits in delivering lessons using ICT infrastructure.					

Appendix 3: Request to Conduct Research

Choukudza Primary School

P.O Box 310

Chivhu

30 October 2024

The Provincial Education Director

Ministry of Primary and Secondary Education

Mashonaland East Province

P.O Box 752

Marondera

MINISTRY OF PRIMARY SECONDARY EDUCATION
THE HEAD
CHOUKUDZA PRIMARY SCHOOL
OCT 2024
Phone Number: 0773402373
Signature:
P.O. BOX 310, CHIVHU

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CARRY OUT AN EDUCATIONAL RESEARCH

The above matter refers

I wish to carry out a research in Chigara Cluster of Chikomba District in your province.

Below are the details:-

1. Bindura University of Science Education Student Number : B225865A
2. Programme :HBSCEDMT
3. Research topic : Assessing the impact of ICT integration in Mathematics Teaching and Learning in Chigara Cluster of Chikomba District
4. Targeted Schools : Primary and Secondary Schools in Chigara Cluster of Chikomba District
5. Method of research : Mixed methods using questionnaires and surveys for teachers and school administrators.
6. Period of research : 01/11/2024 – 30/11/2024
7. EC Number : 0981165H
   ID Number : 18-088274-R83
   Cell Number : 0773 402 373/ 0718 942 444
   Email Address : cainmutupo@gmail.com

Ministry Of Primary & Secondary Education
MASH EAST
CHIKOMBA DISTRICT OFFICE
31 OCT 2024
EDUCATION INSPECTOR
P.O. BOX 162, CHIVHU
ZIMBABWE

Appendix 4: BUSE Letter of Permission to Conduct Research

BINDURA UNIVERSITY OF SCIENCE EDUCATION

30/10/24

TO WHOM IT MAY CONCERN

NAME MUTUPO CAIN REGISTRATION NUMBER B225865A

PROGRAMME MBSc Ed Mt PART 2.2.

Science Education in the Faculty of Science Education

...programme. The research topic is...

...IMPACT OF ICT INTEGRATION IN ASSESSING TEACHING AND LEARNING IN MATHEMATICS IN CHICAGA CLUSTER OF CHIKOMBA DISTRICT.

...assistance is greatly appreciated.

Thank you