TOPIC: AN INVESTIGATION OF THE CHALLENGES ENCONTERED IN INTEGRATING TECHNOLOGY IN THE TEACHING OF MATHEMATICS IN SECONDARY SCHOOLS. A CASE STUDY OF MASVINGO DISTRICT SECONDARY SCHOOLS.

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SIGN ....................................................
DEDICATIONS

I dedicate this to my wife Sandra and my son Abison. To my parents Tadios and Maritha Mutekwa, your lessons in life will always be remembered. I am tall today because I am standing on your shoulders.
ACKNOWLEDGEMENTS

I give honor to God who is my Lord and Savior. I thank you lord for allowing me to begin and complete this amazing project and for sending so many wonderful people to be instrumental during the enormous task and making it possible to complete. Completion of this research project would not have been possible had it not been for the collaborative efforts of various individuals who sometimes went out of their ways to help. Thus I will forever be indebted to them because I could not have made it on my own.

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ABSTRACT

This study was carried in a bid to investigate the challenges encountered in integrating technology in the teaching of Mathematics in secondary schools. In order to achieve this, the three schools were visited for at least three days for data collection and direct field observations. The study was carried out using a survey design. A sample of three secondary schools selected from Masvingo district secondary schools was selected using stratified random sampling. The three secondary schools represented strata of rural day secondary school, urban day secondary schools and boarding schools. Participants were sampled, that is mathematics educators and headmasters of the three schools. Altogether there were a total of 20 participants. The sample of teachers and headmasters were interviewed and the results were tabulated and presented graphically. Direct field observations were used to gather information on the challenges encountered in the integration of technology in teaching mathematics in the three selected secondary schools. The results revealed that there is a greater digital divide in the use and integration of technology in secondary schools in the teaching of mathematics in Masvingo due to several reasons. The causes of the digital divide include shortage of infrastructure, technology devices, skilled manpower, lack of support from the relevant authorities, attitude of teachers and reluctant to change by teachers etc. There may be many other challenges in integrating technology but the challenges listed above are the major ones. Recommendations were made on how secondary schools can improve usage of educational technology tools for effective mathematics teaching. The recommendations include assisting teachers to acquire skill and competences to effectively integrate technology into the school curriculum through in-service training. Recommendations for further studies in as far this study was concerned were made.
LIST OF TABLES

Table 4.1: Comparison by Gender ........................................................................................................................................33
Table 4.2: Composition of Sample by Professional Qualification .........................................................................................35
Table 4.3: Composition of Sample by Teaching Experience ................................................................................................37
Table 4.4: Composition of Respondents by School ...........................................................................................................37
Table 4.5 component of respondent by level taught ........................................................................................................38
LIST OF FIGURES

Figure 4.1 Composition by Gender ................................................................. 34

Figure 4.2 Composition of Sample by Professional Qualification .......................... 36
LIST OF APPENDICES

APPENDIX 1: INTERVIEW GUIDE FOR TEACHERS ................................................................. 53

APPENDIX 2: INTERVIEW GUIDE FOR HEADMASTERS .................................................. 54

APPENDIX 3: OBSERVATION CHECKLIST FOR CLASSROOM INTERACTION ................... 56
# TABLE OF CONTENTS

## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPROVAL FORM</td>
<td>i</td>
</tr>
<tr>
<td>RELEASE FORM</td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATIONS</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>viii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>ix</td>
</tr>
<tr>
<td><strong>CHAPTER 1</strong></td>
<td></td>
</tr>
<tr>
<td>1.0 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background of the Study</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Statement Of The Problem</td>
<td>4</td>
</tr>
<tr>
<td>1.3 Aims Of The Study</td>
<td>5</td>
</tr>
<tr>
<td>1.4 Research Questions</td>
<td>5</td>
</tr>
<tr>
<td>1.5 Research Objectives</td>
<td>6</td>
</tr>
<tr>
<td>1.6 Significance of the Study</td>
<td>6</td>
</tr>
<tr>
<td>1.7 Limitations Of The Study</td>
<td>7</td>
</tr>
<tr>
<td>1.8 Delimitations of the Study</td>
<td>7</td>
</tr>
<tr>
<td>1.9 Definition Of Terms</td>
<td>8</td>
</tr>
<tr>
<td>1.10 Summary</td>
<td>9</td>
</tr>
<tr>
<td><strong>CHAPTER 2</strong></td>
<td></td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>10</td>
</tr>
<tr>
<td>2.0 Introduction</td>
<td>10</td>
</tr>
<tr>
<td>2.1 Challenges Faced In Integration Of Technology</td>
<td>10</td>
</tr>
<tr>
<td>2.2 Teachers Beliefs in Technology Integration</td>
<td>13</td>
</tr>
<tr>
<td>2.3 Teachers Perceptions towards Technology Integration</td>
<td>15</td>
</tr>
<tr>
<td>2.4 Advantages of Integration of Technology in Teaching</td>
<td>17</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>2.5 How to Develop Teachers Professionalism for Successful Integration of Technology</td>
<td>19</td>
</tr>
<tr>
<td>2.6 Support from Schools in Providing Adequate Technology Resources in Classrooms</td>
<td>20</td>
</tr>
<tr>
<td>2.7 Summary</td>
<td>22</td>
</tr>
<tr>
<td>CHAPTER 3</td>
<td>24</td>
</tr>
<tr>
<td>RESEARCH METHODOLOGY</td>
<td>24</td>
</tr>
<tr>
<td>3.0 Introduction</td>
<td>24</td>
</tr>
<tr>
<td>3.1 Research Design</td>
<td>24</td>
</tr>
<tr>
<td>3.2 Target Population</td>
<td>25</td>
</tr>
<tr>
<td>3.3 Sample</td>
<td>26</td>
</tr>
<tr>
<td>3.4 Sampling Criteria</td>
<td>26</td>
</tr>
<tr>
<td>3.5 Research Instruments</td>
<td>27</td>
</tr>
<tr>
<td>3.5.1 Interviews</td>
<td>27</td>
</tr>
<tr>
<td>3.5.2 Direct Field Observations</td>
<td>29</td>
</tr>
<tr>
<td>3.6 Procedures of Collecting Data</td>
<td>30</td>
</tr>
<tr>
<td>3.6.1 Interviews</td>
<td>31</td>
</tr>
<tr>
<td>3.6.2 Observations</td>
<td>31</td>
</tr>
<tr>
<td>3.7 Data Analysis and Presentation</td>
<td>32</td>
</tr>
<tr>
<td>3.8 Summary</td>
<td>32</td>
</tr>
<tr>
<td>CHAPTER 4</td>
<td>33</td>
</tr>
<tr>
<td>DATA PRESENTATION, ANALYSIS AND DISCUSSION</td>
<td>33</td>
</tr>
<tr>
<td>4.0 Introduction</td>
<td>33</td>
</tr>
<tr>
<td>4.1 Data Presentation</td>
<td>33</td>
</tr>
<tr>
<td>4.2 Teachers Perceptions towards the Use of Technology</td>
<td>39</td>
</tr>
<tr>
<td>4.3 Availability of Resources</td>
<td>39</td>
</tr>
<tr>
<td>4.4 Advantages and Disadvantages of Using Technology</td>
<td>40</td>
</tr>
<tr>
<td>4.5 Observation Information</td>
<td>41</td>
</tr>
<tr>
<td>4.6 Summary</td>
<td>41</td>
</tr>
<tr>
<td>CHAPTER 5</td>
<td>43</td>
</tr>
<tr>
<td>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS</td>
<td>43</td>
</tr>
<tr>
<td>5.0 Introduction</td>
<td>43</td>
</tr>
<tr>
<td>5.1 Summary of the Project Including Constraints</td>
<td>43</td>
</tr>
</tbody>
</table>
CHAPTER 1

1.0 Introduction

Teaching and learning through the use of technology takes students to greater heights. The study attempts to investigate the challenges encountered in integrating technology in the teaching of mathematics in secondary schools. In this chapter the researcher presents the background of the study, statement of the problem, aims of the study, research questions, research objectives, significant of the study, limitation and delimitation of the study. To add more to the above items definition of terms used in the research was included and lastly the summary of the whole chapter.

1.1 Background of the Study

The present day world is inferred to as a dynamic information age where the use of technology is critical especially starting from the classroom environment. Technology on its own is important to a countries’ future, economy, social and environmental development. In other words, the major goal of integrating technology into the education system is to craft a system in which learners leave schools confident, innovative and industrious users of new technologies. The general observation is that, many students are struggling to learn Mathematics today and as a result few are taking the subject at higher levels. According to Campoy (1992) technology provides a better way of teaching Mathematics through its ability to act as an equalizer which enables both high and low achievers to reach unknown heights. However, like any method, challenges are likely to occur in the implementation of these technologies. As a result both the teacher and the student should keep abreast with the new technologies.
According to National Council of Teachers of Mathematics (2000), technology is essential in teaching and learning mathematics, it influences the mathematics that is taught and enhances students’ learning. Teacher’s attitudes play an important role in using technology in teaching and learning mathematics. It is very important to improve teacher’s attitudes towards using various technologies in the class room because it may enhance mathematics teaching and learning. However many pre-service and in-service teachers are unfamiliar with types of teaching available for teachers. Also many teachers lack the knowledge of how to properly incorporate technology in the classroom (Doering, Huffman and Hughes, 2003).

Many students have a negative attitude towards Mathematics today and many have a feeling that they will never use it in the future. This negative attitude, thus leads to high failure rates in the subject. The dynamic nature of technology has forced educationists to re-evaluate the mathematics that students need to determine the best methods for attaining higher levels of mathematics achievement. According to Campoy (1992), it does not matter whether the student is a high achiever or a low achiever, teaching and learning through the use of technology takes all learners to heights unknown.

Clements (2003) stated that appropriate designed mathematics software is designed to have a high level of interaction. He believed that by using technology students are unable to “hide” what they do not know. Through the use of technology, students are able to generate multiple representatives of solutions. Students can immediately see the effects of changing variables that can occur in real time, thereby providing instant feedback, while at the same
time allowing students the freedom to solve their problems without the restrictions of pencil and paper.

The National Council of teachers of Mathematics (NCTM, 2000) listed six principles to assist and guide teachers in improving the content and delivery of Mathematics instruction (NCTM 2000). The six principles were equity, curriculum, teaching, learning, assessment and technology. This study focuses on one of these six principles, technology. The use of technology in mathematics education allows students the opportunity to focus less on the computational aspects and to focus more on the application of mathematics (NCTM, 2000).

Shelly, Cashman and Waggoner (2010) postulate that as many teachers and students are engaging in innovative forms of research and projects some are still traditional teachers who resist learning new technologies into their classrooms. Teachers have to develop the ability to demonstrate how these technologies can be used for academic purposes and convey the educational advantages of technology use. Several factors influencing the adoption of integration of technology into teaching of mathematics have been identified by researchers. This study sought to identify the challenges faced by Zimbabwean secondary school teachers in integrating technology in the teaching and learning process of mathematics.
1.2 Statement Of The Problem

Dewey (1933) pointed out that a problem arises of some difficulties that are felt, something that makes a person dissatisfied. This study, examines the problems that are affecting many schools with regards to use of technology in the teaching and learning of mathematics. Secondary schools face a lot of challenges when it comes to the integration of technology into the main stream teaching and learning of mathematics.

In Zimbabwe many students are facing a lot of challenges at tertiary education where a lot of technology is required to boost their researches. The reasons behind are so controversial, some pupils have negative attitudes towards the use of technology in learning mathematics while on the other hand some pupils have positive attitudes towards technology but they are hindered by the fact that they were never exposed to technology during their learning days at primary and secondary level. In addition to the above, the other possible reason is mathematics teachers are largely blamed for not fostering positive attitudes towards the use of technology during instruction (Mandebvu, 1996).

There is evidence that the education sector and government are investing on use of technology for example the issuing of computers in secondary schools in both rural and urban areas by the president of the republic of Zimbabwe. The education sector is currently enrolling a program of installing software that can be used to teach several subjects in many schools around the country. Despite all these investments on technology implementation through infrastructure equipment and professional development of teachers in Zimbabwe, there is very little evidence of technology adoption and use in teaching and learning in schools. This study specifically investigated the challenges faced by secondary
school teachers in integrating technology into the teaching and learning of mathematics in secondary schools.

1.3 Aims Of The Study
The aim of the study is to investigate the challenges faced by secondary schools in the use of technologies in the teaching and learning of mathematics.

1.4 Research Questions

1. How are teachers developed professionally for successful integration of technology into secondary school Mathematics?

2. What are the contributions of policy makers and education officers in supporting the integration of technology in schools?

3. In what ways are schools providing adequate hardware and software in the classroom to support the integration of technology in the teaching of secondary school Mathematics?

4. What are the teachers’ believes and perceptions in the use of technology in the teaching of mathematics in secondary schools?
1.5 Research Objectives

The objective of this research is to:

1. Identify ways in which teachers are being developed professionally for successful integration of technology in teaching secondary school Mathematics.
2. Establish efforts by the policy makers and education officers in supporting the integration of technology in schools.
3. Determine the cooperative strategies by the school heads in providing adequate hardware and software in schools.
4. Evaluate the perceptions and beliefs of teachers in the use of technology in teaching secondary school Mathematics.

1.6 Significance of the Study

The importance of the study emanated from attempting to expose the major barriers that blocks the integration of new technologies into teaching and learning of Mathematics at secondary school level. It is hoped that if the challenges could be identified, it would enable school heads, teachers and policymakers to come up with strategies to improve the situation in schools with regards to incorporation of technology. The results of this study will help Zimbabwe as a country in the strategies they can apply in schools in order to achieve successful innovation of the curriculum by making it a policy to incorporate technology in the classrooms. This study exposed the need of pre-service and in-service training of secondary school teachers for them to be able to incorporate technology in their instruction. The study also exposed the difference in performance between schools where
technology is taken into consideration and those schools where integration of technology is of non-existence.

1.7 Limitations Of The Study

This study is limited to the challenges faced by secondary school Mathematics teachers in their attempt to integrate technology into the curriculum. The other limitation is related to the method that was employed in this study. The researcher used the descriptive method. Ary and Razaviah (2010) argued that the descriptive method lacks predictive power that is the researcher is able to discover and describe “what is” but is unable to predict “what would be”. The respondents may also give false responses there by affecting the validity of the findings. The time to carry out the research was limited since it was carried out in only two semesters. This will affect the quality of the results of the research. Another limitation is that of time for the teacher to visit, other schools since the researcher has to report for duty at his own school and the visits has to be done during normal working hours. Also financial constraints are another challenge that the research face since he has to go for field observation, interviews and arrangements with school heads for proper time table.

1.8 Delimitations of the Study

The study will be confined to Masvingo district secondary schools which have a population of about 30 secondary schools. The study is going to take views from Mathematics teachers and headmasters. The researcher gather information from three schools selected randomly, each school representing its own strata that is rural day school, urban day school and boarding school. The rural day schools were represented by Rumwanda secondary school which is located about 50km from Masvingo along Mutare- Masvingo high way and
20km off the tarred road into the rural areas. Rumwanda has a student population of 300 pupils and 15 teachers. The urban day schools were represented by Ndarama high school which is located in Masvingo urban, with student population of approximately 2000 and teacher population 80. The boarding schools were represented by Mutendi high school which located about 50km from Masvingo in the commercial farming area. Currently there is a student population of 1100 and 46 staff members.

1.9 Definition Of Terms

1. **Technology** - encompasses the range of hardware (desktop and portable computers, projection technology, calculators, data logging and digital recording equipment), software applications (generic software, multimedia resources) and information systems (Intranet, Internet) available in schools at the time of the research.

2. **Geometer Sketchpad (GSP)** - A dynamic geometry software program that allows students to create and manipulate shapes and to study geometry in greater detail.

3. **Integrating** - Bringing together and uniting technology in the teaching of mathematics at secondary school level.

4. **Challenges** - Difficult tasks or problems faced in the integration of new technology in the teaching of mathematics at secondary level.

5. **Curriculum innovation** - deliberate actions to improve learning environment by adapting information technology in teaching mathematics at secondary school level.

6. **Cost benefit analysis** - It is a technique that is used to determine options that provides the best approach for the adoption of Information technology in the teaching of mathematics at secondary level.
1.10 Summary

This chapter gave the background of the study by looking into the challenges encountered in integrating technology in the teaching and learning of mathematics in Zimbabwe centered on Masvingo District. One aspect of this chapter is to examine the delimitation of schools that were selected for data collection. Research questions and objectives were clearly laid out to mark the guide line of what exactly needs to be studied. This chapter also gave the definitions of some terms that shall be frequently used in the research. This will led us to the next chapter which will incorporate the views of many scholars about the integration of technology in the teaching of mathematics in secondary schools.
CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will give an overview of literature which is related to the research problem. The integration of technology in teaching and learning Mathematics in Zimbabwe schools is a challenge that can have far reaching consequences if not properly done. Educators are still struggling to introduce the new curriculum which incorporated the integration of technology which is a major challenge on its own. Thus there might be a lot of reluctance in as far as technology integration is concerned, more so because most of our Zimbabwean schools get their technology resources through donor collaborations. The literature review focuses on challenges that educators and learners face in their endeavor, in using technology in teaching and learning mathematics in secondary schools. The aspect of how educators and learners perceive technology usage in Mathematics teaching and learning is key aspect considerable for discussion in this review. More so, this chapter will discuss the factors which constitutes effective technology integration in a meaningful mathematics learning situation.

2.1 Challenges Faced In Integration Of Technology

The act of the integration of technology into teaching and learning is a complex process and one that may encounter a number of difficulties known as barriers (Schoepp, 2005). A barrier is defined as any condition that makes it difficult to make progress or to achieve an objective (Wordnet, 1997). Another classification found in the literature is teacher-level
barriers versus school-level barriers. Becta (2004) grouped the barrier according to whether they are related to the individual (teacher-level barriers), such as lack of time, lack of confidence and resistance to change or to the institution (school-level barriers), such as lack of effective training in solving technical problems and lack of access to resources. Similarly, Balanskat et al (2006) divided the challenges into micro level barriers, including those related to teachers’ attitudes and approach to technology and more so level barriers, including those related to the institutional context. The later added a third category called macro level (system-level barriers), including those related to the wider educational framework. Another perspective presents the obstacles as pertaining to two kinds of conditions that is material and nonmaterial (Pelgram, 2001). The material conditions may be the insufficient number of computers or copies of software. The nonmaterial obstacles include teacher’s insufficient technology knowledge and skills, the difficult of integrating technology in instruction and insufficient teachers. Some of these studies look at the barriers at teacher, institution or system level. However, since the purpose of this paper is to determine the present and future barriers that face science teachers in their schools, this analysis focuses on the teacher-level and school barriers as will be discussed in other sections.

There are several factors that influence the integration of new technologies into the teaching and learning of secondary school mathematics. Stockdill and Morehouse (1992) identified user characteristics, technological considerations, content characteristic and organizational capacity as factors influencing integration of technology into teaching. Zammit (2012) propounded that lack of confidence and skills with computers and the need for more in-service courses were significant factors in the failure of teachers to integrate
new technologies into their classes. Sherwood (2010) found that the major push factors for teachers to integrate information into their classrooms had to do with the belief that it provided a more effective way of enabling children to learn.

Several researchers indicate that one barrier that prevents teachers from using technology is lack of confidence. Dawes (2000) sees this as a contextual factor which can at as a barrier to integration of technology in teaching mathematics in secondary schools. According to Becta (2004), much of the research proposes that this is a major barrier to the uptake of technology by teachers in the classroom. In Becta’s survey of practitioners (2004) the issue of lack of confidence was the one that attracted most responses from those that took part. Some studies have investigated the reasons for teacher’s lack of confidence with the use of technology in teaching mathematics in secondary schools. For example Begges (2000) asserted that teachers “fear of failure” caused a lack of confidence. On the other hand Balanskat et al (2006) found that limitations in teacher’s technology knowledge makes them feel anxious about using technology in the classroom and thus not confidence to use it in their teaching.

Thus the educators’ perceptions towards technology result in attitudes development towards technology use. Educators who use technology tools more frequently in their teaching will have self-confidence and are in control of how to use the tools. Being confident with technological tools implies that the educators are encouraged to use these tools more frequently. The educators can always come up with activities for different levels learners. Therefore the possibilities of engaging learners with special needs in mathematics are increased and everybody can do mathematics.
Brickner (1995) categorized the obstacles to effective technology integration as first order and second order barriers. First order barriers are defined as extrinsic factors which include access to technology resources, software availability and quality planning time for technology rich lessons and technical support. Whereas, second-order barriers are defined as “intrinsic factors” that include teachers beliefs about teaching and technology, school content and culture, instructional models and openness to integrate technology. Educational research has paid much attention to first-order barriers that affect teachers’ technology integration efforts. Some studies provide lists of barriers based on survey data (Becker, 2000).

2.2 Teachers Beliefs in Technology Integration

Schofield (2005) believed that some teachers think that the use of technologies will add little value to current practices. He also noted some barriers of implementation of new technologies as lack of familiarity with the technology that is computer hardware and software is a threat to teachers’ sense of competence and authority. Moses and Cobb (2001) believed that minority students can learn mathematics at a higher level through the use of technology. They began the “algebra project” because they believed that learning mathematics is a civil right issue. According to Moses and Cobb (2001), algebra is the language of computers and in order for students to be computer literate; they must have an understanding of algebra. They noted that students can get a better understanding of mathematic through the use of technology.

However, the impact of technology is not dependent on the extent to which technology is used in teaching and learning, but how it is used and for what purpose it is used in the
teaching and learning process. Also educators should be aware of the conditions under which learning could be effective. A deep understanding of the mathematics teaching and learning environment implies that educators will know when and how to use the teaching and for what purposes in mathematics.

Since a substantive body of researchers demonstrates the efficacy of technology to enhance science learning, the importance of integrating technology in schools has been addressed in many recent educational reforms. Science teachers are asked to apply technology to help students not only learn science but also do science (National Research Council NRC 2000). In the science and technology-driven 21st century, the need for students with well-developed science content knowledge and critical thinking skills, as well as the knowledge and ability to use, manage, and understand technology as it relates to science learning, is greater than ever. However, effective use of technology remains challenging for science teachers (Yerrick and Hoving, 1999). The vast majority of the teachers either ignore the call to use technology in science teaching or they employ technology in ways that replicate traditional instructional strategies, such as the power point lecture presentations. Teachers who attempt to use technology become frustrated by difficulties related to implementation (Yerrick and Hoving, 1999).

From this result, it is evident that any form of intervention that will contribute to the enhancement of development of the mentioned mathematical skills would be strongly welcomed. In order to develop these skills, the use of technology in teaching and learning mathematics becomes inevitable. A deep understanding of the mathematical teaching and
learning environment gives guidance on the approaches the educators can employ in teaching the subject.

Alagic (2003) believes that technology comes in many forms. Technology can be as simple as the use of a calculator in mathematics and science, using an overhead projector, a computer in the classroom for students to use or the many, new software programs that are beginning to flood the educational market place. He also argues that the key to teaching students higher levels of mathematics through technology is having teachers that can teach the technology. Alagic (2003) believes that teachers can learn in many ways, but it is hard for them to pass on their knowledge to the student directly because they have different experiences and understanding from children. Some students are very advanced with technology tools and they often challenge their teachers to reach their levels.

Therefore, the belief system that educators have will influence their approach to teaching and learning. A good or bad perception about technology usage in teaching and learning mathematics results to educators’ belief systems. A good perception about technology tool usage will influence what tools are used for, how they are used in teaching and learning and how often they are used.

2.3 Teachers Perceptions towards Technology Integration

Galafshami (2002) sees a great deal of educator’s conceptions about the content influencing their instructional practice. Galafsmani went on further to indicate that educators and educational officers who perceive with the use of technology in learning as accumulation of information are likely to view teaching as a transfer of information. Thus these kinds of officers will pump a great deal of information into learner’s heads through
the use of technology. Their approach to teaching tends to be more educator-centered and rote learning is usually encouraged. On the contrary, Galafshami also identifies another type of educators who perceive leaning of mathematics as helping learners to construct mathematics for themselves. Their approach is more learner-centered and through learners’ discussions, debate and questioning amongst themselves independent learning using projectors, computers and internet at large is encouraged.

In order for the mathematics teaching and learning situation using technology be more meaningful and authentic, there is a need to come up with the learning environments that support learner centered approach and de-emphasize rote learning. Thus it is the responsibility of educator to understand what learners need to know and should be able to do, have an immense mathematical knowledge and appropriate instructional strategies to meet the different learning styles of the learners. The educational officers’ belief system on mathematics using technology plays a very important role on how the educators are going to approach their teaching. Sugar, Crawley and fine (2004) see these beliefs system influencing the educators teaching philosophy using technology. A research carried out by Chen and Arnold 2002 in USA found that educators’ belief systems influence the learners’ image of mathematics more easily when integrating technology. They went on further to indicate that educators who are aware of their belief system might use technology to expand learners’ image about mathematics.

The educators understanding of mathematics is of paramount importance, as it will influence the depth at which mathematics is taught integrating technology. The educator will always be confident in what is being done with the learners in class and is not
threatened by the learners because he/she have tested them and know their capabilities of using technology. Such kinds of educators are likely to motivate and encourage their learners to develop a positive attitude to technology when solving mathematics problems, which in turn improve development of a positive attitude and learner’s performance in mathematics (Higgins and Moseley, 2001).

2.4 Advantages of Integration of Technology in Teaching

Research demonstrates, however, that technology plays a critical role in student learning (Russel, Lucas and Mcrobbie, 2003). Large-scale studies have shown the significant increase in achievement scores of students using technology as a learning tool (lei and Zhao 2007). Research in science classroom clearly indicate that the use of technology has a positive influence on a wide variety of student learning out comes, including understanding of science concepts and the development of scientific reasoning skills (Dani and Koenig, 2008 and Lee et al 2007). Furthermore, using dynamic scientific visualization to investigate abstract science topics, phenomena that happen quickly or change that occurs over a long period of time was found to help students develop an integration understanding of science topics (Linn et al 2010).

This implies that the use of learning technologies in science classrooms has been shown to increase students’ attention, engagement, and interest in science. Bearing in mind the varying functions of technology it will be much easier for educators to start from the goals of their learning activities and then see which technology is relevant for them. This will help in eliminating the use of technology in a wrong or less than successful manner in the classroom.
Alagic (2003) says that technology enables users to learn because some technologies are interactive. He believed that interactive technologies like Geometer’s Sketch Pad (GSP) allows the user to observe changes instantly, thereby understanding better what happens when some dimensions of a figure are changed. Gray (2008) stated that through the appropriate use of GSP, mathematics classrooms can move from yesterday into tomorrow that is from the industrial age into the information age. Since research has demonstrated the need of technology to enhance science learning, the importance of integrating technology in schools has been addressed in many recent educational reforms. Science teachers are asked to apply technology to help students not only to learn science but do science. (National research council 2000)

In the science and technology – driven 21st century, the need for student with knowledge and ability to use, manage and understand technology as it relates to science learning is greater than ever. This can be noted from the Mutare teachers’ college motto “digital teaching methodologies for quality instruction in the 21st century “. However, effective use of technology remains challenging for science teachers. (Yerrick and Hoving 1999) the majority of these teachers either ignore the call to use technology in science teaching or they employ technology in ways that replicate traditional strategies, such as using PowerPoint lecture presentations. Teachers who attempt to use technology became frustrated by difficulties related to implementation (Yerrick and Hoving 1999)

Technology usage in mathematics teaching is not consistent in different countries and in different set ups of a country even though there are high expectations. Usage in mathematics teaching and learning can benefit both the educators and learners provided
tools are used appropriately irrespective of the frequency of usage. Appropriate use of technological tools implies that different tools foster different mathematical skills.

2.5 How to Develop Teachers Professionalism for Successful Integration of Technology

Eccles and Wingfield (2002) believes that beliefs, knowledge and motivation play important roles in teachers technology – rich classrooms practices, thus there is need to integrate these important issues into motivation theories. Kagan (1992) pointed out that teachers’ beliefs are closely related to their classroom practices. Roeling and Luft (2004) pointed out that teacher’s beliefs are associated with teaching style. In the context of technology integration, studies have also shown that teacher’s beliefs about technology influence their use of technology in the classroom instruction. Teachers who are the most technology users hold strong constructivist beliefs (Windschill and Sahl, 2002).

Shulman’s (1986) work on teachers knowledge, led many researchers to focus on Pedagogical Content Knowledge (PCK) to understand teaching. He emphasized that PCK makes teachers different from the content specialists. Mishra and Koehler (2006) described pedagogical content knowledge derived from the original work of Shulman (1986). They view PCK as a framework for teachers to integrate technology into their teaching. It is a combination of knowledge of content, knowledge of pedagogy and knowledge of technology (Koehler and Mishra, 2008).

In order for the mathematics teaching and learning situation to be more meaningful and authentic, there is needed to come up with the learning environment that support learner-
centered approach and de-emphasize rote learning. Thus it is the responsibility of the educator to understand what learners need to know and should be able to do have an immense mathematical knowledge and approach instructional strategy to meet the styles of the learners.

2.6 Support from Schools in Providing Adequate Technology Resources in Classrooms

As far as the use of technology in teaching mathematics in secondary schools is concerned, school heads are not allocating enough time to the use of technology (Gray, 2008). Recent studies indicate that many teachers have competence and confidence in using computers in the classrooms, but they still make little use of technologies because they do not have enough time. A significant number of researchers identified time limitations and the difficulty in scheduling enough computer time for classes as a barrier to teacher’s use of technology in their teaching [Alwani 2005, Beggs 2000]. According to Sicilia [2005] the most common challenge reported by all teachers was lack of time they had to plan technology lessons.

Recent studies show that lack of time is an important factor affecting the application of new technologies in science education [al-Alwani, 2005]. According to Alwani (2005), lack of time is a barrier affecting the application of technology in Saudi Arabia because of busy schedules.

Similarly, in Canada, Sicilia (2005) concluded that teachers-take more time to design projects that include the use of new technology than to prepare traditional lessons. Teachers interviewed by Sicilia (2005) commended that the constraints of different class schedule contributed to the lack of time they spent together to work on planning classroom activities”.
Gomes (2005) concluded that one of the main reason that science teachers do not use technology in the classroom is lack of the time necessary to accomplish plans

For effective use of technology in teaching mathematics, school should support in-service training for its staff. One finding of Pelgrum’s (2001) study was that there were not enough training opportunities for teachers in the use of technology in a classroom environment. Similarly Beggs (2000) found that one of the top three barriers to teachers’ use of technology in teaching students was lack of training. Recent research in turkey found that the main problem with the implementation of new technology in science was the insufficient amount of in-service training programs for science teachers (Ozden, 2007) and Toprakci (2006) concluded that limited teacher training in the use of technology in Turkish schools is an obstacle. However, beside the need for pedagogical training, according to Becta (2004), it is still necessary to train teachers in specific technology skills, Schoepp (2005) claims that when new technologies needed to be integrated in the classroom, teachers have to be trained in the use of these particular technologies.

According to Newhouse (2002), some initial training is needed for teachers to develop appropriate, skills, knowledge and attitudes regarding the effective use of computers to support learning by their students. He argued that this also requires continuing provision of professional development to maintain appropriate skills and knowledge. Balanskat et al (2006), inadequate or inappropriate training leads to teachers being neither sufficiently prepared nor sufficiently confident to carry out full integration of technology in the classroom. According to Newhouse (2002) teachers need not only be computer literate but they also need to develop skills in integrating computer use into their teaching learning programs. Similarly, sicilia (2005) found that teachers want to learn how to use new technologies in their classrooms but the lack of
opportunities for professional development obstructed them from integrating technology in certain subjects such as science or mathematics.

Without both good technical supports in the classroom and whole-school resources, teachers’ cannot be expected to overcome the barriers preventing them from using technology (Lewis, 2003). Pelgrum (2001) found that in the view of the top barriers to technology use in education was lack of technical assistance. According to Gomes (2005) technology integration in science teaching need a technician and if one is not available the lack of technical support can be an obstacle. In turkey Toprakci (2006) found that the lack of technical support was one of two significant barriers to the integration of into science education in schools and might be considered serious. Sicilia (2002) argued that whatever kind of technical support and access teaching staff have and whether they have twenty years of teaching experiences or are novices to the profession, technical problems generate barriers to the smooth delivery of science lessons by teachers.

Even with the mentioned benefits of technology integration in mathematics teaching and learning, there is very little provision to support the acquisition of appropriate computer software in mathematics. However, easy accessibility and affordability of technological tools remains true for developed countries compared to developing countries and urban areas compared to rural areas.

2.7 Summary

Many scholars believe that the successful integration of technology in the teaching of science have got many advantages which include increase in performance, improved learning outcomes, understanding abstract science topics, increase in students’ attention, engagement and interest in
science. However, the implementation of technology will not be successful as perceived due to some barriers. In general, several studies have identified a range of the following or similar factors as widespread barriers in the implementation of technology in teaching secondary schools mathematics. The barriers include: lack of computers in schools, lack of quality software, lack of time to prepare technology lessons, technical problems, teachers attitude towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skills, poor fit with the curriculum, lack of incentives, scheduling difficulties, poor training opportunities and lack of skills in how to integrate technology in education.
CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction
This chapter describes research methodology applied in the study including the data collection methods, the data collection instruments, the research population and the method of sampling used. The research methodology outlines and explains the relationship between research problem, the data collecting instruments and the analysis of the research. According to Cohen, Minion and Morrison (2000), the aim of the methodology is to help the researchers to understand the processes and products of scientific inquiry. This can be done through different collecting techniques or strategies that are available and making meaning out of the collected data.

3.1 Research Design
The researcher used a descriptive case study research design. The research design enabled the researcher to employ qualitative research techniques to arrive at the purported objectives. The researcher has applied triangulation using interviews, documentary review and direct field observation. The researcher opted to use case study design following the argument by walker (2002) that research design is an analytical plan for data collection, enhancing clear data analysis which answers research objectives. Qualitative methods such as interviews and observations were employed in this study as they provided the much needed depth of the data. Qualitative methods for instant documentary review and interviews were employed in this research in order to establish challenges faced in integrating technology in teaching mathematics in secondary
schools. In addition, qualitative methods were used to access the contributions put in place by the school authorities and curriculum implementers. Qualitative approach is usually more explanatory in nature, as a result it was easy in this research to determine the challenges encountered by school heads on time tabling, infrastructural development and acquiring qualified personal that are computer literate.

Also, case study approach was used to enable the researcher to collect in-depth information about the challenges encountered in integrating new technology in teaching mathematics in boarding schools and urban and rural day schools. The study is evaluative as it is investigating the challenges of integrating technology in teaching mathematics and out of that investigation decisions will be taken based on the findings (Patton 2002).

3.2 Target Population

A population is any entire collection of people or things which we may collect data. It is the entire group which we are interested in, which we wish to describe or draw conclusions about. Best and khan (1993:12) defines population as, “a group of individuals that have one or more characteristics in common that are of interest to the researcher”. All individual or objects within a certain population usually have a common binding characteristics or trait. It is important that the investigator carefully and completely defines the population before collecting the sample, including a description of the members to be included. The samples for purposes of research are drawn from the population. The targeted population in this study was all mathematics educators and headmasters of schools in Masvingo district. The sample was drawn from this population and the results were generalized for the whole district. Rumwanda secondary has got 2
mathematics teachers, Mutendi has got 5 qualified teachers and 1 student teacher and Ndarama has got 9 mathematics teachers and operated hot seating. Ultimately, there were 3 Headmasters who participated in the study. All in all there were 20 participants in the study.

3.3 Sample

A sample is a group of units selected from a large group. Wegner (2003) defines a sample as a subset of a population. A small proportion of population is going to be selected for analysis. By studying a sample it is hoped to draw valid conclusions about the larger group. A sample is generally selected for study because the population is too large to study in its entirety. Out of the seventy secondary schools in Masvingo district only three schools were selected. The schools were taken one from the categories, urban day school, rural day school and boarding school by stratified random sampling. The sample should be representative of the general population. Only mathematics educators and school headmasters were used as subjects. The schools used are Rumwanda secondary (rural day), Ndarama high (urban day) and Mutendi high (boarding).

3.4 Sampling Criteria

The sampling of the population was done using purposive or judgmental and the stratified sampling technique. According to Crashaw and Chambers (2001) stratified sampling is used when the population is split into distinguishable layers or strata that are quite different from each other and cover the whole population. Masvingo district secondary schools were put into three strata that are boarding schools, rural day school and urban day schools. After the schools were put into stratus the judgmental sampling was used to select one school from each strata. A sample is a subset or smaller set of the population in a research study in which information is
obtained. It is a representative of a population taken to show what the results are like. Melville and Goddard (2005) stress the importance of sampling and further explain that if the population is very large, it can be satisfactorily covered through sampling. Purposive sampling technique was used in this research because the sample is easy to select. The sample size used in this research was 5% of the target population. The total number of schools in Masvingo district was 70, so by employing purposive sampling it was suitable since sampling frame was easily identified. The reason why the researcher used purposive sampling is that, the starting point is not automatically the first in the list but is instead randomly chosen from within schools list. This enables the researcher to select those schools strategically. The purposive technique enabled the researcher to select a school which is best to meet the demands of research objectives.

3.5 Research Instruments

Research instruments are measurements tools for example questionnaires which are designed to obtain data on the topic of interest for research subject. Instruments are different tools used by the researcher to gather data. It is important to collect data using a variety of methods in order to get the best understanding of one’s point and needs. In this research the instruments used were interviews and lesson observations.

3.5.1 Interviews

Another way of collecting primary data is the interview. It can be conducted in several ways that is either face to face or over the telephone. An interview according to Hussey et al (1997), gives the researcher the opportunity to probe deeply in order to uncover new clues and open new dimensions of a problem under scrutiny. The interview can contain both closed and open ended questions. The advantage of closed ended questions is that they demand short or one word
answer and the advantage of open ended questions is that they allow the client to talk more and come up with their solutions.

Face to face interviews were undertaken to all participants in order to gather information about how technology integration lessons were conducted. Interviews were used so as to get adequately answered questions. Interviews are more flexible than questionnaires and provide good opportunity for demonstrations. Results are more accurate due to interviewer control and gestures from the respondents. This method proved to be faster since responses were got there and there other than leaving the respondent with your questionnaire which may take them some time to answer. Both closed and open ended questions where used in preparing the interviewers’ guide for both teachers and headmasters.

The interview consists of the two schedules of structured questions. The one was for the educators and the other schedule was for school headmasters. The questions were written in English since it is the formal language. The researcher recorded the responses. Interviews were conducted during long breaks and after the official conduct time of learning and teaching. This was done to observe the culture of teaching and learning as most of the data was collected during conduct time form of observations. The educator schedule was administered to each educator who was involved in the study and the headmaster’s schedule was administered to every headmaster of a school involved in the study. Interviews were used to assess the levels of educators in education and their years of experience at work. In addition to the above, the interview was not just limited to the questions on the interview guide but it was open to new and unexpected questions. This type of data collection method generally decreases the number of ‘do
not know’ and ‘no answer’ responses and interviewers also provide a guard against confusing items (Griffie, 2005).

The main reason for using interviews was that, interviews are characterized by synchronous communication in time and place and they take their advantage of social cues like voice and body language of the interviewee which can give the interviewer a lot of extra information that can be added to the verbal answer of the interviewee as noted by Opdenakker (2006). This was further supported by kvale (1996) who states that interviews allow people to covey to others a situation from their own perspective and in their own words and they capture many of the subjects views on something. Also interviews helped the researcher to obtain valid information since he can explain to the respondent some confusing issues on the interview guide questions. This is why interviews were chosen as a data collection method in this study since they are useful tool which can lead to further research using other methods like observations.

However interviews have their own drawbacks in that they are time consuming and sometimes respondents may be too busy to attend to the researcher’s questions. The respondent may answer questions just to impress the interviewer and might leads to distorted results.

3.5.2 Direct Field Observations

Observations are when the researcher watches what will be happening and take notes. This method was used to gather information on the challenges encountered in the integration of technology in teaching mathematics in secondary schools. Newman (2003) highlighted that observations are ways of gathering data by watching behavior, events or noting physical characteristics in their natural setting. Observations can be direct or indirect. Direct observation is when one watches interactions, behavior and processes as they occur (schurink, 1998). Direct
field observation helped the researcher in such a way that, the researcher has the capacity to view the causes of these challenges within the classroom. Observation was done during the educator normal working hours, the school’s daily time table was followed for conducting observation and thus there were no class disruptions. The main focus of the observations on the learners and educators was to identify how they interact with technology in the teaching and learning situation. The researcher was observing educators, learners in their natural teaching and learning environment. Any observation schedule was used to collect data. The researcher also commented on the infrastructure of the school which he would have observed.

In the study, the observer was not part of the participants. The observer was also not actively involved in the observation process therefore a passive participation was done. In this type of participation the observer does not interact with the participants during the observation process (Spradley 1980). Also the researcher, observed the kind of challenges being faced by both teachers and learners hence gave the researcher room to assess the measures to put in place as part of recommendations to overcome the challenges.

The advantage of observing is that seeing what happens in the actual context helps the researcher have a better understanding of why a person would act in a particular way. The researcher can identify other important issues that might have been over looked. On observation the drawback is that, often pupils change their behavior if they are observed.

3.6 Procedures of Collecting Data

The primary data collection procedures were the interviews and direct field observation. Data was collected during the first school term of 2015. Three days were spent on Rumwanda, one week was spent on Ndarama High School and one week again at Mutendi High School.
3.6.1 Interviews

The researcher gave the interviewee a brief background of the project. This is done to make the person have focused such that s/he has an idea of what type of information is wanted. Subjects were given the questions for interview before the interview so that they gathered information. The researcher followed the following procedures during the interview:

i) Ask one question at a time.

ii) Give the interviewees plenty of time to answer questions.

iii) Ask follow up questions when interviewees do not answer the question completely or when clarification was needed.

iv) Record verbal utterances, attitudes and even body language and their meanings for the interviewee.

v) Give eye contact so that the interviewee knows that i was listening.

3.6.2 Observations

The researcher asks for permission to observe one lesson from each and every mathematics teacher out of the three schools in the sample. The researcher was mainly focusing on observing physical features of the school and teachers’ behaviors and teachers’ teaching methods during mathematics lessons. Availability of resources was also under study during the observation. The researcher was not a participant in the classroom but just seated at the back of the classroom and taking down notes. On physical features the researcher would need to observe the size of the laboratory, ventilation, sitting arrangements and the positioning of computers and other equipment such as whiteboards and projectors for power point presentations in the laboratory.
3.7 Data Analysis and Presentation

Bomel and Michael (2001) defined data analysis as a process of inspecting, cleaning, transforming, and modeling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse technique. In this case the researcher collected all gathered information to come up with conclusions to specific questions. The findings from the above methods used to gather data was analysed in relation to the objectives set. The findings were both reported and graphically tabulated. Findings are presented and categorized according to the objectives of the study in relation to the number of the interviewed respondents, through the use of tables and graphs. The researcher chooses to use tables to present data because it will be easy to tabulate figures of the three schools.

3.8 Summary

This chapter presented the research design, data collection method, data presentation and analysis procedure, population, sample and sampling technique. The importance of sampling and stratified random sampling was described. The methods described in this chapter were used to obtain the findings of this study which constitute the next chapter of this research. The interview and direct field observations were used as data collecting instruments in this study. Advantages and disadvantages of the data collection instruments were also given in this chapter. The next chapter looked at data presentation, analysis, discussion and interpretation.
CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction
The use of computers is not different in rural and urban day schools in Masvingo district. The only difference is the provision of electric supply, but in terms operation they are one and the same. On the other hand the boarding schools are more advantaged than the day schools on electricity supply, selection of teachers who are more expert on using computers. Although the urban day schools are electrified, the problem of load shedding affects the use of technological tools that require electricity such as computers. The analysis was carried out looking at the perceptions toward technology usage and educators frequent use of technology in mathematics teaching and learning. Also the analysis dwelt on the headmaster’s support on the use of technology. The data presentation methods used in this chapter is frequency tables, pie charts and bar graphs.

4.1 Data Presentation

<table>
<thead>
<tr>
<th>Category of respondents</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17</td>
<td>85</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

*Table 4.1: Comparison by Gender*
The majority of the samples were a male teacher that is 85% and female teachers constitute 15% of the sample. The datum was considered statistically significant to the extent that it confirmed the hypothesis that more teachers in Zimbabwean schools are of male gender than the female one. For example, Makoni (2011) on study of gender composition of teachers in Hwange urban in Zimbabwe found that 69% of the mathematics teachers were male while 31% were female.

![Composition by Gender](image)

*Figure 4.1 Composition by Gender*
<table>
<thead>
<tr>
<th>Professional qualification</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificate in education</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Diploma in education</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Bachelor’s degree in</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-teaching degree</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4.2: Composition of Sample by Professional Qualification

Table 2 above shows that the majority of the respondents have a professional qualification. Those with non-teaching degrees constituted 5% of the sample. This implies that mathematics in secondary schools is being taught by qualified teachers. The majority of the teachers have diploma in education and thus there is need for the teachers and curriculum implementers to look into their issues and upgrade them.
Figure 4.2 Composition of Sample by Professional Qualification

Figure 2 above clearly shows that the highest level of education amongst mathematics teachers is the diploma in education in which about 40% of the sample is found in that category. The least number of people in the sample holds a non-teaching degree and the constitute 5% of the sample.
Table 4.3: Composition of Sample by Teaching Experience

Table 3 shows that most of the respondents had more than ten years of teaching experience. Those below ten years teaching experience constituted 25% of the respondents. The majority of teachers with more than ten years’ experience can accommodate change regarding the use of technology in their teaching. However, teachers with more than 10 years teaching experience may resist change due to several reasons.

Table 4.4: Composition of Respondents by School

Name of school | Frequency | Percentage
--- | --- | ---
Rumwanda secondary | 3 | 15
Ndarama high | 10 | 50
Mutendi high | 7 | 35
Total | 20 | 100
Table 4 above shows that Rumwanda secondary school has only 15\% of the mathematics teachers of the sample with the headmasters being inclusive. This might be due to their low enrolment and the geographical location of the place. Boarding schools and urban day schools have more mathematics teachers and student enrolment. Ndarama high have got more teachers because of their hot seating due to the high urban population. More so, there is competition by teachers to fill-in teaching posts in boarding schools because of the better standards of leaving which include taped water, electricity and adequate accommodation. This will result in boarding schools taking the best of teachers leaving out the less qualified teachers for rural schools.

<table>
<thead>
<tr>
<th>Level taught</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZJC</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>‘O’ Level</td>
<td>5</td>
<td>29.4</td>
</tr>
<tr>
<td>‘A’ Level</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>

*Table 4.5 component of respondent by level taught*

The total number of respondents in the table above reduced to 17 since all the 3 headmasters at the three schools do not teach any classes. Some of the teachers may be teaching at least one level of education.

The majority of the teachers in the sample (65\%) indicated that they were computer literate just for their own convenience and not to the extent of using it as a method of instruction. 20\% indicated that they can operate a computer and can use it as a mode of instruction to teach
mathematics. 15% of the sample indicated that they were not computer literate at all. The majority of the teachers to them using technology is transforming from logarithm tables to the use of calculators. However, some teachers were now a step ahead since they were able to prepare notes downloading the information from the internet, using mathematics software to teach concepts and to teach using power point presentations.

4.2 Teachers Perceptions towards the Use of Technology

In Rumwanda secondary school, teachers still preferred to use logarithm tables instead of using calculators. The major reasons being that pupils cannot afford the calculators, teachers are afraid of change, negative perception that non calculator versions are very easy to pass. In 40% of the sample population, lack of availability of resource such as the computers, infrastructure and electricity reduces the usage of technology during teaching and learning of mathematics. However, in Ndarama and Mutendi high schools where resources and technological devices are available, most teachers shun using technology due to its high demand of time in preparing the technology lessons. More so, the majority of the teachers lack the knowledge on how to use some of the technology.

4.3 Availability of Resources

Shortage of computers in schools creates challenges of implementing technology in mathematics education at secondary level. Out of the 20 sample respondents, 90% indicates that the pupil computer ratio was above 1:3 respectively. This can create problems when the teacher wants pupils to have hands own practice. However, due to the acute shortage of computers in the majority of the schools, 65% of the mathematics teachers testify to have never used any form of technology in their teaching.
4.4 Advantages and Disadvantages of Using Technology

The 20% of the teachers who use technology effectively in their mathematics teaching at secondary level testify that there are some advantages as well as disadvantages that are associated with incorporating technology in the lesson. The advantages they stated included that students grasp concepts easily since the computers or calculators will do the rigorous exercise of computing information. However, some teachers complained that the use of technology hinders the learning process by reducing the pace of the syllabus coverage. All the 20% of the participants indicated that inadequate time allocation for mathematics lessons is the major drawback for them to use technology in the teaching and learning of mathematics. School headmasters cited teacher incompetence’s as the major drawback in using computers in mathematics lessons. More so, the school headmasters indicated lack of electricity in their school and were electricity is available; load shedding will also affect the use of technology in teaching and learning mathematics.

Those who indicated that they were willing to use technology in their lessons gave the following reasons that the internet gives students access to latest information in their subject, teachers work becomes easier since the computer becomes another teacher, technology motivates students in their learning and concentration. Those who had indicated unwillingness to use technology stated the reasons that technology reduces learning demands on students as they will not concentrate on the syllabus, teachers believe that they are not competent enough to handle computer lessons, some schools do not have adequate resources like internet connection and few computers and lastly lack of support from the school headmasters and parents.
4.5 Observation Information

Rumwanda secondary school is a day school in the Masvingo rural district. It caters for day scholars from Chipinda area. There is no electricity at the school and the school does not have any generator. The school does not have a proper computer laboratory. The school had 10 computers which were donated by His Excellency Cde R.G. Mugabe which are still in their boxes.

Ndarama high school is a public day school which caters for the majority of pupils residing in Masvingo. The school did not have a computer laboratory up to the year 2000. Therefore, one of the classrooms was turned into a computer laboratory, which implied that learner’s accommodation was sacrificed. At the time of investigation, the computers were placed in four rows of five computers each. The school did not have a data projector or an overhead projector. The only resource that the educator can use for presentation was a chalkboard mounted to the wall in front in the laboratory. Microsoft excel was the only application software that is mathematically related, otherwise there was no specific mathematics software.

4.6 Summary

From the findings it can be concluded that computer technology is not sufficiently used in mathematics teachings in all schools up to full capacity. Also, in all secondary schools laboratories are used to a very minimally and in most instance used for other purposes other than teaching and learning. This chapter has shown that in all schools selected secondary school educators and learners have very strong positive perceptions about the use of educational technology in mathematics teaching and learning even though the educational technology resources are not utilized. It can also be concluded from the findings that only a handful of
educators attended training on educational technology integration in teaching and learning. There were also other problems that contributed to training not being done as planned, due to financial constraints, online training could not be done and thus the face to face training was extended for a longer period.
CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction
The aim of this study was to investigate challenges encountered in the integration of technology in teaching mathematics at secondary school level. Even though there is some willingness across all boarders on technology usage to improve teaching and learning in these schools, there are a lot of things that need to be looked into. In order to achieve this aim, the answers to the following questions were needed.

- To what extent are technology used in mathematics teaching and learning in all secondary schools of Masvingo district?
- What are teacher’s and learner’s perceptions on the use of technology in mathematics teaching and learning?

5.1 Summary of the Project Including Constraints
The findings from the study review that 20% of the teachers have been trained to teach mathematics using supported techniques. These findings tally with observation buy Sandholtz and Reilly (2004) who argues that researcher technology skills are strong determinants of technology integration. Findings also show that the majority of researchers indicated that their schools do not have adequate computers. Effect adoption and integration of technology into teaching in schools depends mainly on the availability of technological availability such as hardware and software. This implies that access to computers, updated software and hardware
are key elements of successful adoption and integration of technology into the curriculum (Buabong and Andoh, 2012).

The study also shows that only a few mathematics teachers use technology during lesson delivery. This means that a significant number of students are losing out on the benefit of using technology. As Kangai (2012) postulate technology offers varied and powerful ways for teachers and students to interact, manipulate data and promote effective teaching and learning. Finding from the study also reviewed that some of the teachers were willing to use technology in their lessons and another set of teachers strongly resisted the use of technology. This finding is congruent with findings from Shelly, Cashman and Waggoner (2010) who postulate while many teachers are engaging in innovative forms of research and novel projects, there are still many traditional teachers who resist new computer skills and do not want bring computer based technologies into their classrooms. Findings also reveal that most teachers felt that their heads do not approve of the use of technology during the learning teaching process. Heads of schools as curriculum leaders in the schools are strong predictors of teacher use of computers in the classroom. As Yee (2000) advices the leader who implements technology plans and also shared a common vision with the teacher stimulates them to use technology in the classroom.

5.2 Conclusions

This study concluded that there was greater digital divide in the use and integration of technology in secondary schools in the teaching of mathematics in Masvingo district, due to technological resources. There were cause factors for digital divide which include lack of funds to buy technological software and hardware, skilled manpower and general physical infrastructure. Teachers had basic skills in information technology which were not adequate for
use and integration in the teaching of mathematics that is the majority of teachers lack technology competency to effectively integrate technology in their curriculum activities. It can be deduced that even after undergoing training on technology usage there is still lack of understanding of the role of technology in teaching and learning. Despite the challenges experienced there were several opportunities to rely on for technology use in teaching mathematics in secondary schools in Masvingo district.

5.3 Recommendations

In light of the findings of this study, the researcher would like to make some recommendations.

- Teachers should be assisted to acquire skill and competences to integrate technology into the school curriculum for the benefits of learners.
- The schools should provide on-going support to help educators overcome challenges they meet daily in trying to integrate technology in their teaching and learning.
- In-house training of teachers will be much more convenient for schools without sufficient funds.
- Schools should prioritise the acquisition of modern computers to cater for individual learning needs of pupils so that the task of guiding learners by teachers becomes easier.
- The Ministry of primary and secondary education has to in-service those teachers who are stack with traditional models of lesson delivery so that they could change their negative attitude toward technology usage in the classroom.
- Heads of school should demonstrate a willingness to provide technological leadership to their teachers so that they may also adopt the use of technology for teaching purposes.
Those teachers already integrating technology in their teaching should make sure that they properly guide pupils so that they do not abuse some of the facilities provided by internet.

Research on a large scale is needed to see if the findings of the investigation can be generalised to all the schools of Masvingo province.
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APPENDIX

APPENDIX 1: INTERVIEW GUIDE FOR TEACHERS

Below follow the interview questions focused during the interview with the educators on using technology in the class:

1. Sex
   - Male
   - Female

2. How old are you?
   - 18-20yrs
   - 21-29
   - 30-40
   - Above 40

3. How long have you been teaching mathematics?
   - 1-2
   - 3-5
   - 6-10
   - 11-20
   - >21

4. What is your highest education qualification?
   - C.E
   - DIP IN ED
   - B.Ed.
   - Non T
   - Masters Dg

5. Which levels are teaching?
   - Z.J.C
   - ‘O’ level
   - ‘A’ level

6. Are you computer literate?

7. How did you introduce the technology to learners?

8. Does your school have adequate computers?

9. Do you use technology during your lessons?

10. What major challenges do you face when integrating technology in teaching mathematics?

11. In what way did technology
   - help your teaching?
   - hinder your teaching?

12. How did the learners respond to technology?

53
APPENDIX 2: INTERVIEW GUIDE FOR HEADMASTERS

1. Does your school have internet? [Yes] [No]

2. If no, what are the challenges that are stopping you from having internet at your school?

3. What forms of technological tool that are found at your school?

4. What technological tools that are not found at your school that you wish you should have? [0-2 y] [3-5 y] [>6 y]

5. How long have your maths teachers been using technology?

6. Do you think technology have played a great role in improving you mathematics pass rate?

7. Do you think teachers at your school are using the available technological tools in their mathematics lessons? [Yes] [No]

8. If no, what are the possible reasons why they are not teaching using technology?

9. Do you allocate enough time on the time table for technology lessons?

10. Are the mathematics teachers at your schools equipped with the relevant skills needed to technology use?

11. Do you recommend your teachers to go for in-service training?

12. Do you have adequate computers?

13. Does your school have electricity?

14. Do you have an alternative source of power?

15. What technical support did you gave to your teachers?

16. What aid did you receive from policy makers and education officers?

17. In your own view, what are the major challenges faced by teachers in integrating technology?
18. What recommendations do you suggest for effective technology integration?
APPENDIX 3: OBSERVATION CHECKLIST FOR CLASSROOM INTERACTION

1. PHYSICAL FEATURES

1.1 How big is the computer lab?

1.2 How is the lighting in the lab?

1.3 How are the computers positioned in the lab?

1.4 How is ventilation in the lab?

1.5 What is the learners sitting arrangements?

1.6 How are the computers’ conditions? (clean, dusty)

1.7 Number of operational computers?

1.8 Number of computers connected to the internet and/printer?

1.9 Number of mathematics software programmes available?

2. USE OF TECHNOLOGY IN CLASS

Does the educator

a. Use media and technology that are specific to the current area?

b. Including integrated teaching and learning experiences using internet and other technologies?

c. Provide opportunities for learners to use the internet as a source of information?

d. Integrate technology to stimulate real world problems?

e. Create group projects using computers and mathematics programs?

f. Allow learners to discover, share and create things using computers and Maths programs?

g. Give provisions for learners’ feedback presentations in their projects using computers?