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CHALLENGES FACED BY TEACHERS IN USING ICTs IN THE TEACHING OF MATHEMATICS AT GRADE 5 LEVEL IN INSUZA CLUSTER OF UMGUZA DISTRICT

BY

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL FOUNDATIONS AND MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF BACHELOR OF EDUCATION IN PRIMARY (ICT and ENVIRONMENTAL SCIENCE).

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APPROVAL FORM

The undersigned certify that they have read and recommended to the Midlands State University for acceptance a dissertation entitled:

Challenges faced by teachers when using ICTs in the teaching of Mathematics at Grade five level in Insuza Cluster of Umguza District, Matabeleland North Province.

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YEAR DEGREE GRANTED: 2020

DECLARATION

I **Manjeru Priviledge** hereby declare that this research project is my own work and has not been submitted to any university or other tertiary institution for the award of a degree.

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This project is submitted to the Department of Educational foundations and management in partial fulfilment of the requirements of bachelor of education in primary (ICT and Environmental Science) with the approval of the academic supervisor(s).

Signed..... Date.....

SUPERVISOR

DEDICATION

To my dear husband and best friend, Leonard Manjeru, family and friends.

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ABSTRACT

The study sought to establish on the challenges faced by teachers when using Information and Communication Technologies (ICTs) in the teaching of Mathematics at Grade five level. It was guided by five themes, which are: understanding the concept of ICTs, uses of ICTs, the extent to which the use of ICT improves the teaching of Mathematics, challenges faced by teachers when using ICTs during the teaching of Mathematics as well as strategies which may be used to help teachers use ICT effectively during the teaching of Mathematics. The researcher adopted the descriptive survey design and used both quantitative and qualitative research paradigms. Population comprised of eight school administrators and eight grade five teachers in Insuza cluster of Umguza District in Matabeleland North Province. The researcher adopted non-probability sampling techniques and the purposive sampling procedure was used. Questionnaires and interviews were used to collect data which was analyzed using themes. The study revealed that school administrators and teachers partially understood the concept of ICT. They indicated that ICT involves communication by the use of electronic devices such as laptops and cellphones. However, most administrators and teachers did not see the fully utilization of ICTs at their schools in the teaching of Mathematics since none of the schools had any ICT tools for classroom use. Their understanding of ICT uses was limited as they were only aware of only a few ways of using ICT during Mathematics lessons. Some teachers admitted that they were not using any ICT tools during lessons as their schools had none. Both school administrators and teachers agreed that the use of ICT had an impact on the academic performance of the learners as far as Mathematics was concerned. It was highlighted that ICTs arouse interest and fascinated the learners which helped the objectives be achieved more quickly and clearly. Some of the typical challenges faced by teachers when using ICT in the teaching of Mathematics include lack of knowledge, shortage of resources, lack of confidence, inadequate funding, negative attitude and resistance to change especially on the older generation. The study recommends that teachers should be staff developed and be provided with in-service training on ICT. It also recommends the school administrators to engage more with both governmental and non-governmental organizations on funding and donations in order to improve on the availability of resources. Parents are also recommended to be more involved in school activities by providing financial assistance and moral support to schools.

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CHAPTER 1

THE PROBLEM AND ITS CONTEXT

1.1 Introduction

This chapter presents the background to the study, the statement of the problem, and the research questions. The chapter also highlights on the significance of study, the geographical and conceptual boundaries of the research as well as the limitations of the study. Key terms that are frequently used in the research shall be defined. Lastly, the summary of the chapter shall also be given.

1.2 Background of the study

The act of involving the use of ICT into teaching and learning is a complex process and one may encounter a number of challenges. Different categories have been used by researchers and educators to classify the problems in the use of ICT in educational institutions. The researcher have noticed some of the indicators of different challenges being encountered by teachers in their attempt to use ICT when delivering Mathematics lessons.

One of the obstacles which is faced by teachers in using ICTs when teaching is the insufficient number of computers and copies of software (Habibu, Abdullah-Al-Mamun and Clement, 2012). From this finding, the researcher has noticed on lack of computers at one of the schools in Insuza cluster and has made an assumption that lack of adequate resources could be one of the challenges encountered by teachers in integrating ICT to teaching of Mathematics. Furthermore, most

teachers are using cellphones which do not have access to the internet hence lack of copies of software.

Habibu et al., (2012) further postulate that the non-material obstacles include teachers' insufficient ICT knowledge and skills, the difficulty of integrating the use of ICT in instruction, and insufficient teacher time. From these perspectives, the researcher has been made privy of the fact that most primary teachers in Insuza cluster have inadequate knowledge and skills in ICT as indicated by their lack of interest in using typed schemes of work as well as continuous use of handwritten teaching and learning material. For example, the researcher noticed that during one of the cluster workshops, no teacher volunteered to type the minutes which can also be an indication of lack of knowledge or negative attitude towards ICT. Difficulty in integrating the use of ICT was also indicated by the continuous and frequent use of concrete objects when teaching Mathematics.

According to Watson (1999), one of the problems in the implementation of computers in teaching-learning is teachers' acceptance, which in turn is influenced by their attitudes towards these media. The researcher is in agreement with this statement as she has noticed some negative attitudes from some teachers on embracing the use of Information Communication Technologies which is mandatory in the updated competence-based curriculum. This was indicated by negative comments during staff meetings and staff development workshops. From these observations, the researcher has then found it worthwhile to carry out a research on challenges being faced by teachers when using ICTs in teaching Mathematics at grade 5 level in Insuza cluster.

1.3 Statement of the problem

The major thrust underlying the carrying out of this research was to investigate on the challenges faced by teachers in using Information Communication Technologies (ICTs) in the teaching of

Mathematics at Grade 5 level in Insuza cluster of Umguza District. The researcher had been made privy of the fact that ICT has not been fully implemented in the teaching and learning of Mathematics as informed by the poor academic performance of learners in the subject. With this observation, the recognition and strategic management of ICT challenges is bound to improve the teaching and learning of Mathematics at Grade5 level.

1.4 Research questions

1.4.1 Main Research Question

- ❖ What challenges are faced by teachers when using Information Communication Technologies (ICTs) in the teaching of Mathematics?

1.4.2 Sub-questions

- What are Information Communication Technologies?
- How do teachers involve the use of Information Communication Technologies in the teaching of Mathematics?
- To what extent does the use of ICT assist the teaching and learning of Mathematics?
- What challenges are faced by teachers in implementing ICT when teaching Mathematics?
- What strategies may be used to help teachers use ICTs effectively in the teaching of Mathematics?

1.5 Significance of the study

1.5.1 to Theory

This study may help to enlighten on what other researchers have found out on the role of Information communication technology, its barriers as well as its successes. Furthermore, it will

bring forth the challenges being faced by primary school teachers in using ICT when teaching Mathematics at Grade 5 level as well as suggest possible solutions to these obstacles.

1.5.2 To teachers

Teachers will benefit as they may use the findings of the study in engaging ICT appropriately in executing their obligations as teachers. Teachers shall also benefit from the advantages of using ICT when teaching Mathematics, be able to identify challenges faced by learners during teaching and learning processes and be able to come up with strategies to minimize challenges in the teaching and learning of Mathematics using ICTs. Studying the challenges to the use of ICT in teaching Mathematics may assist teachers to overcome these barriers and become successful technology adopters in the future.

1.5.3 To learners

It is also the hope of the researcher that this study would help children to develop holistically without any hindrances from the use of ICT tools when learning Mathematics.

1.5.4 Ministry of Education

Through this study, the ministry will note the challenges faced by teachers in implementing ICTs in the learning process of Mathematics. The recommendations will then influence policy formulation through the ministry.

1.5.5 Non-Governmental Organizations

Non-Governmental Organizations working with schools will use the findings of the study. They may assist schools in creating a computer literacy environment through funding computer laboratory buildings as well as providing some ICT tools and equipment. They may also assist by providing short in-service trainings and workshops for teachers to develop skills acquisition and knowledge.

1.5.6 To the researcher

The researcher will learn about the research process and acquire research skills. At the same time, an in-depth understanding of the importance of ICT involvement in the teaching of Mathematics shall be acquired.

1.6 Limitations

1.6.1 Financial

The research was done when the cost of living was going up. Despite the economic hardships, the researcher was expected to be in constant communication with the project supervisor. The researcher was also expected to prepare enough research instruments for respondents and the administration of these was expensive since all the respondents had to be given enough data bundles to work on the questionnaires online. Furthermore, due to social distance, interviews were done through phone calls which were very costly. However, the researcher worked within her means to acquire material for the research.

1.6.2 Time

There was limited time as the researcher was working on other modules and preparing for exams. The research was carried out at the time when the covid-19 pandemic was in full swing and this affected the researcher's movement and physical contact with the respondents as well as the research supervisor. However, the researcher utilized every possible communication method to progress with the research while observing social distance.

1.6.3 Attitudinal limitation

Due to different reasons that include attitude, some participants did not manage to return the questionnaires distributed for data collection on time. The researcher had to make sure that she administered the questionnaires and collected them in the shortest possible time. The researcher also followed research ethics for participants to develop positive attitude.

1.6.4 Distance

As this research was carried out during the lockdown period and premature closure of schools due to the covid-19 pandemic, all the respondents were located in various places which were apart from each other. The researcher encountered some challenges in reaching out to all these participants during the stipulated time. However, maximum effort was put to fulfill the requirements of the research within the given timeframe.

1.7 Delimitations

The focus of this research was to investigate on the challenges faced by teachers in using Information Communication Technologies when teaching Mathematics at Grade5 level. This research was carried out in Insuza cluster of Umguza District in Matabeleland North Province, Zimbabwe. The research was carried out with effect from October 2019 to August 2020.

1.8 Definition of Terms

- **Information Communication Technologies (ICT)** refers to the computer and internet connections used to handle and communicate information for learning purpose (Ratheeswari, 2018). It may be viewed as all types of technologies that enable access to information through telecommunication.

- **Learner-centred learning environment**: is a learning environment that pays attention to knowledge, skills, attitudes, and beliefs that learners bring with them to the learning process where its impetus is derived from a paradigm of learning called constructivism (Jonassen, 1991). In the context of this research, it may be defined as learners' active involvement to the learning ask using the computer, internet connection or any other ICT tool.

- **E-learning–** E-learning is also called online learning. Ratheeswari (2018) states that e-learning involves learning at all levels both formal and non-formal that uses an information network– the Internet, an intranet (LAN) or extranet (WAN). The components include e-portfolios, cyber infrastructures, digital libraries and online learning object repositories (Collis & Jung, 2003; Tinio, 2002).

1.9 Summary

The chapter focused on the background of the study, the statement of the problem, research question and the research sub-questions. It highlighted the significance of the study, the delimitations of the study and the limitations.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on various authors' views concerning Information Communication Technologies (ICTs), their involvement and uses in teaching and learning, challenges faced by teachers in implementing ICTs when teaching Mathematics as well as the strategies which may be used to help teachers use ICTs effectively in the teaching of Mathematics.

2.2 Information Communication Technologies (ICTs) defined

ICT stands for "Information Communication Technology". It refers to technologies that provide access to information through telecommunication (Ratheeswari, 2018). It is similar to Information Technology (IT) but focuses primarily on communication technologies. These include the internet, wireless networks, cell phones and all other communication media. UNESCO (2002) views ICT as a scientific, technological and engineering discipline and management technique used in handling information, its application and association with social, economic and cultural matters. Information Communication Technology (ICT) is basically an umbrella term that encompasses all communication technologies such as the internet, wireless networks, cell phones, satellite communications, digital television, computers and network hardware and software; as well as the equipment and services associated with these technologies, such as video-conferencing, e-mail and blogs, that provide access to information (Tinio, 2002). Information Communication Technologies (ICTs) in this context can be viewed as all computer and internet connections used to handle and communicate information for learning purposes.

2.3 Uses of ICT in the teaching and learning of Mathematics

ICTs are making big changes in societies across the whole world. They have a great impact in life and their influences are hugely felt in schools. As ICTs provide both learners and facilitators with more opportunities in suiting learning and teaching to individual needs, society is pushing schools to respond to this technical innovation (Pearson, 2003). ICT enables self-advanced learning through different tools such as assignment and computers hence teaching and learning has become more constructive and meaningful. ICT also helps facilitate the transaction between producers and users by keeping the students updated and enhancing teachers' capacity and ability to foster live contact between the teacher and the student through e-mail, chalk sessions, e-learning, web-based learning including internet, intranet, extranet, CD-ROM, and TV audio-videotape (Jonassen, 1991). Technology has become a very powerful medium for the interactive participation of experts and learners and it reaches a wide population from different parts of the world.

According to Pearson (2003), ICTs provide opportunities for teachers and students to operate, store, manipulate, and retrieve information. They also encourage independent and active learning to students. ICTs enable self-responsibility for learning and motivate teachers and students to continue learning even outside school hours. They help teachers to plan and prepare lessons, design materials and facilitate sharing of resources, expertise and advice (Pearson, 2003). Modern schools are currently facing ever-increasing demands in their attempt to ensure that learners are well equipped to face the global demand of computer literacy and numeracy. Research indicates that computer technology can help support learning, and that it is especially useful in developing the higher order skills of critical thinking, analysis, and scientific inquiry (Ratheeswari, 2018). Mathematics is regarded as the head of all sciences even though for long, its role was limited

purely to the academic domain. Nowadays, the role of Mathematics is not restricted to the purely academic domain, but it has entered the domain of Technology as well. New fields in Mathematics such as Operation Research, Control Theory, Signal Processing and cryptography have been generated which need technology.

ICT as a versatile instrument has the capability not only of engaging students in instructional activities to increase their learning, but of helping them to solve complex problems to enhance their cognitive skills (Jonassen, 1991). Generally, three objectives are distinguished for the use of ICT in education. The first one is the use of ICT as object of study. That refers to learning about ICT, which enables students to use ICT in their daily lives. Secondly, there is the use of ICT as an aspect of discipline or profession that refers to the development of ICT skills for professional or vocational purposes. The third one is the use of ICT as medium for teaching and learning which focuses on the use of ICT for the enhancement of the teaching and learning process (Tinio, 2002). In this research, focus will mainly be on the third objective of ICT as the research is on challenges faced by teachers when using ICT in teaching Mathematics. It is a fact that teachers are at the center of curriculum change and they control the teaching and learning process. Therefore, they must be able to prepare young people for the knowledge society in which the competency of using ICT to acquire and process information is very important.

ICT plays various roles in learning and teaching processes. Several studies have reviewed literature on ICT and learning and have concluded that it has great potential to enhance student achievement and helps the teacher to facilitate learning (Chong,Sharaf and Jacob, 2005). Chong et al. (2005) also point out that technology can play a part in supporting face-to-face teaching and learning in the classroom. Technology should be used as a tool to support mathematical objectives such as

skills for searching formulae and calculations, communication and problem solving which are important for preparation of students for mathematical concepts.

Piaget (1973) states that children first develop ideas concretely, then later progress to abstractions. In designing learning environments, it is often helpful to apply this principle in reverse, that is, to help students learn an abstract idea, then provide them with more tangible visualizations (Pearson, 2003). Researchers have found that when technology makes abstract ideas tangible, teachers can more easily build upon students' prior knowledge and skills, emphasize the connections among mathematical concepts and connect abstractions to real-world settings. (Chong et al., 2005). Having computers in the classroom is an asset to any teacher. With a computer, teachers are able to demonstrate a new lesson, present new material, illustrate how to use new programs, and show new websites.

There are various types of technologies currently used in traditional classrooms. Among these are radio, television, audio tape, video tape, slide projector and overhead projector, digital cameras, video cameras, interactive whiteboard tools, document cameras and LCD projectors. To add on, there are a variety of Web tools that may be implemented in the classroom. Blogs allow for students to maintain a running dialogue, such as a journal, thoughts, ideas, and assignments that also provide for student comment and reflection (Ratheeswari, 2018). Mobile devices such as smart phones can be used to enhance the experience in the classroom by providing the possibility for learners and facilitators to get feedback and calculations in Mathematics (Tinio, 2002). Furthermore, an interactive whiteboard that provides touch control of computer applications can be used to enhance the experience in the classroom by showing anything that can be on a computer screen (Chong et al., 2005). This not only aids in visual learning, but is interactive as the students can draw, write, or manipulate images on the interactive whiteboard. Also, digital video eliminates

the need for in-classroom hardware (players) and allows teachers and students to access video clips immediately by not utilizing the public Internet (Ratheeswari, 2018) . This helps them in solving problems on their own without much assistance and without the use of the Internet.

E–learning is also another important use of ICT when teaching Mathematics. The website is an e-resource for syllabus, online text books, other publications such as sample question papers and multimedia packages which helps both the students and teachers in teaching learning Mathematics (Pearson, 2003). Software used for teaching and learning Mathematics includes graphic calculators, dynamic graphing tools (Geogebra), dynamic geometry tools, Microsoft Excel spreadsheets, Microsoft Mathematics, Mat lab and Auto shape (Jonassen, 1991). All these components create a digital identity of the user and connect different stakeholders in education.

Another use of ICT is through digital games**.** The field of educational games in primary school Mathematics has been growing significantly over the years as learners develop more interest in learning through play (Pearson, 2003). The digital games are provided as tools for the classroom and have a lot of positive feedback including higher motivation for students. As indicated by Jonassen (1991), it may be concluded that ICTs play a very crucial role in the teaching of Mathematics at primary level, and various tools and strategies may be adopted to implement the use of ICTs when teaching mathematical concepts in and outside the classroom.

2.4 The extent to which the use of ICT assists the teaching and learning of Mathematics

The use of ICT when teaching and learning Mathematics is not a new innovation, since humankind has always been looking for solutions to avoid time consuming regular work. The use of technology has a long history in Mathematics education. Starting from magic slate, book, magic lantern, Blackboard, radio, Slide rule video tape, television, calculator, computer, Interactive

Board, Apple I-Pad all come under technology (Sharma, 2011). All these services, availed through ICT, play a great role in teaching and learning. It allows higher participation and greater interaction. It also improves the quality of education by facilitating learning by doing, directed instruction, self-learning, problem solving, information seeking and analysis and critical thinking as well as the ability to communicate, collaborate and learn (Karmal, 2005).

Researchers have found that the move from traditional paper-based mathematical notations to on-screen notations (including algebraic symbols, graphs, tables, and geometric figures) can have a dramatic effect. In comparison to the use of paper and pencil which supports only static, isolated notations, use of computers allows for dynamic, linked notations with several helpful advantages (Sharma, 2011). ICT integration also assists the teaching of Mathematics helping us in making education more accessible and affordable. Increasing role of ICT will make education more democratic that is improving the quality education services available to even students sitting in far- flung remotest corners of the country (Karmal, 2005).

Technology can reduce the effort devoted to tedious computations and increase students' focus on more important mathematical objectives, for example calculation of large numbers (Khajapeer, 2001). Equally importantly, technology can represent Mathematics in ways that help students understand concepts, for example the use of multimedia tools. In combination, these features can enable teachers to integrate project-based learning. Calculators and other technological tools, such as computer algebra systems, interactive geometry software, applets, spreadsheets, and interactive presentation devices, are vital components of a high-quality Mathematics education (Karmal, 2005). With guidance from effective Mathematics teachers, learners at Grade 5 level can also use these tools to construct knowledge and develop 21st Century skills such as critical thinking, problem solving and decision making.

To a great extent, a technological creativity learner will help generate sharing of knowledge to solve mathematical tasks in a better way and to develop their capacity and skills to keep pace with the rapid changes (Sharma, 2011). Teachers must empower learners with the latest technology to tap the latest skills and hidden potential of primary school learners. There is a possibility that technology can expand and improve Mathematics at grade five level with special reference to design and content of instructional materials, delivery, as well as assessment and feedback.

Other benefits for using ICT when teaching Mathematics include instant feedback to students. ICTs also enable greater flexibility with respect to location and timing, that is, it promotes learning even outside the classroom, at any given time irrespective of distance or location. They also provide improved reliability, improved impartiality, enhanced question styles which incorporate interactivity and multimedia as well as greater storage efficiency (Jonassen, 1991). From this idea, it may be seen that using ICTs when teaching Mathematics is, to a larger extent, more beneficial to teachers as it provides accuracy, accessibility, flexibility, self-reliance and much fun in lesson presentations.

2.5 Some typical challenges faced by teachers in using ICT when teaching Mathematics

The use of ICT in teaching Mathematics can make the teaching process more effective as well as enhance the students' capabilities in understanding basic concepts. Nevertheless, implementing its use in teaching is not without problems as numerous barriers may arise (Hudson, 2008). Different categories have been used by researchers and educators to classify the problems in the use of ICT in educational institutions and several studies have divided the problems into extrinsic and intrinsic categories. Habibu, Abdullar-Al-Mamum and Clement (2012) refer to extrinsic problems as those conditions outside the individual's attitudes which affect the use of ICTs in teaching and learning,

for example, access, time, support, resources and training. Intrinsic problems refer to individual inner-challenges and perceptions towards ICTs which include attitudes, beliefs, practices and resistance (Abdullar-Al-Mamum and Clement ,2012). Pelgrum (2001) further views extrinsic problems as those challenges found in institutions rather than in individuals and intrinsic as problems pertaining to teachers, administrators and individuals.

Another perspective presents the obstacles in the use of ICT in educational institutions as pertaining to material and non-material conditions (Flanagam and Jacobsen, 2003). The material conditions may be the insufficient number of computers and copies of software. The non-material obstacles include teachers' insufficient ICT knowledge and skills, the difficulty of integrating the use of ICT in instruction, and insufficient teacher time.

Lack of adequate software is one of the challenges faced by teachers in their attempt to use ICT in teaching Mathematics. There are unreliable and pirated software that had been frequently changed in the computer labs which are difficult to use properly in teaching-learning process (Khajapeer, 2001). In most cases ICT facilities are limited for both the teachers and students and they have to share with other teachers. According to Karmal (2005), the inaccessibility of ICT resources is not always merely due to the non-availability of the hardware and software or other ICT materials within the institution but may be the result of one of a number of factors such as poor organization of resources, poor quality hardware, inappropriate software, or lack of personal access for teachers. The limitations on access to hardware and software resources influence teachers' motivation to use ICT in the classroom (Pelgrum, 2001).

Lack of sufficient training is also a major challenge faced by teachers in their quest to use ICT in teaching Mathematics. Most of the teachers lack the skills to use ICT in teaching-learning processes because they lack enough training (Habibu et al., 2012). Teachers are rarely seen using

ICT in a classroom environment because most of the teachers are reluctant to embrace new technology. New technologies need to be integrated in the classroom and teachers have to be trained in the use of these ICTs in particular (Pelgrum, 2001). In this regard, some initial training is needed for teachers to develop appropriate skills, knowledge, and attitudes regarding the effective use of computers to support learning. Johnson et al. (2016) assert that one of the top three problems to teachers' use of ICT in teaching is the lack of training. Hannafin (1993) also states that the issue of training is certainly complex because it is important to consider several components to ensure the effectiveness of the training. These include time for training, costs involved and ICT use in initial teacher training (Fathima, 2013). Providing pedagogical training for teachers, rather than simply training them to use ICT tools, is an important issue as not only should they know how to operate ICT tools but also have adequate knowledge on integrating it to other subjects like Mathematics.

The lack of learning equipment tools and resources, since the computers are very few and in some cases not available at all, is another challenge faced by teachers when using ICT in teaching Mathematics. Various research studies indicate several reasons for the lack of access to technologies. A teacher may have no access to ICT materials because most of these are either shared with other teachers or not available at all (UNESCO, 2002). Teachers have an insufficient number of computers, insufficient peripherals, numbers of copies of software, and insufficient simultaneous internet access as the main obstacles to the implementation of ICT in educational institutions (Neelam, 2003). According to Banks (1994), the accessibility of ICT resources does not guarantee its successful implementation in teaching, and this is not merely because of the lack of ICT infrastructure but also because of other problems such as lack of high quality hardware, unsuitable educational software, and access to ICT resources. Aggrawal (2003) also asserts that

poor choices of hardware and software and lack of consideration of what is suitable for classroom teaching are problems facing many teachers. Similarly, Baskhara (2004) states that the majority of teachers agree that insufficient ICT resources in the institution and insufficient time to review software prevent teachers using ICT.

Another challenge faced by teachers in the implementation of computers in teaching-learning Mathematics is teachers' acceptance, which in turn is influenced by their attitudes towards these media (Shukla, 2008). Teachers' attitudes seem to be the major predictors of the use of new technologies in instructional settings as the successful use of new technology in the classroom depends largely on the teachers' attitudes toward these tools (Banks, 1994). Their attitudes towards computers affect their use of computers in the classroom and the likelihood of their benefiting from training. According to Shukla (2008), one of the problems of integrating ICT in education is the teachers' reluctance to new technology. Hannafin and Savenye (1993) argue that integrating the new technologies into educational settings requires change and different teachers will handle this change differently.

Neelam (2003) further argues that considering different teachers' attitudes to change is important because teachers' beliefs influence what they do in classrooms. Fathima (2013) also claims that one key area of teachers' attitudes towards the use of technologies is their understanding of how these technologies will benefit their teaching and their students' learning. Aggrawal (2003) further postulates that, although teachers feel there is more than enough technology available, they do not believe that they are being supported, guided, or rewarded in the integration of technology into their teaching. It has been observed that the teachers are lacking in the knowledge and skills, and they are reluctant about the changes and incorporation of extra learning associated with computers into their teaching practices. Hence there is a problem of teachers' acceptance and adoption of

ICT. Accordingly, teachers who do not use computers in classrooms claim that lack of skills is a constraining factor preventing them from using ICT (Johnson et al., 2016).

Other studies further reveal that many teachers have skills in using computers in the classroom, but they still make little use of technologies because they do not have enough time. A significant number of teachers identified time limitations as one of the difficulties in scheduling enough computer time for classes as a problem in their use of ICT in their teaching-learning (Flanagam and Jacobsen, 2003). The problem of lack of time exists for teachers in many aspects of their work and it affects their ability to complete tasks. Teachers need time to research, prepare lessons, explore and practice using the technology, deal with technical problems and receive adequate training. Recent studies show that lack of time is an important factor affecting the application of new technologies in ICT education (Banks, 1994). Simply revising lesson plans can occupy a great deal of time, but revising lesson plans to incorporate technology is even more time consuming. When adopting new classroom technologies, educators face the problem known online as the 'double innovation' problem (Khajapeer, 2001). Double innovation essentially adds an additional layer of preparation teachers must work through. The teacher must first learn the technology well enough to use it in a classroom setup before deciding how to integrate the technology with classroom objectives.

In addition, lack of confidence is also considered to be one of the problems that prevent teachers from using ICT in their teaching Mathematics. Due to 'fear of failure' many teachers do not consider themselves to be well skilled in using ICT and feel anxious about using ICT in front of a class (Baskhara, 2004). Limitations in teachers' ICT knowledge make them insecure about using ICT in the classroom and thus lack confidence in using it in their teaching.

2.6 Strategies that may be used to help teachers use ICT effectively in teaching Mathematics

Mathematics, to most, is a complex and difficult subject. The tendency for most students is to consider the subject as one that is boring, thus, creating lack of interest in the topics being discussed. This poses a great challenge for teachers and educators, especially in the primary and intermediate levels, wherein a good study habit and a firm grasp of basic concepts should be developed (Sangra and Gonzalez-Sanmamed, 2010). To effectively harness the power of the new Information Communication Technologies (ICTs) to improve learning, some essential conditions must be met.

Firstly, teachers must have sufficient access to digital technologies and the Internet in their classrooms, schools, and teacher education institutions (Baskhara, 2004). Secondly, high quality, meaningful, and culturally responsive digital content must be available for teachers. This enables them to disseminate correct and current information and formulas in teaching Mathematics without any bias. Furthermore, teachers must have the knowledge and skills to use the new digital tools and resources to help all students achieve high academic standards (Chong et al., 2005). This calls for all teachers to be well versed with technological demands as well as be able to enhance their knowledge through further research.

Another strategy which may be used to help teachers use ICT in teaching Mathematics is for him/her to pose as a director/coach or a facilitator and not the holder of all knowledge. This is because ICT enhances the quality of teaching and learning by arousing inquiry, curiosity and exploration on the learner (learner-centred) (Pearson, 2003). ICT will afford opportunity to the individual learner for self-paced learning, which caters for learners' individual abilities and aptitudes. The innovative use of ICT can facilitate student-centered learning. Hence, every classroom teacher should use learning technologies to enhance their student learning in every

subject because it can engage the thinking, decision making, problem solving and reasoning behaviours of students (Aggrawal, 2003). Teachers must understand the potential role of technology in Mathematics learning. Also, they should become effective agents to be able to make use of technology in the classroom.

Due to the importance of ICT in society and possibly for the future of education, identifying the possible obstacles to the use of ICT in educational institutions would be another important step in improving the quality of teaching and learning of Mathematics (Neelam, 2003). Identifying the fundamental problems may assist teachers and educators to overcome these problems and become successful technology adopters. Understanding the pedagogical, psychological and cognitive barriers to the successful use of ICT when teaching Mathematics is a vital precondition for improving the utilization of computers and other technological aids in the educational institutions (Karmal, 2005). Also, the detection of these barriers provides information that is helpful in supplementing existing in-service training programs (Banks, 1994). Identifying the fundamental barriers may assist teachers and educators to overcome these barriers and become successful technology adopters.

Recent research on technology use in the classroom indicates that significant advances have been made to overcome the first-order (external) barriers to technology integration, especially concerning access to computing resources (Hannafin and Savenye, 1993). Strategies to make further improvement include exploiting the expertise of master teachers in professional learning communities, requesting training on newly adopted educational software from experts and ensuring that adequate technical, administrative, and peer support is available to teachers during the implementation (Fathima, 2013). Furthermore, providing teacher training that highlights

constructivism and student-centered education, focusing on professional development efforts toward those which emphasize the use of technology in instruction, rather than for administrative tasks, including visualization tools in student tracking technologies which allow teachers to easily interpret student progress, involving teachers in the decision-making process when adopting new technologies and offering teachers training on the intersection of technological knowledge, pedagogical knowledge, and content knowledge (Hudson et al., 2008).

2.7 Summary

This chapter focused on various authors' views on the explanation of Information and Communication Technologies, their involvement and uses in teaching and learning, some typical challenges faced by teachers in implementing ICT when teaching Mathematics as well as the strategies which may be used to help teachers use ICTs effectively in the teaching of Mathematics. The next chapter will look at the research methodology.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focused on research design, population sample and sampling procedures. Data collection instruments and data collection procedures were also discussed. The chapter also looked into reliability and validity issues in the instruments used. Data analysis and presentation was then explained. Each sub-heading was explained in detail related literature in order to make this research scholarly.

3.2 Research Design

A research design is a systematic plan to study a problem (Johnson and Christensen, 2000). The design of study defines the study type, for example descriptive survey, correlation and experimental. It constitutes the blueprint for the collection, measurement and analysis of data (Wiseman, 1999). This study employed the descriptive survey design. Aggrawal (2008) postulates that a descriptive survey is devoted to the gathering of information about prevailing conditions for the purpose of describing and interpreting data. Chiromo (2009) also asserts that it entails studying a limited number of cases with a view of drawing conclusions that cover the generality of the whole group under study. In this research, both quantitative data (represented by statistical analysis) and qualitative data (summarized explanations) were used in the descriptive survey design. Since the researcher used both qualitative and quantitative, presentation and interpretation of data was more detailed and easy to comprehend as it was presented by statistical and textual explanations.

However, there are a number of challenges which were likely to be encountered when using descriptive survey. As a survey entails a study of a limited number of cases with a view to drawing up conclusions that cover the generality of the whole group under review, the selected population (sample) might not represent the characteristics of the whole population. To add on, the methods of collecting data used in descriptive survey such as interviews and questioners are time consuming and also pause the danger of respondents giving inaccurate information. To minimize and control these challenges, the researcher included all grade five teachers in cluster schools, deputies and school heads so as to get the whole population represented. Also, the researcher chose more convenient time for handing out questionnaires and interviewing the respondents in order to avoid hurried answers.

3.3 Population and Sampling

3.3.1 Population

Bartram and Christiansen (2014) postulate that the word population refers to total number of people, groups or organizations that could be included in a study. Chiromo (2009) also defines a population as all individuals, units, objects or events that will be considered in a research project. From these definitions, the population in this research was the number of primary school teachers in Insuza district who participated in the research. Therefore, in this context, population refers to the target group under investigation.

3.3.2 Sample

Borg and Gall (1990) define a sample as a part of the whole, or a subset of measurements drawn from the population. Johnson and Chritensen (2000) assert that a sample is a subset of population that is selected in order to research the population without having to collect data from each and every individual of the population. Therefore, a sample may be viewed as a collection of

individuals chosen from the population. The sample in this research included four schools each having four participants. These included the school head, the deputy and two grade five teachers (per school).

3.3.3 Sampling techniques and Procedure

Non-probability is a sampling technique. Ary, Jacobs and Sorensen (2010) state that non probability sampling is a qualitative sampling procedure in which the researcher chooses participants because they are available, convenient, and represent some characteristic the investigator seeks to study. In other words, no one knows if every characteristic or element of the population have been included on the sample. It is appropriate where the researcher's aim is to generate theory and a wider understanding of social process. Examples of non-probability sampling are convenience (or accidental) sampling, snowball sampling, purposive or judgmental sampling and quota sampling.

For the purpose of this study, the researcher used non-probability sampling techniques. The convenience sampling was to select four schools that were nearer to the researcher. Purposive sampling technique were school heads, deputies and teachers. The school heads are in charge of the school, therefore, purposive sampling was the most suitable. Deputies have more detail on issues concerning grade five teachers since they are in charge of the junior school department at school level, therefore, purposive sampling was also appropriate. Grade five teachers are the ones teaching Mathematics on daily basis and expected to implement the use of ICT in the subject and hence they were purposely chosen.

3.4 Research instruments

Instruments are tools that facilitate data collection and they are used by the researcher. They include Questionnaire, interview schedules and observation schedules, (Bartram and Christiansen, 2014). According to Leedy (1980), the questionnaire and interview are the most commonly used instruments for collecting data in survey design studies. Since this research was using a survey design, the best instruments selected were questionnaires (for the grade five teachers) and interview (for the school heads and deputies).

3.4.1 Questionnaire

Wimmer and Dominick, (1994) postulate that a questionnaire is a printed document that contains instructions, questions and statements that are compiled to obtain answers from respondents. Furthermore, Creswell (2012) also asserts that questionnaires are forms used in a survey design that participants in a study complete and return to the researcher. Participants respond to questions and provide basic, personal, or demographic information about themselves. Questionnaires enable researchers to formulate the questions and receive replies without actually having to talk to every respondent. Questionnaires were chosen for this study as they reached out to participants in a short period of time since they were self-administered. The respondents were free to express themselves as they responded to issues without any interference by the researcher. Ader (2008) says that a questionnaire can have closed or open ended questions. Cohen and Mansion (1994) say closed ended items allow a respondent to select his or her responses from a number of options. Leedy (1980) also states that open ended items allow the respondents to express themselves using their own words. For the purpose of this research, both closed and open-ended questions were used.

However, Wimmer and Dominick (1994) point out that constructing a questionnaire requires a lot of time and skill to design and develop. This comes as one of the demerits of the above instrument. To add on, questionnaires need to be short and simple to follow, therefore, complex question structures are not possible. The researcher will not be always available to clarify on questions that are not clear. The respondents may not understand the questions asked and give the answers they think the researcher wants. Furthermore, not everyone is able to complete an open-ended questionnaire. Also, data analysis can be time consuming as the researcher is expected to write everything that the respondents say or do.

As a way of addressing these challenges, the researcher used very simple language. The researcher also used straight forward questions. The questionnaires were short so that respondents would attempt all questions where possible. The researcher prepared a closed and open-ended questionnaire for the grade five teachers.

3.4.2 Interviews

Bartram and Christiansen (2014) define an interview as a conversation between a researcher and a respondent. Bartram and Christiansen (2014) further elaborate that the researcher is the one who sets the agenda and asks questions. Creswell (2012) also state that an interview occurs when researchers ask one or more participants general, open-ended questions and record their answers. The researcher also has in mind particular information that he/she want from the respondent therefore design particular questions to be answered. Interviews can be structured, semi-structured or unstructured. The purpose of an interview in this study was to find out from the school heads and deputies on the challenges which are faced by teachers when using ICT in the teaching of Mathematics.

There are some advantages in using this tool. According to Wiseman (1999), the researcher will be available if the respondent need clarity on any question. This means that the researcher can also ask more questions to obtain detailed information on ICT challenges if the respondent has given insufficient detail initially. The respondents might also find it better to talk to the researcher than to answer a long questionnaire as it is less time consuming and less tiresome. Interviews are generally easy to carryout, with data coming in as firsthand information and very fast as the responses are instant (Chiromo, 2009), Furthermore, this is an ideal method to use to get in-depth data from the school heads and deputies. Interviews can also lead to generation of large amounts of data that will need to be captured. The researcher requested to record the interviewee so that it would be easy to analyze data as the researcher referred to notes jotted and the audio recorded.

However, Creswell (2012) outlines a number of disadvantages of using interview as an instrument for data collection. These include the power relations, for example, when a student teacher is interviewing a senior member in school administration, power relations are likely to influence the interview. According to Oliver (2008), the greater the status difference between the interviewer and the interviewee, the greater the chances of distorting some more useful information. This was likely be faced by the researcher in this study as school heads and deputies were also considered as some of the respondents. This may influence the quality of questions asked by the researcher and also compromise the responses given by the senior members. Another challenge is that the respondent may also choose to give false information and this may hinder the true results of the research (Leedy, 1980). However, the researcher conducted structured interviews using open ended questions with heads, deputies and teachers. Also, the researcher structured questions that

were clear. In addition, the researcher tried as much as possible to abide by ethical considerations on issues of confidentiality. This was done by ensuring that the responses of the subjects were private and confidential. The participants neither wrote nor gave out their names in both these instruments which were used.

3.5 Data collection procedures

Data collection procedures are the ways that the researcher used for distributing instruments used for the research. Chaleunvong (2009) says that data-collection procedures allow a systematic collection of information about the objects of study (people, objects, phenomena) and about the settings in which they occur. The procedures have to be systematic because it can be difficult to answer the research questions in a conclusive way.

Firstly, the researcher got an authorization letter from Midlands State University which was to be taken to the Ministry of Primary and Secondary Education Matabeleland North Provincial Offices to ask for permission to collect data in Insuza District. When approval was granted, the researcher distributed the questionnaires to the respondents and these are school heads, deputies and grade four teachers. Walliman (2011) alludes that questionnaires can be self-administered to the respondent, therefore, these questionnaires were self-administered to respondents as this was a more convenient way of distributing them. The questionnaires were collected two weeks after distribution as this was the agreed time between the researcher and the respondents. Walliman (2011) further asserts that interviews can be done in different forms which include face-to-face. Therefore, the researcher used the face-to-face interview with the school heads, deputies and the grade five teachers. Appointments to conduct interviews with all these respondents was made in advance.

3.6 Reliability and Validity issues

Validity and reliability refers to the degree to which a study accurately reflects the specific concept that the researcher is attempting to measure (Wiseman, 1999). It may be viewed as the extent to which a study truly shows the actual concept that the researcher is trying to measure. Variability of quantitative research is assessed in terms of its reliability and validity. Qualitative research is accurately assessed according to trustworthiness through credibility, transferability, dependability and conformability (Baxter and Jack, 2008). Credibility enables the researcher to establish confidence in the 'truth' of her findings. To ensure credibility, the researcher used member checks where interview was used. The researcher also captured information on transcripts so that they would confirm whether the researcher captured their responses correctly during face to face interviews. However, member-checking may lead to confusion rather than confirmation because participants may change their minds about an issue, the interview itself may have an impact on their original assessment, and new experiences may have intervened (Cohen and Crabtree, 2006). To counter these problems, the researcher had to refer to the original voice recorded data to come up with credible findings. In this study, questionnaires and interviews were used for methodological triangulation.

3.7 Ethical considerations

Ethical considerations are issues relating to the protection of all participants who took part in this research. Creswell (2012) alludes that human behaviour is subject to ethical principles, rules and conventions which distinguish socially acceptable behavior from that which is socially unacceptable. The researcher had to abide by ethical considerations so as to ensure that individual rights were not infringed upon and to promote fairness in the interpretation of data. Principles such as obtaining informed consent, respecting the right to privacy and participation, anonymity,

confidentiality and other principles as highlighted by Cohen and Glabtree (2006) were adhered to during data collecting, data analysis and interpretation.

3.7.1 Informed consent

Cohen, Manion, and Morrison (2000) view informed consent as the procedure in which individuals choose whether to participate in an investigation after being informed of the purpose of research. Therefore, the researcher did not force any member to participate in the data collection and was to respect their denial to participate if any such reactions were to arise.

3.7.2 Right to confidentiality and anonymity

When carrying out a research, every participant is empowered to privacy and confidentiality both on ethical grounds and in terms of the protection of their personal and sensitive data. Meke (2011) states that this put the participants at ease to give information which might otherwise be regarded as sensitive. Thus, confidentiality exists when the researcher is the only one who is aware of the participants' identities and honor the promise of not revealing their identity to others. To this effect, the researcher did not disclose any information from or about the participants to anyone.

3.7.3 Protection from harm

In the context of research ethics, harm may be viewed as any action or information that may cause physical discomfort to emotional stress, humiliation or embarrassment, or myriad influences that may adversely affect the participants in a significant way (Rensburg, 2010). Therefore, the researcher did not expose participants to any intentional danger or injury. The researcher had to abide by ethical considerations.

3.8 Data analysis and presentation

Data collected can be analyzed, presented and interpreted in various ways. Data analysis helps on obtaining usable and useful information. According to Ader (2008), data analysis is the process of representing, clearing, transforming and modeling data with the aim of highlighting useful

information, suggesting conclusions and supporting decision making. This implies that data analysis is a step by step process where data is scrutinized, coded, sorted and it may be further investigated if there is a need. Data collected was summarized and analyzed according to the research questions and information based on literature review sub- headings. Thus, the analysis focused on understanding what Information Communication Technologies (ICTs) are, how teachers involve the use of ICTs in teaching Mathematics, the extent to which ICTs are useful in the teaching of Mathematics, challenges faced by teachers when using ICTs in the teaching of Mathematics at grade five level as well as strategies which may be used to help teachers effectively use ICTs in the teaching of Mathematics.

Tables and graphs were used to present collected data. Data items were then each analyzed after the completion of interviews and questionnaires. As both qualitative and quantitative data was collected, the presentation was merged as both statistical and word explanations. This means that the same data presented by tables and graphs was explained by non- statistical explanations for better clarity and understanding. Conclusions were finally drawn from the data gathered using questionnaires and interviews.

3.9 Summary

This chapter focused on research design, population sample and sampling procedures. Data collection instruments and data collection procedures were also discussed. The chapter also looked into reliability and validity issues in the instruments used. Data analysis and presentation were then explained. Each sub-heading was explained in detail related literature in order to make this research scholarly. The following chapter will focus on data presentation, analysis and interpretation.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter focused on data presentation, analysis and discussion. Biographical data was presented first, showing the number of respondents, the response rate, their age and qualifications. The next section focused on data presentation and analysis which were based on the themes drawn from the Sub-research questions. Discussion of data was then done according to the presentation and analysis themes, whereby interpretation, meaning and implications of the data was presented.

4.2 Biographical Data

4.2.1 Number of respondents

Sixteen respondents were involved in this research. Eight of these were administrators, which means that four school heads and their deputies were all interviewed. Also, eight grade five teachers were consulted, whereby two teachers represented each school. This gave a striking balance on the research as an equal number of respondents was used in all of the four schools in the cluster.

4.2.2 Sex

A striking balance in terms of gender was noted on administrators as indicated by the equal number of males and females. Four out of eight administrators were males and the other four were females. This helped to find out opinions and responses which were not gender biased. An imbalance occurred on grade five teachers as seventy-five percent (six out of eight) respondents were female. However, male representation was also involved as twenty-five percent (two out of eight)

respondents were involved. This helped to get a better result in terms of gender, whether challenges encountered by teachers when using ICTs in teaching Mathematics had anything to do with gender or sex.

4.2.3 Response Rate

Of all the questionnaires distributed, the response rate was one hundred percent as all the eight teachers gave feedback on all the questions asked. This gave a clear picture of the responses from all the cluster schools. Respondents also attempted to answer all of the questions asked and this also helped the researcher to get as much information as possible. This was also the case with the interview as all eight administrators responded to all of the questions asked by the researcher. Respondents also asked for clarity where they did not understand and the researcher was also able to probe further on some of the responses given.

4.2.4 Age range

All of the four school heads who were interviewed ranged between the ages of fifty to sixty. This indicated how a huge generation gap exists between the majority of administrators and new recruited teachers. Three deputy heads ranged between the ages of thirty-five to forty-five, while one between thirty-five and forty years of age. Unlike the case of school heads, a wider range of age differences was noted in deputy heads and this could help find various opinions and facts from different age groups. Two teachers ranged between ages twenty-six to thirty five, four between thirty-six to forty-five and only two were above forty-six years. This could also be an advantage in terms of age ranges as their responses would indicate different perspectives based on age.

4.2.5 Highest academic qualifications

Fourteen of the respondents (both administrators and teachers) had Ordinary level as their academic qualifications, whereas only two had Advanced level (one school head and a deputy).

This indicated that all the respondents consulted had the minimum required academic qualifications to be Primary school teachers.

4.2.6 Professional Qualifications

All eight teacher respondents were Diploma in Education Certificate holders. This means that all the teachers consulted were trained professionals whose opinions would be used to represent real teaching experiences. Of the four school heads, three had Degrees in Education while the other one had a Masters Degree. This indicated that all school heads had the requirements of being administrators hence their input and opinions reflected the true opinions of administrators where ICTs in Mathematics teaching was concerned. Two of the deputy heads also had degrees while the other two are Diploma holders.

4.2.7 Professional Experience

4.2.7.1 Administrative Experience

Four respondents consulted had been in the administrative position for three years. One school head had five years of experience while one deputy had two. All these administrators had commenced on administrative duties between the year 2015 (which is the year the curriculum was revised) and 2018. This meant that all their responses were based on recent assessment experiences, in line with the introduction of the Competence-based curriculum which strongly demands the involvement of ICTs in the teaching and learning of Mathematics. All the information given by these administrators indicated how the updated curriculum was being implemented as far as the use of ICTs in Mathematics teaching was concerned especially at grade 5 level. Two school heads had more than ten years of administrative experience as one had eleven years and the other one had twenty-three years. These were very essential to the research as they represented senior

administrators or the older generation whose opinions on the use of ICTs were very useful to this research.

4.2.7.2 Teaching Experience

Of the eight respondents consulted in this research, three of these had five years of teaching experience with two years of those in grade five. Two had eight years of working experience with five in grade five. The other two had seven years of working experience with one having taught grade five for four years and the other for five years. One senior teacher had thirteen years of teaching experience with eight of those in grade five. The researcher noticed that all these teachers had taught grade five more than once. This helped to get better information based on experience since the current grade five teachers did not yet have enough classroom experience with the learners due to the Covid-19 pandemic disturbances and premature closing of schools. Therefore, their responses were based on years of experience with grade 5 in their particular schools.

4.2.8 ICT Training

Of all the sixteen respondents consulted in this research, only two have had formal training on ICT with certificates of participation in Introduction to Computers. This means that these two had some basic knowledge and skill on using ICTs during Mathematics teaching and were expected to be able to operate some ICT tools during lessons without much difficulties. The other fourteen (87.5%) participants solely relied on general knowledge of ICT and workshops. This clearly indicated how proper training on ICT was lacking on the majority of the teachers and administrators in Insuza cluster.

4.3 Data Presentation and Analysis

4.3.1 Understanding Information Communication Technologies (ICTs)

Respondent one and three of the school heads explained Information Communication Technologies (ICTs) as impartation of knowledge through the use of electronic devices like laptops, cellphones and desktops. Respondent two and four referred to ICTs as tools used for communication. In view of the deputy heads, respondent one viewed ICTs as all communication technologies that include the internet and electronic devices. This was somehow related to respondent four who viewed ICTs as all technological devices. However, respondent two and three of the deputy heads simply gave examples of ICT tools such as smartphones and laptops. Explaining their own understanding of ICTs, teacher respondent one, five, seven and eight simply viewed ICTs as technologies that are used specifically for communications. Respondent two said ICTs are modern day technological requirements for sending and receiving information. Respondent three and six gave a similar view of ICTs as any means of communication which require the use of electronic devices. Respondent four of the teachers said that ICTs are all gadgets used to disseminate information.

4.3.2 Uses of ICTs in the teaching and learning of Mathematics

Asked to suggest any five ICT tools which can be used in teaching and learning, all participants stated cellphones, laptops, desktops, calculators and tablets as common tools to be used. Four of the participants also added a projector and digital camera. All respondents said that no school was providing them with any ICT tools for teaching and learning purposes except for one school which

had two donated Leap learning tablets. Two participants said they were currently not using any ICT tools as their school was not providing for them. The other six said they were using their own personal tools like laptops, calculators and smartphones for calculation and mathematical games when teaching Mathematics. Asked if they were familiar with any e-learning platforms which can be used to teach Mathematics, all participants had only one example, 'Ruzivo'. Three school heads and all four deputies said they have witnessed teachers using their smartphones and calculator during Mathematics lessons and one mentioned a radio.

4.3.3 The extent to which the use of ICT assists the teaching and learning of Mathematics

Asked if they find the use of ICT useful in the teaching and learning of Mathematics at Grade 5 level, all the eight teachers said yes. All the eight administrators said they also find the use of ICTs very useful in the teaching and learning of Mathematics at grade five level. Their reason was that ICTs motivate the interests of the learners as they seem to enjoy lessons which involve any electronic gadgets. Five of the teachers said ICTs help learners to grasp and understand concepts much better as the hands on approach is used where learners manipulate the gadgets. Two teachers said ICTs make lessons more interesting as they fascinate the learners. One teacher mentioned on ICT being very helpful in Mathematics teaching through research use of multimedia tools such as videos and graphical illustrations. Asked if the use of ICTs in teaching Mathematics affect results at grade five level, four administrators said it had a negative impact since most topics required the use of calculators which were not available. However, the other four said they were positive that it had a positive impact on the results as their pass rate had slightly improved since their attempt to involve ICTs in teaching and learning.

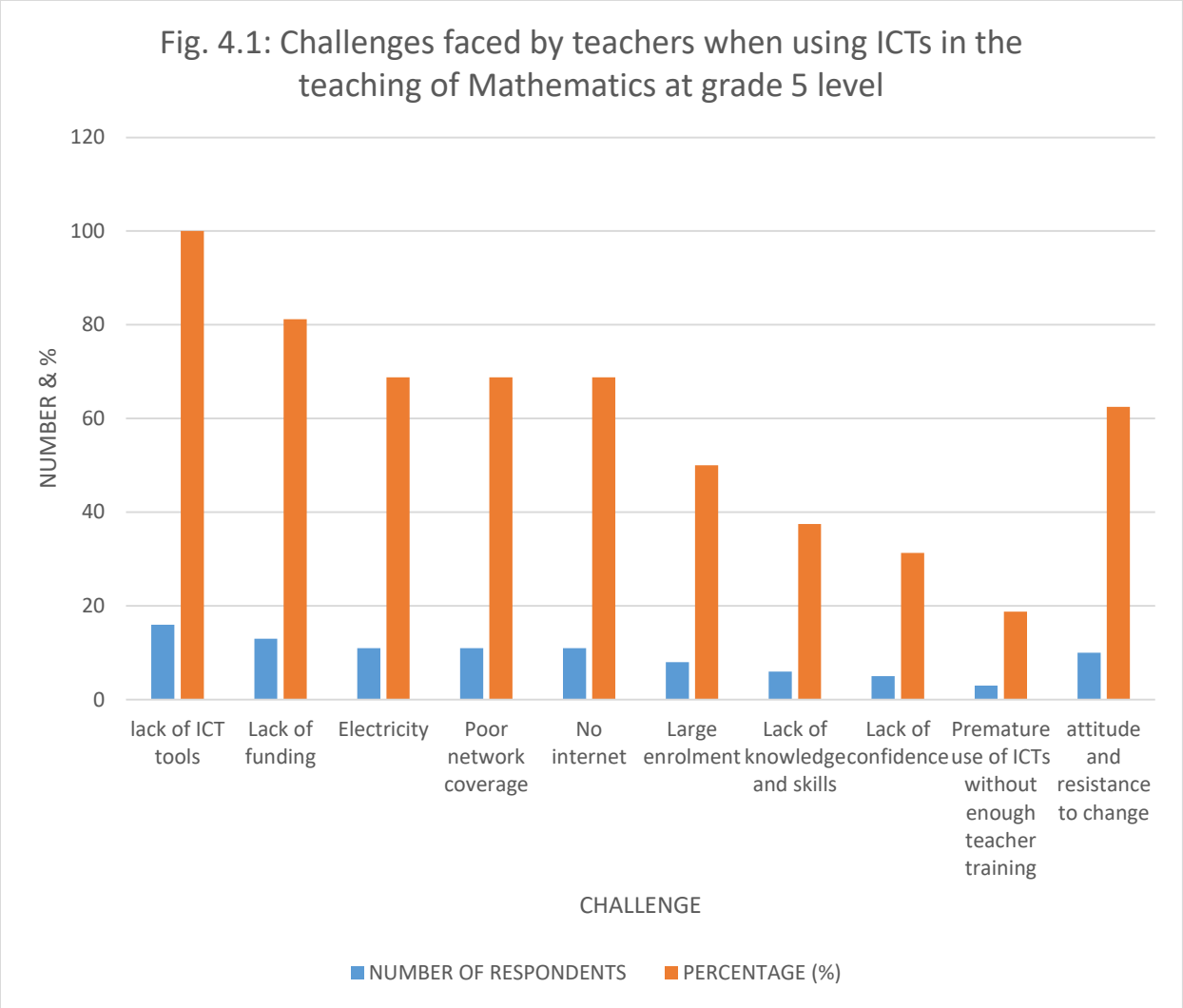
4.3.4 Some typical challenges faced by teachers when using ICT when teaching Mathematics

All the sixteen respondents said that teachers face challenges when using ICTs in teaching Mathematics at grade level. 37.5% of the respondents mentioned lack of ICT knowledge and skills as one of the challenges. All of the participants agreed that lack of ICT tools was the biggest challenge. Ten participants (62.5%), also highlighted on attitude and resistance to change in some of the teachers, especially the older generation, as one of the challenges. Lack of electricity, poor network coverage as well as no internet connections were also stated as some of the challenges by eleven participants (68.75%). Three respondents (18.75%), felt that the introduction and involvement of ICTs as a crosscutting theme in Mathematics and other areas was prematurely done since no in-service training on how to use these had not yet been done. Five teachers (31.25%) stated that they lack confidence on the little knowledge they had on ICTs. Eight respondents (50%), mentioned on the number of learners in relation to the improvised ICT equipment they could get as a challenge. Lack of funding from both the government and non-governmental organizations was a challenge mentioned by all administrators as well as five teachers (81.25%).

TABLE 4.1: CHALLENGES FACED BY TEACHERS WHEN USING ICTs IN THE TEACHING OF MATHEMATICS AT GRADE 5 LEVEL

CHALLENGE	**NUMBER OF RESPONDENTS**	**PERCENTAGE (%)**
Lack of ICT tools	16	100
Lack of funding	13	81.25

Electricity	11	68.75
Poor network coverage	11	68.75
No internet	11	68.75
Attitude and resistance to change	10	62.5
Large enrolment	8	50
Lack of knowledge and skills	6	37.5
Lack of confidence	5	31.25
Premature use of ICTs without enough teacher training	3	18.75



4.3.5 Strategies that can be used to help teachers use ICT effectively in teaching Mathematics

Asked if there were any motivational strategies which have been adopted by their schools to encourage the use of ICTs in the teaching and learning of Mathematics in Insuza Cluster, all administrators said no. Three schools confirmed to have done school development programs on using ICTs in the teaching of Mathematics though not specifically at grade five level. One school had no such program as of yet as they were still to find a resource person. All the respondents

suggested on possible strategies which may be used to help teachers use ICTs effectively during the teaching and learning of Mathematics at grade level. Four of the administrators suggested on engaging in ICT workshops at cluster level. Eleven participants stated that schools should seek for more donations and funding from both governmental and non-governmental organizations. One administrator suggested on visiting schools that have engaged ICT and collaborating with other schools at cluster level. Teacher training was also an idea from all the participants. Ten respondents suggested on doing more staff development programs as well as engaging resource persons. Rural electrification was also an issue of concern by eleven participants and seven of them suggested on procurement of solar panels as another solution. Eight respondents also proposed the introduction of Computer levies as another method of dealing with lack of ICT tools. Four suggested on more engagement of parents for donations. The issue of motivating teachers was also raised by fourteen participants who felt that even little support in terms of data bundles would be encouraging especially during the time of Covid-19 pandemic. Administrators also suggested on deployment of ICT special trained teachers who would assist other teachers without adequate knowledge of ICT use in teaching subjects such as Mathematics.

4.4 Discussion of Findings

4.4.1 Understanding Information Communication Technologies (ICTs)

4.4.1.1 Administrators

Respondent one and three of the school heads explained Information Communication Technologies (ICTs) as impartation of knowledge through the use of electronic devices like laptops, cellphones and desktops. These two respondents had a basic idea on what is entailed by

ICTs as indicated by their examples of computer devices. This was supported by Tinio (2002), who defines Information Communication Technology (ICT) as basically an umbrella term that encompasses all communication technologies such as the internet, wireless networks, cell phones, satellite communications, digital television, computers and network hardware and software. Respondent two and four referred to ICTs as tools used for communication. This was also a simpler definition of ICTs based on the sentiments that they are tools which allow communication. In view of the deputy heads, respondent one viewed ICTs as all communication technologies that include the internet and electronic devices. This was alluded by Ratheeswari (2018), who states that ICTs refer to technologies that provide access to information through telecommunication. This was also somehow related to respondent four, who viewed ICTs as all technological devices. However, respondent two and three of the deputy heads simply gave examples of ICT tools such as smartphones and laptops. This indicated that even though they knew examples of tools in ICT, they had limited knowledge of what is really entailed by ICTs and their use. From all the above responses, it could be noted that all administrators had some light on what ICTs are all about, though some seemed to have more limited knowledge than others.

4.4.1.2 Teachers

Explaining their own understanding of ICTs, teacher respondent one, five, seven and eight simply viewed ICTs as technologies that provide access to information through telecommunication. This shade some light on their own understanding of what ICTs are all about. However, with the word to word similarities indicated in their responses, these respondents might have consulted the meaning from one source (Ratheeswari, 2018), who defines ICT as technologies that provide access to information through telecommunication. This could have a negative impact on the

findings as the responses could not have been original and did not indicate the true understanding of ICTs from the respondents' own knowledge.

Respondent two said ICTs are modern day technological requirements for sending and receiving messages. This highlighted how the respondent only perceives ICTs as social media tools as indicated by receiving and sending of messages. Other packages of ICTs, especially beneficial for Mathematics learning were not indicated in this response as explained by UNESCO (2002) which views ICT as a scientific, technological and engineering discipline and management technique used in handling information. Respondent three and six gave a similar view of ICTs as any means of communication which require the use of electronic devices. Respondent four said that ICTs are all gadgets used to disseminate information. All these respondents picked on some of the factors which make up ICTs although none of them could give the full meaning. This indicates that most teachers have partial knowledge of the whole aspect of ICTs.

4.4.2 Uses of ICTs in the teaching and learning of Mathematics

This theme aimed at finding out if and how teachers involve the use of ICTs in the teaching of Mathematics at grade 5 level. Asked to suggest any five ICT tools which can be used in teaching and learning, all participants stated cellphones, laptops, desktops, calculators and tablets as common tools used. This is supported by literature as stated by Karmal (2005), that calculators and other technological tools, such as computer algebra systems, interactive geometry software, applets, spreadsheets, and interactive presentation devices, are vital components of a high-quality Mathematics education. From the examples given by respondents, it was noted that the above mentioned examples are now commonly used in education. Four of the participants also added a

projector and digital camera. This indicated that some of the respondents were familiar with more ICT tools than others.

All respondents said that no school was providing them with any ICT tools for teaching and learning purposes except for one school which had two donated Leap-learning tablets. This indicated that all schools in Insuza cluster were struggling to provide the teachers with enough ICT teaching tools. Hence, if the use of ICTs was being implemented then they would have to use their own personal tools. The researcher asked teachers if they were using any ICT tools during the teaching of Mathematics at grade five level and two different responses were given. The first response was from two participants who said that they were currently not using any ICT tools as their school was not providing for them. This came as an indicator that some teachers were struggling to find any suitable resources to implement on the use of ICTs during Mathematics teaching. It also highlighted on the negative attitude and passiveness by some teachers as no effort had been done to improvise any simple resources for ICTs. The second response was given by the other six participants who said they were using their own personal tools like laptops, calculators and smartphones for calculation and mathematical games when teaching Mathematics. This indicated how dedicated some teachers were on using ICTs in teaching Mathematics. It also showed that ICTs were being used during lesson delivery with as little resources as teachers could get.

Asked if they were familiar with any e-learning platforms which can be used to teach Mathematics, all participants had only one example, ‘Ruzivo’. From this response, it is evident that teachers had very little knowledge on e-learning. This could be because of their geographical location as these schools are located in rural areas where there is poor network coverage and no internet access. Three school heads and all four deputies said they have witnessed some of the teachers using their

smartphones and calculator during Mathematics lessons and one further mentioned the use of a radio. This also shaded light on the commitment on some teachers to use ICTs during teaching and learning of Mathematics.

From all the above responses given by the participants, the researcher noticed that all participants had basic knowledge on some of the ICT tools and how they can be used in the Mathematics at grade 5 level. Although all these teachers could state ICT tools and their uses, none of the four schools in Insuza cluster have ICT tools to use when delivering Mathematics lessons at grade 5 level. As a result, some teachers (25%) were currently not using any form of ICTs as they felt that it was solely the duty of their institutions to provide them with all the resources. However, 75% of the teachers showed their commitment on using ICTs during teaching as they use their own personal tools. According to Pearson (2003), ICTs provide opportunities for teachers and students to operate, store, manipulate, and retrieve information. This was indicated by the respondents who stated some of the examples on how they use these ICTs when teaching Mathematics which included calculations, games, problem solving and videos. The researcher also noticed that all the mentioned uses of ICTs by the respondents involved little or no use of the internet and other network requirements. This showed that the majority of teachers were engaging in the use of ICTs, though resources are scarce.

4.4.3 The extent to which the use of ICTs assists the teaching and learning of Mathematics

From all the responses found from the interviews and questionnaires, using ICTs when teaching Mathematics is very necessary. As indicated by Jonassen (1991), ICTs play a very crucial role in the teaching of Mathematics at primary level. Asked if they find the use of ICT useful in the teaching and learning of Mathematics at Grade 5 level, all the eight teachers said yes. All the

administrators (100%), said they also find the use of ICTs very useful in the teaching and learning of Mathematics at grade five level. Their reason was that ICTs motivate the interests of the learners as they seem to enjoy lessons which involve any electronic gadgets. This showed that administrators had observed how the use of ICTs when teaching Mathematics motivated both the teacher and the learners. As effective teaching should arouse the interests of the child, use of ICTs proved to be ideal to get the attention and active participation of the learners. Five of the teachers said ICTs help learners to grasp and understand concepts much better as the hands on approach is used where learners manipulate the gadgets. This indicated that these teachers saw the need to use ICTs among learners as a better way of making their concepts grasped effectively. This is supported by Karmal (2005), who states that ICT improves the quality of education by facilitating learning by doing, directed instruction, self-learning, problem solving, information seeking and analysis and critical thinking as well as the ability to communicate.

Through the use of ICTs, learners were given the opportunity to learn through try and error as well as discovery method, which is essential for self-confidence and sense of achievement. This was indicated by two teachers who stated that ICTs make lessons more interesting as they fascinate and motivate learners. Literature also agrees with this sentiment as indicated by Pearson (2003), who states that ICTs enable self-responsibility for learning and motivate teachers and students to continue learning even outside school hours. One teacher mentioned on ICT being very helpful in Mathematics teaching through research use of multimedia tools such as videos and graphical illustrations. This showed that some teachers use their own ICT tools for researching on Mathematical problems as well as use them for various multimedia packages such as videos, pictures and graphs.

Asked if the use of ICTs in teaching Mathematics affect results at grade five level, four administrators said it had a negative impact since most topics required the use of calculators which were not available. This means that 50% of the administrators felt that ICT use in Mathematics was not bringing any positive outcomes in Mathematics teaching as a result of the failure to implement its use due to lack of resources. They further stated that their schools were yielding poor results in Mathematics especially on concepts which require the use of calculator as learners are accustomed to manual calculations. This proved how the absence of ICTs in grade 5 classes negatively affected their results as indicated by Jonassen (1991) that ICT works as a versatile instrument has the capability not only of engaging students in instructional activities to increase their learning, but of helping them to solve complex problems to enhance their cognitive skills. However, the other four said they were confident that it had a positive impact on the results as their pass rate had slightly improved since their attempt to involve ICTs in teaching and learning. This indicated that 50% of the administrators had already seen the positive impact of using ICTs in the teaching of Mathematics.

From the above responses, it can, therefore, be said that some respondents realize and appreciate the use of ICTs in teaching Mathematics at grade five 5 level. However, some still feel that its use is having a negative impact as they do not have adequate resources yet. It should be noted, however, that this fact does not rule out the effectiveness of using ICTs in teaching Mathematics. Rather, these two groups indirectly agree on how useful and powerful ICTs are in Mathematics lessons as the absence of these negatively affected the results and the presence of these helped improve the results. It can, thus, be concluded that ICTs have a great impact on the teaching and learning of Mathematics at grade 5 level.

4.4.4 Some typical challenges faced by teachers when using ICT when teaching Mathematics

In the research findings from both interview and questionnaire, it was evident that teachers do encounter quite a number of challenges in their attempt to use ICTs when teaching Mathematics at grade 5 level in Insuza. All the sixteen respondents (100%) agreed that teachers face challenges when using ICTs in teaching Mathematics at grade level. This was already indicated by literature, as according to Hudson (2008), implementing ICT use in teaching comes with its own share of problems as numerous barriers may arise. Six participants (37.5%) mentioned on the lack of ICT knowledge and skills as one of the challenge. This group alluded that some teachers have very little knowledge and required skills to operate ICT tools such as computers. This is supported by literature as Flanagam and Jacobsen (2003), alluded that non-material obstacles which include teachers' insufficient ICT knowledge and skills is one of the major challenges in education.

All respondents (100%) agreed that lack of ICT tools was the biggest challenge. This had already been indicated on section 4.4.3, where respondents indicated that there were no ICT tools provided by their schools for classroom purposes. As already indicated in the literature review, teachers may have no access to ICT materials because most of these are either shared with other teachers or not available at all (UNESCO, 2002). This really proves to be one of the biggest challenges since the absence of equipment may jeopardize the effectiveness of using ICTs when teaching Mathematics.

Ten participants also highlighted on attitude and resistance to change in some of the teachers, especially the older generation, as one of the challenges. This makes it a big challenge as well since 62.5% of the respondents mentioned it. Their concern was that some teachers (and even administrators), are not willing to embrace the demand of modern day technology and global changes. Their opinion was that there are other professionals who are still bound by their old methods of teaching which require manual labor and traditional methods of solving problems.

According Khajapeer (2001), technology can reduce the effort devoted to tedious computations and increase students' focus on more important mathematical objectives, for example calculation of large numbers. Despite these stated advantages, some teachers are still believed to be so resistant to change that they are not willing to use smartphones or computers. This was already indicated by Shukla (2008), who postulates that another challenge faced by teachers in the implementation of computers in teaching-learning Mathematics is teachers' acceptance, which in turn is influenced by their attitudes towards these media. This becomes a major challenge considering the demand of the competence-based curriculum which require ICTs in every learning area, especially Mathematics.

Lack of electricity, poor network coverage as well as no internet connections were also noted as some of the challenges by 68.75%. According to Karmal (2005), the inaccessibility of ICT resources is not always merely due to the non-availability of the hardware but also software or other ICT materials within the institution. Lack of electricity, network and the internet pause as a big challenge since most of the ICT uses require the internet or network. Teachers need to research as well as search for other teaching material and resources on different learning management systems. Furthermore, teachers need to interact and find out any new information on social media platforms like Facebook and WhatsApp. They also need to have access to group chat with their students and parents from home especially during school holidays on different e-learning platforms such as Zoom, Google Classroom and Moodle, which require strong network and/or internet. Although most teachers agreed to be using their own personal ICT tools, lack of electricity comes as a huge blow to their effort. As indicated by Pelgrum (2001), limitations on access to hardware and software resources influence teachers' motivation to use ICT in the classroom (Pelgrum,

2001).Most respondents alluded that power challenges faced by teachers when trying to use ICTs in lesson delivery end up spoiling their efforts.

Another challenge, which was raised by 18.75% of the respondents, was that the introduction and involvement of ICTs as a crosscutting theme in Mathematics and other areas was prematurely done since no in-service training on how to use these had been done. Though a smaller number had alluded this, lack of training still pauses as one of the major challenges. This challenge was already mentioned by Habibu et al., (2012), who state that most of the teachers lack the skills to use ICT in teaching-learning processes because they lack enough training. The introduction of the competence-based curriculum, as recommended by the Nziramasanga Commission, brought a strong mandate to involve ICTs in each learning area as a way of coping with global change. In this modern day technology, an ICT illiterate teacher is considered to be an incompetent teacher. This leaves the majority of teachers in that category of incompetence since the curriculum was introduced before teachers were well equipped with proper skills and knowledge on ICT.

31.25% of the respondents stated that they lack confidence with the little knowledge that they have on ICTs. This suggests that lack of confidence is one of the challenges on using ICTs in the teaching of Mathematics. According to Baskhara (2004), due to ‘fear of failure’ many teachers do not consider themselves to be well skilled in using ICT and feel anxious about using ICT in front of a class. This indicates that although most teachers have some basic knowledge on ICTs, they still doubt their capabilities and are not confident enough to embrace ICTs. This was also indicated in the background of this research when the researcher noticed that in one of the workshops carried out in Insuza, none of the present members of staff opted to type the notes but rather preferred handwritten ones.

50% of the respondents mentioned on the number of learners in relation to the improvised ICT equipment they could get as a challenge. This can really be taken as a big challenge considering the limited number of resources that can be acquired by the teachers. Most effective ICT uses require students to manipulate as child-centered approach is the norm in Primary school education. This means that there should be enough resources for learners and a small ratio on smaller gadgets like calculators and smartphones. In most cases, teachers struggle to deliver the Mathematics concepts effectively as they will using one small ICT tool in relation to the whole class. This becomes time consuming as the teacher would need to move around demonstrating on small group numbers. The challenge of time was highlighted in literature review by Flanagam and Jacobsen (2003), who postulate that a significant number of teachers identified time limitations as one of the difficulties in scheduling enough computer time for classes as a problem in their use of ICT in their teaching-learning. In some cases, the lesson objective may not be achieved as the learners may end up losing focus but rather fascinated by the unique gadget itself.

Financial challenges and lack of funding by both the government and non-governmental organizations was a challenge mentioned by all administrators and five teachers (81.25%). All of the schools in Insuza cluster alluded that they were facing financial challenges. This resulted in schools failing to purchase any ICT tools for classroom use. All except one school had never received any form of donation or funding related to ICTs. The only school which received some kind of donation was in the form of two leap-learning tablets which have limited functions other than games. Lack of ICT funds has resulted in all these schools failing to fully implement the use of ICTs in the teaching of Mathematics. Most of the above mentioned challenges are a result of shortage of funds and financial problems as indicated by Pelgrum (2001), who states that institutions face different types extrinsic problems include financial barriers. Most administrators

stated that most of the parents were struggling to pay fees on time and that the gazette of the levies was very low. This has left these schools without any financial means of procuring ICT tools.

4.4.5 Strategies that can be used to help teachers use ICT effectively in teaching Mathematics

A number of possible solutions and strategies which may be adopted to help teachers use ICTs effectively during the teaching and learning of Mathematics were suggested by the respondents. Asked if there were any motivational strategies which have been adopted by their schools to encourage the use of ICTs in the teaching and learning of Mathematics in Insuza Cluster, all administrators (100%) said no. This could have been one of the reasons why teachers were struggling to fully implement on the use of ICTs when teaching Mathematics. According to Fathima (2013), schools should motivate teachers by ensuring that technical, administrative, and peer support is available to teachers during the implementation of ICT use. Though they had not yet adopted this strategy, 80% of the administrators suggested that schools and members of staff should come up with various motivating strategies like WIFI connectivity in schools for research purposes and online lessons. The issue of motivation was also raised by all the teacher participants who felt that even a little support in terms of data bundles would be encouraging especially during the time of ovid-19 pandemic. Other motivational strategies like assigning typing work to less confident teachers could also be ideal for them to build their self-confidence.

Another strategy which was suggested by 80% of the respondents was staff development programs as well as consulting more resource persons. Through this strategy, schools may, as suggested by Neelam (2003), identify the possible obstacles to the use of ICT in teachers and help each other improve the quality of teaching and learning of Mathematics using ICTs. Three schools confirmed to have done School Development Programs (SPDs) on using ICTs in the teaching of Mathematics

though not specifically at grade five level. One school had no such program as of yet as they were still to find a resource person. Since this research was focusing on grade 5 teachers only, there is a possibility that other grades teachers might have better knowledge and skills in ICTs hence engaging in more SDPs on how to use ICTs when teaching Mathematics could be very helpful. This will further assist other teachers who may teach the same grade in future. Chong et al. (2005), state that teachers must have the knowledge and skills to use the new digital tools, thus, the use of SDPs might be helpful to enhance teacher knowledge.

In addition to SDPs, 50% of the administrators suggested on engaging in ICT workshops at cluster level. This could be a more effective strategy as it extends the SDP to all cluster schools. Hudson et al., (2008) emphasize on the importance of collaborating with other schools stating that schools should adopt professional development efforts toward those which emphasize the use of technology in instruction. As more schools engage in workshops, more ideas will be shared and most teachers will benefit. This could also be another way of sharing those little resources which the teachers and schools have. For example, during the interview, all school admitted to own one laptop for administration purposes. These laptops could be brought for practice purposes to enhance teacher knowledge and skills. These schools should also collaborate with other clusters who have better resources in terms of ICTs.

As a way of overcoming financial challenges, 68.5% of the participants stated that schools should seek for more donations and funding from both governmental and non-governmental organizations. As most of the schools in urban areas and a few in rural areas have received ICT tools such as desktops, laptops and tablets, Insuza cluster should look for the same. They need to apply for donations from the Ministry of Education (government), rural district council, churches and other non-governmental organizations. They should also try and reach out to network

providers like Econet and Netone for network services such as booster installation and mobile Wi-Fi services. As alluded by Chong et al. (2008), schools must be provided with adequate resources to help all students achieve high academic standards.

As another solution to enhance better knowledge and skills acquisition to teachers, in-service training was also brought out as an idea by all the participants. They felt that teachers need to be trained on the use of ICTs, that is, the skill to operate the computers as well as other learning management systems. This idea could have been seen as of utmost importance by all participants due to the Cocid-19 pandemic which left the only option of education as online teaching. Most of the teachers might have felt that they are lagging behind since they could not conduct lessons on various e-learning platforms due to lack of expertise. According to Fathima (2013), requesting training on newly adopted educational software from experts and ensuring that adequate technical support is available to teachers during the implementation of ICT is paramount.

Rural electrification was also an issue of concern by 68.75% participants in which 64% of them of them suggested on procurement of solar panels as another solution. This is in agreement with Hannafin and Savenye (1993), who suggest that significant advances need to be made to overcome external barriers to technology integration, especially concerning access to computing resources. All the consulted schools were in need of electricity as most ICT tools and activities needed these. Electrical gadgets like televisions and radios as well as computers require power to function. In place of electricity, schools may consider using solar power. Both these power sources, however, require more money hence the previous strategy of seeking for donor funds.

50% of the respondents also proposed the introduction of Computer levies as another method of dealing with lack of ICT tools. This may be viewed as in line with Fathima (2013), who strongly suggests on improving administrative support on ICT implementation. This might be an effective

way of solving financial challenges in schools for acquiring ICT tools. These funds could be used for purchasing computers, calculators as well as other ICT services. Since their current school levies are very low, introducing computer levies could be an ideal solution to improve on the availability of ICTs in rural areas. However, as already indicated by administrators, most parents are already struggling to pay school fees hence adding on to the levies might further reduce the number of payments.

40% of the respondents suggested on the engagement of parents and School Development Committees (SDCs) for donations. This could be an ideal strategy as some parents are capable of buying or funding ICT tools and equipment. This was again postulated by Fathima (2013), saying that ensuring that adequate technical, administrative, parental and peer support should be available to teachers during the implementation of ICT use in teaching. The SDC may organize fund-raising functions and seek donations from other stakeholders which may help in acquiring ICT tools. Parents may even be requested and encouraged to buy ICT tools for their children such as cellphones and calculators. Some parents may also be consulted as resource persons especially those who would have done ICT courses.

Administrators also suggested on more deployment of ICT special trained teachers who would assist other teachers with adequate knowledge on ICT use in teaching subjects such as Mathematics. Training institutions are now offering ICT modules hence all recent trained teachers are expected to be computer literate. Deploying these in rural areas like Insuza could help the rate of computer literacy in schools as these will staff develop others. From consulted literature, strategies to make further improvement include exploiting the expertise of master teachers in professional learning communities (Fathima, 2013). Computer trained teachers may help the

improvement on using ICTs in teaching Mathematics as their expertise will help both teachers and students.

4.5 Summary

This chapter was looking at data presentation, analysis and discussion. Biographical data was presented first, showing the number of respondents, the response rate, their age, sex and qualifications. The next section then focused on data presentation and analysis. This was done by following themes drawn from the Sub-research questions and all the data presented followed each theme. The last section was discussion of data, where the researcher followed all themes formulated before to interpret the meaning and give implications of the data indicated in the previous section.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study is about the challenges faced by teachers in using ICTs in the teaching of mathematics at grade 5 level in Insuza cluster of Umguza district. This chapter focused on the summary of the study and conclusions drawn from both literature and evidence on the ground. The chapter also provides recommendations for different stakeholders that include the government, parents, and Grade five teachers, school administrators, Non-Governmental Organizations and the community at large.

5.2 Summary

The major thrust underlying the carrying out of this research was to investigate on the challenges faced by teachers in using Information Communication Technologies (ICTs) in the teaching of Mathematics at Grade 5 level in Insuza cluster of Umguza District. The researcher had been made privy of the fact that ICT has not been fully implemented in the teaching and learning of Mathematics as informed by the poor academic performance of learners in the subject. As the background of the study, the researcher noticed that teachers had no adequate resources for ICT uses in Mathematical teaching in Insuza cluster. The main question which drove this research was to find out what challenges are faced by teachers when using Information Communication Technologies (ICTs) in the teaching of Mathematics.

From the consulted literature, ICTs can be summed up as technologies that provide access to information through telecommunication. Also, they provide both learners and facilitators with more opportunities in suiting learning and teaching to individual needs. Literature also revealed

that ICT improves the quality of education by facilitating learning by doing, directed instruction, self-learning, problem solving, information seeking and analysis and critical thinking as well as the ability to communicate, collaborate and learn. Different scholars viewed the obstacles in the use of ICT in educational institutions as pertaining to both material and non-material conditions such as lack of resources and knowledge. Different sources alluded that teachers must have the knowledge and skills to use the new digital tools and resources to help all students achieve high academic standards.

This study employed the descriptive survey design. The researcher employed both quantitative data (represented by statistical analysis) and qualitative data (summarized explanations) data gathering techniques. The sample in this research included four schools each having four participants. These included the school head, the deputy and two grade five teachers which were chosen using non-probability sampling technique and as a result, purposive sampling was used. Since this research was using a survey design, the best instruments selected were questionnaires (for the grade five teachers) and interview (for the school heads and deputies). Statements, tables and graphs were used to present collected data. Since both qualitative and quantitative data was collected, the presentation was merged as both statistical and word explanations.

The general definition of ICT by the respondents was that ICTs are all electronic devices used for communication which provide impartation of knowledge through the use of electronic devices like laptops, cellphones and desktops. According to the research findings, ICTs are used for calculations, problem solving and Mathematical games during the teaching of Mathematics. ICTs play a pivotal role in Mathematical teaching as their involvement provides better results, motivate the learners and make learning enjoyable. The main challenges encountered by teachers include shortage/absence of resources, lack of knowledge and skills, poor network and power supply,

resistance to change as well as lack of motivation and funding. Respondents further suggested on teacher training, workshops, staff development programs, sourcing of donations as well as creating motivational strategies and income generating projects as solutions to dealing with the challenges.

5.3 Conclusions

5.3.1 Understanding Information Communication Technologies

The concept of Information Communication Technologies is understood by participants in different ways. The study concluded that Information Communication Technologies (ICTs) are impartation of knowledge through the use of electronic devices like laptops, cellphones and desktops. It also concluded that ICTs involve all communication technologies that include the internet and electronic devices. It was also understood that ICTs may simply refer ICT tools such as smartphones, desktops and laptops. The research also concluded that ICTs include all those technologies that are used specifically for communications as well as all technological requirements for sending and receiving information. The concept of ICTs is also understood as any means of communication which require the use of electronic devices and all gadgets used to disseminate information. The overall conclusion was that even though some respondents knew examples of tools in ICT, they had limited knowledge of the whole concept of ICTs and their uses. From all the findings, it can also be concluded that both administrators and the teachers do not fully understand the concept of ICTs as they only could come up with partial explanation or a few related examples.

5.3.2 Uses of ICTs in the teaching and learning of Mathematics

This research concluded that teachers should use ICTs when teaching Mathematics at Grade 5 level. Some of the required ICT tools which can be used to teach Mathematics include cellphones, laptops, desktops, calculators, projectors, digital cameras and tablets. The examples stated indicated that some of the respondents were familiar with more ICT tools than others. The research also concluded on the fact that schools were struggling to find suitable resources to implement on the use of ICTs during Mathematics teaching. As a result, some teachers were not involving ICTs when teaching Mathematics although some used their personal gadgets. This finding indicates on the negative attitude and passiveness by some teachers as no effort had been done to improvise any simple resources for ICTs. The research also brings to light how committed some teachers are to implement ICT use despite their challenges. Different ICT tools are used are useful for calculations, problem solving and Mathematical games. Conclusion on e-learning was that teachers in Insuza have very little knowledge on learning management systems which involve e-learning platforms.

5.3.3 The extent to which the use of ICTs assist the teaching and learning of Mathematics

The research concluded that the use of ICTs assist the teaching of Mathematics in many ways. It was concluded that teachers find the use of ICTs very necessary in the teaching of Mathematics. The research findings indicated that ICTs motivate the interests of the learners as they seem to enjoy lessons which involve any electronic gadgets. As effective teaching should arouse the interests of the child, use of ICTs proved to be ideal to get the attention and active participation of the learners. It was also concluded that ICTs help learners to grasp and understand concepts much better as the hands on approach is used where learners manipulate the gadgets. Another conclusion was made that ICTs make lessons more interesting as they fascinate and motivate learners. ICT

was also found to be very helpful in Mathematics teaching through research use of multimedia tools such as videos and graphical illustrations. The extent to which ICTs are helpful was concluded by two different findings, which indirectly agreed that, the absence of ICTs negatively affected the results and the presence of these helped improve the results. It was, thus, concluded that ICTs have a great impact on the teaching and learning of Mathematics at grade 5 level

5.3.4 Some typical challenges faced by teachers when using ICT when teaching Mathematics

The research concluded that a number of challenges are being encountered by teachers in their attempt to use ICCTs in the teaching of Mathematics. It was revealed that teachers lack ICT knowledge and skills. Another typical challenge found was the negative attitude and resistance to change by some of the teachers, especially the older generation. The research also shaded some light on lack of electricity, poor network coverage as well as no internet connections as some of the challenges faced in Insuza schools. It also revealed that the introduction and involvement of ICTs as a crosscutting theme in Mathematics and other areas was prematurely done since no in-service training on how to use these had not yet been done. Furthermore, the research also discovered that teachers lack confidence on that little knowledge they had on ICTs. Another conclusion was made that the large classes taught by these teachers in relation to little resources paused as another challenge. The biggest conclusive challenge found was financial challenges and lack of funding from both the government and non-governmental organizations.

5.3.5 Strategies that can be used to help teachers use ICT effectively in teaching Mathematics

The research concluded on some strategies that may be adopted to help teachers use ICT effectively in teaching Mathematics. The research suggests on schools engaging in ICT workshops at cluster level. Another conclusion was that schools need to seek for more donations and funding

from both governmental and non-governmental organizations. It was also revealed that visiting schools that have engaged ICT and collaborating with other schools at cluster level could be a good solution. Teacher training was also an idea concluded by the research. Another suggested strategy was on doing more staff development programs as well as engaging resource persons. Rural electrification was also an issue raised as well as procurement of solar panels to counter power challenges. Another conclusion which came up was for schools to propose the introduction of Computer levies as another method of dealing with lack of ICT tools. Parents should be more involved on resource acquisition. The issue of motivating teachers was also raised. Lastly, deployment of ICT special trained teachers who would assist other teachers without adequate knowledge of ICT use in teaching subjects such as Mathematics was also concluded.

5.4 Recommendations

After reviewing literature and analyzing the data that was found on the ground the researcher recommends the following:

5.4.1 Teachers

- Teachers should staff develop each other on the use of ICTs in the teaching of Mathematics
- Teachers should develop their computer literacy by in-service training and other ICT courses
- Teachers must embrace technology with a positive mind and attitude by fighting resistance to global changes
- Teachers should improvise and source for ICT tools to fully implement ICT use in teaching Mathematics by opting for personal gadgets

- Teachers should encourage and motivate each other to build more confidence in ICT use through practice and peer education

5.4.2 Administrators

- School administrators should look for ways of motivating teachers to use ICTs in the teaching of Mathematics by providing WI-FI services and data bundles
- Administrators should look for donations and funding to acquire ICT resources by reaching out to different organizations
- Administrators should encourage teachers to use ICTs during lesson delivery by ensuring that every lesson observed includes ICT use.
- Administrators need to consult and engage parents and SDCs more on ICT matters by holding meetings
- Administrators themselves should develop their ICT knowledge and skills through workshops and in-service training
- They should organize more SDPs and workshops on using ICTs in the teaching of Mathematics by engaging other schools
- They should ensure that their schools have enough power supply and other resources
- They should introduce Computer levies
- They should encourage all parents to pay school fees on time

5.4.3 Parents and School Development Committees

- SDCs to come up with income generating projects for ICT resources by organizing fund-raising programs
- Parents to be actively involved in sourcing of school resources by attending meetings and offering donations

- They should provide their children with own personal ICT tools for school use by buying calculators, smartphones and palm/laptops.
- Those who are computer literate to assist schools and teachers as resource persons
- They should liaise with other stakeholders like political parties to contribute financial towards the implementation of ICT use
- All parents should pay school fees on time

5.4.4 Ministry of Primary and Secondary Schools

- The ministry should assist rural schools with computers and other ICT requirements
- Introduction of computer levy should be approved
- Should provide in-service ICT training and teacher development programs by offering state-funded courses
- ICT specialist teachers should be deployed in all schools especially in rural areas
- The ministry should liaise with the Ministry of Higher and Tertiary Education on offering more ICT courses

5.4.5 Non-governmental organizations

- These should offer donations on all required ICTs to rural schools
- They should fund workshops and other in-service teacher trainings on ICT
- They may offer free courses and educational services to teachers
- They may offer other technical services like WI-FI to rural schools

5.4.6 Rural District Council (RDC)

- This should support rural schools financially by funding ICT programs and resources
- They should advocate for computer literacy in their schools and community by bringing in local based training for both teachers and the society
- They should create power generating projects in local schools through rural electrification or solar system

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APPENDICES

Appendix 1: **QUESTIONNAIRE FOR GRADE 5 TEACHERS**

My name is Priviledge Manjeru. I am a student at Midlands State University doing Bachelor of Education Degree in Primary (ICT and Environmental Science). I am researching on **Challenges faced by teachers when using Information Communication Technologies in the teaching of Mathematics at Grade 5 level in Insuza Cluster, Umguza District of Matabeleland North Province.** May you answer the following questions according to your understanding. The collected information shall be treated with utmost confidentiality.

SECTION A: BIOGRAPHIC INFORMATION

1. What is your sex ?: Male ☐ Female ☐

2. What is your age range? :

Under 25years ☐

26 - 35 years ☐

36 – 45 years ☐

46 years plus ☐

3. What is your highest academic qualification?

Ordinary Level ☐

Advanced Level ☐

Degree ☐

Other: (Specify) ……

4. What is your highest professional qualification?

Certificate in Education ☐

Diploma in Education ☐

Degree in Education ☐

Post Graduate Diploma in Education ☐

Masters in Education ☐

Other (specify)……

5. How many years of teaching experience do you have?

Years ☐

5. For how long have you been teaching Grade 5?

Years ☐

6. Have you ever received any form of training in the use of ICT in teaching?

YES ☐ NO ☐

If the above answer is 'YES', please specify on the type of training:

SECTION B: THE USE OF INFORMATION COMMUNICATION TECHNOLOGIES (ICTs)

7. What do you understand by the term Information Communication Technology (ICT)?

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   ……

   ……..……

8. Can you suggest any five ICT tools which can be used in teaching and learning?

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9. Does your school provide any ICT tools for educational purposes?

   YES ☐ NO ☐

   If 'YES', please state them.

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10. Do you use ICT in the teaching and learning of Mathematics at Grade 5 level?

YES ☐ NO ☐

If 'Yes', state some of the tools that you use and briefly explain how you use them.

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If 'No', give reasons why you do not use ICTs?

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11. Do you know any e-learning platforms that can be used in teaching Mathematics?

YES ☐ NO ☐

If 'YES', please name any two e-learning platforms that you are familiar with.

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12. Do you find the use of ICT useful in the teaching and learning of Mathematics at Grade 5 level?

YES ☐ NO ☐

13. Of what benefit does ICT have in the teaching and learning of Mathematics at Grade 5 level?

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14. Do you face any challenges when using ICTs in the teaching and learning of Mathematics at Grade 5 level?

YES ☐ NO ☐

If the above answer is 'Yes', please state some of the challenges

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15. . What do you think should be done to improve the use of ICTs in the teaching of Mathematics at Grade 5 level?

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Thank you for your cooperation.

Appendix 2: INTERVIEW GUIDE FOR SCHOOL HEADS AND DEPUTIES

1. What is your highest academic qualification?

2. What is your highest professional qualification?

3. Which administration position do you hold currently?

4. For how long have you been in this position?

5. What do understand by the term Information Communication Technology (ICT)?

6. From your past supervision experience with Grade 5 classes, do teachers use ICTs in the teaching and learning of Mathematics?

7. Which ICT tools do they usually use?

8. Does your school have any computers or other ICT tools for educational purposes?

   Which ones?

9. Do you face any financial constraints in acquiring ICT equipment at your school?

10. Have you ever received any financial assistance or any other donations for acquiring ICT resources?

11. How does the use of ICT in Mathematics teaching and learning affect your results?

12. What is the attitude of your teachers in the implementation of ICT in the teaching and learning of Mathematics at your school?

13. What challenges are usually faced by your teachers when using ICTs in the teaching and learning of Mathematics at Grade 5 level?

14. Are there any motivational strategies which have been adopted by the school to encourage the use of ICTs in the teaching and learning of Mathematics?

15. Have you carried out any staff development sessions on the use of ICTs in the teaching and learning of Mathematics at school level?
    How many?
16. What strategies can be adopted by your school to counter the challenges faced by teachers in using ICTs when teaching Mathematics?

Thank you for your cooperation.