# TEACHERS' PERCEPTIONS OF THE INTRODUCTION OF COMPUTER-ASSISTED LEARNING IN MATHEMATICS IN RURAL SENIOR SECONDARY SCHOOLS IN THE ZAMBEZI REGION, NAMIBIA

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## ABSTRACT

After Namibia's independence, the government of the Republic of Namibia embarked on creating opportunities for Informational Communication Technologies (ICT). The Namibian government started with the development of policies for ICT implementation and integration in Namibian schools, which targeted the introduction and implementation of ICT in primary schools, secondary schools, the colleges of education then and the universities. The policies stipulate the need for infrastructure development, internet connectivity as well as technical support at all levels of implementation. The equal distribution of resources was one of the key elements in the implementation, for the rural schools to benefit equally as urban schools.

This research study investigated the teachers' perceptions of the introduction of Computer-Assisted Learning (CAL) in Mathematics in rural senior secondary schools in the Zambezi Region of Namibia. To achieve this goal, three research questions were formulated in order to facilitate a better understanding of teachers' perceptions of the introduction of CAL in the Mathematics classroom, namely:

a) How do teachers perceive the introduction of Computer-Assisted Learning (CAL) in Mathematics classrooms in the selected schools?
b) How do teachers envisage Computer-Assisted Learning (CAL) lessons to be introduced/implemented in the case schools?
c) What characteristics of Computer-Assisted Learning environment do teachers perceive as important for their positive decision making to use computers in a Mathematics class in the case schools?

This study is a qualitative study whose methods for collecting data were individual interviews and group interviews. A total of twelve (12) NSSCO Mathematics teachers from the selected rural senior secondary schools in the Zambezi Region participated in this study. These Mathematics teachers from seven rural senior secondary schools where purposively selected.

The main findings of the study were that Mathematics teachers from rural senior secondary schools in the Zambezi Region perceived the introduction of Computer-Assisted Learning in the Mathematics classroom in a very positive way. The findings also revealed that Mathematics teachers perceive the introduction of CAL fitting in the NSSCO Mathematics curriculum and the majority suggest the introduction to start as early as upper primary schooling. However, they consider provision of facilities and services such as computer labs, internet connectivity and technical personnel support to be the important components of the effective introduction or implementation of CAL, with a two-third of them indicating a one to one intervention as the best approach. The findings revealed that Mathematics teachers see themselves as instructors and facilitators during the Computer-Assisted Learning lessons.

For the successful introduction or implementation of Computer-Assisted Learning, the education stakeholders have to address the following aspects perceived as problems that could hinder the effective introduction or implementation of CAL. These problems are: lack of computers and computer laboratories, lack of space to convert into a computer laboratory, lack of internet connectivity, computer literacy among learners and teachers, lack of technical support, power failure, ICT security, limited time and funding.

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- The Mathematics teachers in rural senior secondary schools in the Zambezi region;
- My family and
- The Almighty God in the highest for all the guidance and protection.

## DEDICATION

To my late father Mr Bornface Nchindo Matengu and my mother Mrs Margaret Mulela Salyonga-Nchindo who continuously gave me words of wisdom throughout my academic life. May the humble Lord in the highest continue to rest him in eternal peace and may the almighty continue to bless my mother.

## DECLARATION

I, Evans B. Nchindo, declare that the study "TEACHERS' PERCEPTIONS OF THE INTRODUCTION OF COMPUTER-ASSISTED LEARNING IN MATHEMATICS IN RURAL SENIOR SECONDARY SCHOOLS IN THE ZAMBEZI REGION, NAMIBIA" is a true reflection of my own research and that this work or part thereof has not been submitted for a degree in any other institution of higher education. No part of this thesis may be reproduced, stored in any retrieved system, or transmitted in any form or by means (e.g. electronic, mechanical, photocopying, recording or otherwise) without the prior permission of the author, or the University of Namibia. I, Evans B. Nchindo, grant the University of Namibia the right to reproduce this thesis in whole or in part, in any manner or format, which the University of Namibia may deem fit, for any person or institution requiring it for study and research; providing that the University of Namibia shall waive this right if the whole thesis has been or is being published in a manner not satisfactory to the University.

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Evans B. Nchindo Date

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| | |
|---|---|
| ATU | Attitude Towards Use |
| CAL | Computer Assisted Learning |
| DNEA | Department of National Examinations and Assessment |
| ICT | Information Communication Technology |
| IUM | International University of Management |
| LISREL | Linear Structural Relations |
| NSSCO | Namibia Senior Secondary Certificate Ordinary Level |
| NUST | Namibia's University of Science and Technology |
| PEOU | Perceived Ease of Use |
| TAM | Technology Acceptance Model |
| TPACK | Technological, pedagogical and content knowledge |
| TRC | Teacher's Resource Centre |
| T1SA | Teacher one school A |
| T2SA | Teacher two school A |
| T3SB | Teacher three school B |
| T4SB | Teacher four school B |
| T5SC | Teacher five school C |
| T6SC | Teacher six school C |
| T7SD | Teacher seven school D |
| T8SD | Teacher eight school D |
| T9SE | Teacher nine school E |
| T10SF | Teacher ten school F |
| T11SG | Teacher eleven school G |
| T12SG | Teacher twelve school G |
| UNAM | University of Namibia |

# CHAPTER ONE: INTRODUCTION

## 1.1 Orientation of the study

Investing in Information and Communication Technology (ICT) infrastructure has been one of the key priorities of education policies of countries all over the world over the past decades. In Namibia, according to the Ministry of Education's ICT policy (2007), the ICT education policy aims at implementing and integrating ICT into primary schools, secondary schools, colleges and universities. The primary purpose of this ICT policy is to provide clear objectives and basic competencies for learners, students and teachers to achieve key ICT knowledge and skills. Therefore the curricula is also required to be aligned in order to indicate exactly what is expected of learners, students and teachers with regard to the ICT in education. For the benefit of the Namibian child, the Zambezi region, just like other regions is also to benefit from this intervention. Zambezi region is one of the 14 regions in Namibia that continue to perform poorly as far as Mathematics is concerned (DNEA, 2016). It is against this background that the researcher found it fit to investigate teachers' perceptions of the introduction of Computer Assisted Learning (CAL) in Mathematics in rural senior secondary schools in the Zambezi region.

Furthermore, computer use in schools varies in instructional intensity (Man, 1997). Man (1997) found that there are several forms of Computer-Assisted Learning (CAL). Firstly, the most basic usage of CAL is in the area of drill and practice, where a computer serves primarily to reinforce concepts and knowledge introduced in the classroom. Secondly, a computer can also be used to introduce and reinforce facts and concepts. Thirdly, in higher level learning, people and computers can interact and establish conversation. According to Man (1997), studies have been carried out to test for differences in the effects of Computer-

Assisted Learning (CAL) and Teacher Assisted Instruction (TAI) on learners' learning. These studies indicated that CAL was more effective than TAI intervention whilst some demonstrated that TAI was more effective for initial acquisition and CAL more effective for retention. On the other hand, Hartley, Treagust and Ogunniyi (2008) in their study found that learners considered the application of CAL as a positive step to improve their learning but also placed a high value on the role of the teacher as they perceived competencies of their teacher to have helped them in their achievements. Witte, Haelermans and Rogge (2014) opined that Computer-Assisted Learning (CAL) programs are a way to improve test results of learners, when schools with lower educational attainments use Computer-Assisted Learning more frequently. It is against this background that this study focused on how teachers perceive the introduction of CAL in Mathematics at rural schools in the Zambezi education region.

Although several studies show that teachers are among the most skilled ICT users, it seems that they are still unable to apply these skills to their teaching (Brun & Hinostroza, 2014). This means that those who have the ICT skills are not using Computer-Assisted Learning to their advantage. Teachers are the most important key players in the introduction and implementation of Computer-Assisted Learning (CAL) as they are in the forefront of the curriculum. Therefore, the introduction of Computer-Assisted Learning in the Mathematics classrooms is predominantly influenced by the involvement and the willingness of teachers in particular. ICT does not have an educational value in itself, but it becomes valuable when teachers use it in the learning and teaching process (Hismanoglu, 2012). The presence of ICT does not mean that the students and teachers are using it but rather the impact of ICT is seen when used in a particular content area and further supported by use across the curriculum. Since teachers are the key figures to utilise ICT in educational settings productively and to

help integrate ICT into the curriculum, they need support and training to implement ICT integration into their classrooms.

The cognitive components of attitudes and literature show that teachers' perceptions influence intentions, which in turn influence behaviour (Hismanoglu, 2012). For instance, the teacher's intention to use ICT can be predicted by his/her subjective perceptions of its usefulness. Therefore, the impetus of this research was to explore teachers' perceptions of the introduction of Computer-Assisted Learning in Mathematics in rural senior secondary school in the Zambezi region by using interview questions that were related to the Technology Acceptance Model (TAM). The model indicates that perceived usefulness and perceived ease of use are two specific determinants of a user's acceptance of a technology. Perceived usefulness indicates that user's perception of the extent to which the technology will develop his job performance. This means decreasing the time for performing a specific job and also more productivity and accuracy on the job. Perceived ease of use refers to the user's perception of the amount of the effort necessary for using the system or the extent to which a user believes that employing a specific technology will be easy.

## 1.2 Statement of the problem

Table 1 below is the A-D symbol analysis for grade 12 Mathematics under the Namibia Senior Secondary Certificate Ordinary level (NSSCO) for seven (7) rural senior secondary schools in the Zambezi Region, for the last six years (2011-2016). The Zambezi Region is faced with a challenge of failure as far as Mathematics is concerned, and this is a serious problem. Table 1 below is just an indicator to show exactly how the region has performed at seven (7) rural senior secondary schools. Given this background, the researcher found it

appropriate to investigate the introduction of Computer-Assisted Learning (CAL) in Zambezi Region.

**Table 1:** The A-D Symbol analysis for Grade 12 Mathematics NSSCO for the only seven (7) Senior Secondary Schools in Zambezi Education Region

| SCHOOL | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|
| **A** | 57.89% | 40% | 18.46% | 26.44% | 19.28% | 11.34% |
| **B** | 40% | 16% | 15.2% | 12.94% | 20.83% | 25.83% |
| **C** | - | 44% | 9.01% | 25.61% | 42.42% | 32.04% |
| **D** | 21.51% | 20.25% | 18.97% | 25.33% | 30.43% | 30.85% |
| **E** | 3.33% | 4.92% | 9.38% | 0% | 19.70% | 38.82% |
| **F** | 19.57% | 27.59% | 13.75% | 23.53% | 42.65% | 21.70% |
| **G** | - | - | - | 4% | 26.19% | 33.33% |

*(Source: DNEA, 2016)*

The table above clearly shows that there is a high failure rate at seven (7) rural senior secondary schools in the Zambezi region as far as Mathematics results are concerned. A-D symbols in a subject is the minimum requirement that should add up to twenty five (25) points in five (5) subjects for all the higher institutions of learning in Namibia; this includes the University of Namibia (UNAM), Namibia's University of Science and Technology (NUST) and International University of Management (IUM). The above table gives a clear picture that only a small number of candidates from these rural schools managed to access institutions of higher learning in the past six (6) consecutive years, which is not adequate to help the country achieve its national goals, which include the newly launched NDP5 and Vision 2030. Thus, to have a turnover of these types of results in Mathematics the researcher finds it imperative for all stakeholders to be involved in identifying the causes and the

solutions to the problems at hand. According to Tienken (2007), Computer-Assisted Learning (CAL) provides one possible avenue for education leaders to overcome and address the problem of low achievement in Mathematics. Given this background, the researcher had to investigate teachers' perceptions of introduction of Computer-Assisted Learning (CAL) in Mathematics at seven (7) rural schools in the Zambezi education Region.

## 1.3 Objective and Research questions

The main objective of this study was to generate information on how teachers perceive the introduction of Computer-Assisted Learning in Mathematics in rural senior secondary schools in the Zambezi Region. Specifically, this study sought to investigate the following research questions:

d) How do teachers perceive the introduction of Computer-Assisted Learning (CAL) in Mathematics classrooms in the selected schools?
e) How do teachers envisage the Computer-Assisted Learning (CAL) lessons to be introduced/implemented in the case schools?
f) What characteristics of the Computer-Assisted Learning environment do teachers perceive as important for their positive decision making to use computers in a Mathematics class in the case schools?

## 1.4 Significance of the study

Policy makers and stakeholders in the education sector will have an insight into how the Mathematics teachers in the seven rural senior secondary schools perceive the introduction of Computer-Assisted Learning in the Mathematics classroom so that they make use of the findings to their advantage. The Ministry of education might offer workshops that could train and equip Mathematics teachers with better and effective teaching methods and knowledge

on how to apply Computer-Assisted Learning. Moreover, if Mathematics teachers familiarise themselves with the findings of this study, learners will benefit through better and effective approaches that Mathematics teachers might employ in their classrooms.

## 1.5 Limitations of the study

Distance was one of the constraints because these rural schools are far apart from each other. In addition, since the schools were busy with external examinations, the time to meet the Mathematics teachers (according to the expected schedule) was also another limitation.

## 1.6 Delimitations of the study

The study was limited to Mathematics teachers in the seven rural senior secondary schools in the Zambezi Education Region. Therefore, the results cannot be generalised across the Zambezi Region or Namibia, as it is a small sample.

## 1.7 Definition of terms and concepts

This section operationalises terms and concepts that are used in this study.

- **Computer**: an electronic device that stores and manipulates information (Jamil, 2012).
- **Computer-Assisted Learning**: (CAL) is a computer program aimed at facilitating the teaching and learning in a classroom environment (Jamil, 2012).
- **Learning**: the ability or process of gaining knowledge or skill by studying, practicing, being taught, or experiencing something (Wang & Woo, 2007).
- **Perceptions**: are general evaluations people make about themselves, other persons, objects or issues and involve lasting likes and dislikes, preferences, and aversions, toward specific aspects of the external world (Tezci, 2011).

- **Teacher**: is a person who instructs or facilitates learning to someone in order to understand a particular element in a setup of a school or institution (Bruner, 1960)
- **Teaching**: is the process of attending to people's needs, experiences and feelings and making specific interventions to help them learn particular aspects (Bruner, 1960).

## 1.8 Conclusion

This chapter contextualised this study by presenting its orientation. It highlighted the research gap that this study sought to fill. The chapter also outlined the questions of the study and justified the study by explaining why it was carried out. The limitations and delimitations of the study were presented in this chapter. This chapter ends with the definition of key terms and concepts that are used in the study. The next chapter examines literature related to the topic under investigation.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

Computer Assisted Learning (CAL) is a computer program aimed at facilitating the teaching and learning in a classroom environment (Jamil, 2012). The following sections form part of literature namely; Perceptions of the teachers towards CAL; Gender and ICT integration; ICT integration in learning; ICT integration in teaching; and Infrastructure, ICT resources and Support.

## 2.2 Perceptions of the teachers towards CAL

Perceptions are general evaluations people make about themselves, other persons, objects or issues and involve lasting likes and dislikes, preferences, and aversions, toward specific aspects of the external world (Tezci, 2011). Tezci (2011), further classified perceptions in three categories: cognitive, affective and behavioural. For example, a teacher might think that computers are helpful in education; this is referred as a cognitive component. Secondly, he/she might like or dislike computers; this is referred as an affective component and might invite his fellow colleagues to use computers in their classrooms, which is labelled as a behavioural component. Perceptions towards computers involve individuals' beliefs, values and judgements about them. In a study conducted by Jamil (2012), it is clear that CAL saves the teachers' time and improves learners' understanding on subject knowledge.

**A**ccording to Tezci (2011), perceptions of teachers towards the introduction of Computer-Assisted Learning or merely computers in general differ from one teacher to another. Those teachers who do not own computers tend to be more negative than those who own a personal computer. This means that those who do not own a personal computer find it difficult to

integrate technology in the classroom, unless they get help or support from others to integrate technology in their teaching. Tezci (2011), further states that the same applies to internet connectivity; the perceptions of teachers who have little access to the internet in their schools are more negative than teachers who have access to the internet in their schools. To rectify this situation, the schools with no internet access should make means to bring the internet to the teachers and the learners (Tezci, 2011).

## 2.3 Gender and CAL integration

The relationship between gender and CAL integration is also an important component, which is seen in the educational institutions (Tezci, 2011). On this point in discussion, male teachers' perceptions towards technology are more inclined to female teachers because the field of computers is considered a masculine profession (Tezci, 2011). Therefore, the study shows that female teachers need more technical and motivational support in their CAL implementation and integration efforts than the male teachers do. Tezci (2011) concluded that male teachers in general have better computer skills than female teachers, which means that it is imperative that gender factors should be taken into account in the administration of ICT integration and in particular CAL integration process in schools.

## 2.4 CAL integration in learning

Computer Assisted Learning (CAL) holds the potential to engage students in deep learning through exploration, rather than simply being used in drill and practice activities. CAL also has the capacity to strengthen students' risk-taking, confidence, persistence and engagement by offering private, instant and non-judgmental feedback. Man (1997) points out that student engagement occurs when students are procedurally engaged in their lessons enjoy, learning and view this learning as worthwhile. He further believes that Computer-Assisted Learning

(CAL) has the potential to engage students, promote deep and meaningful learning, and as a result today's children are reaching frontiers that generations before could never hope to glimpse. According to Wang and Woo (2007), effective CAL integration into the learning process has the potential to engage learners. For instance, using multimedia to present authentic and ill-structured problems in problem-based learning can motivate and challenge students and hence develop their problem-solving skills. CAL can support various types of interaction. These types of interaction make the learning process more interactive and learners more active and engaged (Wang & Woo, 2007).

## 2.5 CAL integration in teaching

Before teachers can successfully integrate CAL into their classrooms, they need to have a sound level of pedagogical content knowledge - PCK (Man, 1997). Man (1997) describes PCK as a special amalgam of content and pedagogy that the teacher has. Not only do teachers have to know the particular content well and know what teaching strategies support learning, they also need to understand which pedagogical practices are the best to utilise when teaching particular concepts within a particular context (Man, 1997).

Technological, pedagogical and content knowledge (TPACK) is a computer model which sees the integration of CAL into the teaching and learning process as logical, while contributing to the development of both content and good pedagogical practices (Man, 1997). TPACK provides a conceptual framework for teachers to reflect upon the knowledge needed to design learning experiences for thinking about teaching and learning employing ICT. To be confident to modify their pedagogical practices to integrate CAL seamlessly through a TPACK approach, teachers need to be critical users of CAL, deciding if, when, what and why

to use CAL in their classrooms. Teachers also need a deep understanding of the content that may surface when students are investigating using CAL (Man, 1997).

According to Ghavifekr, Razak, Ghani, Ran, Meixi and Tengyue (2014), the findings of their study illuminate that most of the teachers are normal users and many teachers more frequently use ICT in the teachers' room for their work rather than using it in their classroom for teaching and learning. Moreover, results show that teachers should always be ready and well-equipped in terms of ICT competencies and positive attitude to provide ICT-based learning opportunities for students to improve their learning quality (Ghavifekr et al., 2014).
On the other hand, Bhasin (2012), states that ICT integration is a comprehensive process of applying technology to the educational system to improve teaching and learning. Its success depends not only on the availability of technology, but also heavily on the pedagogical design. Though there is no one formula for determining the optimal level of ICT integration in the educational system, creative teachers at all levels of education have always found ways to incorporate innovative teaching aids and strategies in their classes. However, ICTs should be used in conjunction with well-planned classroom teaching (Bhasin, 2012).

### 2.6 Infrastructure, ICT resources and support

An adequate infrastructure and the availability of technical and pedagogical support are necessary conditions to integrate ICT into educational institutions (Brun & Hinostroza, 2014). Brun and Hinostroza (2014) state that, there are more available and accessible resources in most of the educational institutions and in the hands of the teachers but this does not guarantee them to use these important resources to their advantage. In contrast, these computers which are available at teachers' disposal are usually not connected to the internet, which makes them difficult to use as they become less useful in their context. Goktas,

Yildirim, S. and Yildirim, Z. (2009) state that providing access to ICT is not enough but there is a need for a larger budget for purchasing new hardware and software and for updating and upgrading them. Therefore, funding for new ICT resources should be increased in order to provide adequate ICT equipment and resources. Rather than limiting ICTs to certain centres, ICTs should be spread to the whole physical environment, particularly classrooms. This would create a more authentic environment and involve students in more practice. Moreover, laboratories can be kept open for the use of teachers and students not only during lesson hours but also after lessons by employing assistants, as technical support staff, which is a crucial component in ICT integration (Ibid).

## 2.7 Theoretical Framework

The study was based on the constructivism theory, Cognitive Absorption (CA) and a concept of Technology Acceptance Model (TAM). Bruner (1960) believes that learning is an active process in which individuals construct new ideas based on their current or past knowledge. Furthermore, Bruner states that a theory of instruction should address four aspects: firstly, predisposition towards learning; secondly, the way in which a body of knowledge is structured so that it can be most readily grasped; thirdly, the most effective sequences in which to present material; and lastly, the nature and pacing of rewards and punishments. In addition, Bruner's theory also involves the three stages of learning namely: Enactive-learning by doing, iconic-learning by means of images and pictures, and symbolic-learning by means of words or numbers (Bruner, 1960). Both the Technology Acceptance Model and the Cognitive Absorption model were used to explore the teachers' perceptions of the introduction of Computer-Assisted Learning (CAL) in Mathematics in rural senior secondary schools in the Zambezi region, Namibia.

### 2.7.1 Technology Acceptance Model

One of the well-known models related to technology acceptance and use, is the Technology Acceptance Model (TAM). This is a theoretical model in helping to explain and predict user behaviour of information technology (Park, 2009; Bertrand & Bouchard, 2008). TAM provides a basis with which one traces how external variables influence belief, attitude and intention to use. Two cognitive beliefs are posited by TAM; perceived usefulness and perceived ease of use. According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioural intentions, attitude, perceived usefulness of the system and perceived ease of the system. TAM also postulates that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Figure 1 below depicts the original TAM.

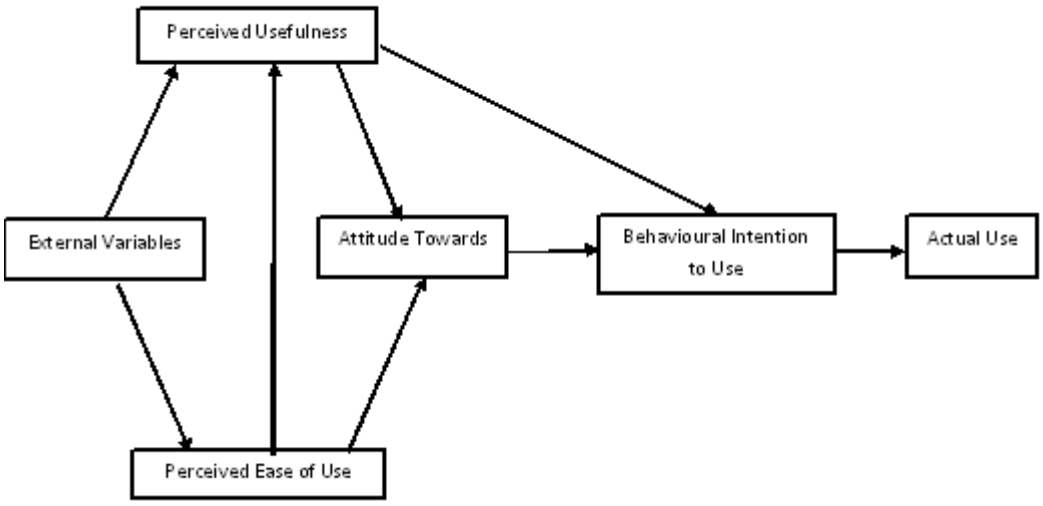


Figure 1: Original Technology Acceptance Model (TAM)

#### *2.7.1.1 TAM and E-Learning*

According to Park (2009), several studies have examined TAM as a model to explain how people adopt and use e-learning. She evaluated TAM on university students where he tested the relationships among perceived usefulness, perceived ease of use and intention to use,

using the structural equation modelling techniques of the Linear structural relations (LISREL) program. The conclusion showed that the model fits with the results and findings of the collected data and that the usefulness and ease of use turned out to be good determinants of the acceptance and use of a course website as an effective and efficient learning technology. Perceived usefulness can be defined as the extent to which a person believes using e-learning will boost his or her learning. Meanwhile, perceived ease of use is defined as the extent to which one believes using e-learning will be free of cognitive effort (Masrom, 2007).

According to Park (2009), TAM constructs had a direct and indirect effect on university students' behavioural intention to use e-learning. For that reason, there is potential for practical application in the development and management of e-learning in university. First, educators and managers should make an effort in boosting university students' e-learning self-efficacy. Both on- and off-line support should be provided to build up e-learning self-efficacy. Therefore, it is necessary for the university to put more emphasis on e-learning by offering a greater variety of e-learning courses and advertising the benefits of e-learning to attract students. Even though perceived usefulness and ease of use had no direct effect on university students' intention to use e-learning, these constructs were related to the attitudes toward e-learning. Overlooking these constructs could have detrimental effects on the user's acceptance of information technology. Thus, it is necessary that managers and developers of e-learning help students confirm or increase their perception positively through e-learning (Chadel & Sharma, 2013; Al-Adwan, Amer., Al-Adwan, Ahmad & Smedley, 2013).

#### *2.7.1.2 TAM in learning with Mobile Devices*

In recent years, individuals and institutions have fully accepted that Information Communication Technologies (ICT) can enable them to perform their functions in a much-improved way (Mugo, Njagi, Chemwei & Motanya, 2017). However, owing to the affordance and conveniences provided by mobile technologies, consumers are shifting their preferences from fixed technologies towards technologies that are mobile. This has resulted to ready acceptance and adoption of the mobile technologies across the various sectors of human endeavours, including education. Consequently, the use of mobile technologies for educational purposes is becoming common practice and expectation amongst learners is high. Learners (particularly those in rural areas) are demonstrating eagerness to use mobile technologies as tools that can extend beyond communication and entertainment. The argument is that the devices portable are perceived as convenient tools, affording learners the freedom to study when they want. Besides, mobile devices are likely to afford student ownership of the learning process, which can produce positive learning experiences (Mugo et al., 2017; Phan & Daim, 2011; Trakulmaykee, Numtip, Trakulmaykee, Yaowalak., & Hnuckek, 2015).

**Perceived usefulness**

Perceived usefulness of a mobile device is associated with its ability to provide a teacher with ease of access to online study groups and to the learner instant access to numerous academic websites, graphics, video simulations and academic films (Mugo et al., 2017). Mobile devices are useful to teachers and learners as they allow them to utilize them effectively. Mugo et al. (2017), observed that Mobile-Learning can maintain the appeal of learning and provide a motivating factor that can at times be lacking in traditional modes of education. Mobile devices, particularly those running on Android Operating System have useful apps which

learners and teachers can find useful in performing tasks specific to curricular engagements (Trakulmaykee et al., 2015)

**Perceived ease of use**

The second aspect of TAM is perceived ease of use (PEOU). The argument is that, mobile devices are easier to use especially their operating system, which manages its hardware and software. The user does not require formal training for them to operate the interface. Within thirty minutes or less of operation, a user can navigate through the graphical user interface with ease. Today's' mobile devices have a large internal memory and slots for a large capacity micro SD cards. This makes it convenient and easy for users to save and retrieve files downloaded from the internet or obtained from any other computing devices. Finally, many mobile devices are portable, have inbuilt net interface that allow internet connectivity, either through Wi-Fi, blue tooth, hotspot, GPRS/EDGE/3G or 4G facilities. This gives the user support, ease and freedom to carry and connect to the internet as well as share or receive academic data and files without the need of plugging extra hardware (Mugo et al., 2017; Lee, Hsieh & Hsu, 2011; Trakulmaykee et al., 2015).

**Attitude towards use**

The third aspect of TAM is attitude towards use (ATU). The attitude of a user towards usage of a technology tool is an important element in determining the acceptance of the technology. A mistake made by donor agencies is to take a technology to schools and expect teachers and learners to utilize these gadgets. Such users get excessive exposure and are subjected to anxiety towards it especially when the technology is not easy to use. In this regard, Mugo et al., (2017) note that user's walk away in frustration and negative attitudes are projected towards the technology. Therefore, a good mobile learning environment must be created

(preferably by training users). By so doing, users are able to change their perception towards the technology, making them embrace its utilization.

#### *2.7.1.3 TAM in Mathematics*

According to, Zogheib, B., Rabaa, Zogheib, S., and Elsaheli (2015), one technological acceptance Model tool that can be used in the Mathematics classrooms is *MyMathLab*. *MyMathLab* is an innovative series of text-specific online courses that are available for Pearson textbooks in Mathematics and Statistics for college, high school and middle school classes. It provides students with a study plan for each chapter which helps them in organising their ideas and the concepts they learned in class. It also provides teachers with a tool that minimizes cheating. It assigns problems that are different from one student to another. *MyMathLab* helps students to identify their difficulties and allows for more practice depending on the students' level. It also has a bank of questions that gives the instructor the freedom to choose a variety of questions to create homework, quizzes and tests (Zogheib et al., 2015).

Park (2009) has used TAM with seven constructs: self-efficacy, subjective norm, system accessibility, perceived usefulness and perceived ease of use, attitude, and intention to use (See Figure 1). In this study, all the above constructs except system accessibility were used. The results indicated satisfaction with *MyMathLab*, the subjective norm indicated that *MyMathLab* was important, to secure future jobs they required to take *MyMathLab* courses, the self-efficacy indicated confidence in finding information on *MyMathLab* webpage, the behavioural intention indicated the frequency use of *MyMathLab*, the attitude to *MyMathLab* was good, the perceived usefulness indicated *MyMathLab* would improve students' learning performance and the perceived ease of use indicated that *MyMathLab* system was easy to use.

The indicators in the proposed model are all reflective because they are considered as effects of the latent variables (Park, 2009).

### 2.7.2 Cognitive Absorption

Cognitive Absorption is the deep involvement of individuals with the technology. Saade and Bahli (2005), and Leong (2011) have explained that Cognitive Absorption (CA) involves three pillars, namely; state of flow (concentration and attitudes), trail of absorption (state of deep attention), and notion of cognitive engagement (intrinsic interest and curiosity). The trait of absorption defines an individual's state of deep attention; state of flow describes the state whereby people are so involved in an activity that nothing else matters while the concept of engagement refers to playfulness and intrinsic interest. Previous studies suggested positive attitudes towards usage behaviour from this type of holistic experience and cognitive absorption (Chandra et al., 2009). Those studies have explained the individual's behaviour towards new technology by taking the holistic experiences with technology as external variable. Motivated by the interest in understanding the influence of holistic experiences on user behaviour and adoption of virtual world for collaboration and learning, they posit that CA as a significant determinant of the salient beliefs of TAM (Chandra et al., 2009).

Other researchers provide some insights into the determinants of cognitive absorption (Chandra et al., 2009). The studies have shown that the significance of individual factors like personal innovativeness and perceived playfulness for determining cognitive absorption.

Zhang, Li and Sun (2006), identified temporal dissociation, focused immersion, heightened enjoyment, control and curiosity as five dimensions of cognitive absorption.

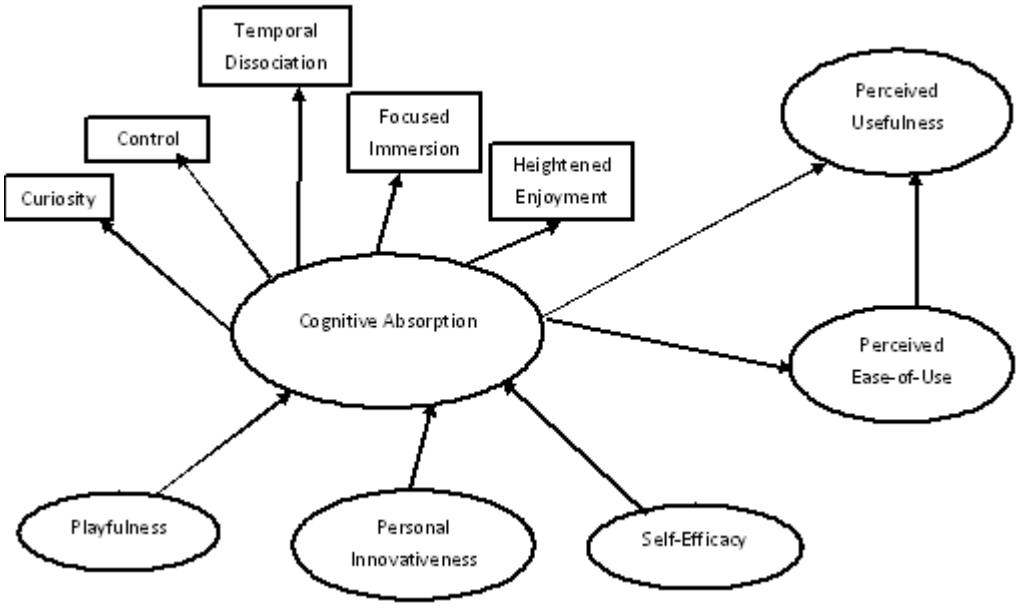


Figure 2: Cognitive Absorption

Figure 2 above shows the Cognitive Absorption Model and how the five dimensions of cognitive absorption are inter-connected to each other for a better understanding. The figure illustrates how curiosity, control, temporal dissociation, focused immersion and heightened enjoyment result in cognitive absorption of the technology and how playfulness, personal innovativeness and self-efficacy with the technology at hand result in cognitive absorption with perceived usefulness and perceived ease of use as important pillars that enable users to continue to explore more.

## 2.8 Conclusion

This chapter provided a review of the literature, key concepts related to the research questions of the study and the theoretical framework. It also provided a general overview of

Computer-Assisted Learning integration in the Mathematics classroom. Finally, the chapter provided a review of literature concerning the perceptions and problems of the Computer-Assisted Learning introduction or implementation. The next chapter discusses the methodology that guided this study.

# CHAPTER THREE: METHODOLOGY

## 3.1 Introduction

Research methodology is a way to "systematically solve the research problem using the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them'' (Kothari, 2004, p.18). This chapter is devoted to a detailed description of the research design, population, sample and sampling method, data collection strategies, validity and reliability of the research and data analysis methods used within the current study.

## 3.2 Research design

This was a qualitative research study. A qualitative research study is a study based on the phenomenological paradigm, which uses a variety of interpretive research methodologies (Best & Kahn, 2006). "Research design is a master plan specifying the methods and procedures for collection and analysing the needed information'' (Pandey, P., & Pandey, M. M., 2015, p.18). Research design is the framework that has been created to seek answers to research questions (Pandey et al., 2015). This study was informed by a phenomenological research design in order to describe the meaning of teachers' perceptions of the introduction of Computer-Assisted Learning (CAL). A phenomenological research design is a qualitative research method that is used to describe how human beings experience a certain phenomenon. It is defined as the direct investigation and description of phenomena as consciously experienced by people living those experiences (Best & Kahn, 2006) Participants were asked to describe their experiences, as they perceive them through interviews specifically individual interviews, group interviews and observations. To understand participants' experiences, the researcher's own beliefs and feelings were put aside and only listened to the participants throughout the whole process.

## 3.3 Population

A population is an entire group about which some information is required to be ascertained. Participants in the population must share at least a single attribute of interest. It is this attribute that makes participants eligible as population members (Asiamah, Mensah & Oteng-Abayie, 2017). The population of the study comprised of all Grade 11 & 12 NSSC Ordinary level Mathematics teachers in the Zambezi Education region. There are 10 senior secondary schools in the Zambezi region with a total number of about twenty (20) NSSC Ordinary level Mathematics teachers. Seven (7) of the ten (10) senior secondary school are located in the rural areas.

## 3.4 Sample and sampling method

All the rural senior secondary schools were purposively selected. The sample included seven (7) rural senior secondary schools namely: School A, B, C, D, E, F and G. All the NSSC ordinary level Mathematics teachers for grades 11 & 12 of these schools formed part of the sample. School A, B, C, D and G have two (2) teachers each while School E and F have one (1) teacher each. In total 12 NSSC ordinary Mathematics teachers formed part of the sample.

## 3.5 Research methods

The following research methods were used namely: Individual interviews and group interviews.

### 3.5.1 Individual interviews

Individual Interviews are a series of in-depth discussions between the participants and the researcher (Freitas, Oliveira, Jenkins & Popjoy, 1998). An individual interview resembles everyday conversations although they focus on the researcher's needs of data. They also

differ from everyday conversation because they are conducted in the most rigorous way in order to ensure reliability and validity. This means that the researcher and the user of findings can be as confident as possible that the findings reflect what the researcher set out to answer, rather than reflecting the bias of the researcher. The researcher ensured that the individual interviews were reproducible, systematic, credible and transparent. The researcher used semi-structured interviews. A semi-structured interview is a meeting in which the interviewer does not strictly follow a formalised list of questions (Freitas et al., 1998). Therefore, these were conducted on the basis of a loose structure made up of open-ended questions defining the teachers' perceptions of the introduction of Computer-Assisted Learning. Another type of interview that was used is in-depth interviews which explored in detail the participants own perceptions and accounts. This method started with open questions and then followed by detailed questions. The individual interviews were conducted with all twelve (12) participants of the seven rural senior secondary schools, namely: School A, B, C, D, E, F and G.

### 3.5.2 Group interviews

''Group interviews are a type of in-depth dialogue accomplished in a group, whose meetings present characteristics defined with respect to the proposal, size, composition, and interview procedures'' (Freitas et al., 1998, p. 2). The advantage of group interviews is that the researcher has access to how people talk to each other in groups. Therefore two types of group interviews were used namely the focus group and the natural group. On the focus group, participants were purposively selected to meet the sampling criteria. Two participants formed part of the focus groups in order to seek a broad range of ideas in a form of open-ended discussions. Each group discussion was audio-taped for easy analysis. On the other hand, the researcher used natural groups, which involves groups that exist independently without the influence of the researcher, where formal and informal format of interview guide

were followed. Group interviews were conducted with the participants of the five rural senior secondary schools, namely; School A, B, C, D and G. School E and F had one participant each and could not form groups.

## 3.6 Validity and Reliability of the research instruments

### 3.6.1 Validity

As suggested by Best and Kahn (2006, p. 289), "validity of research is that quality of a data-gathering instrument or procedure that enables it to measure what it is supposed to measure". Such data should be adequate and valid, and so should be the instruments used to collect it. Therefore, in order to check the validity of instruments used, the interview questions were submitted to the supervisors for comments and corrections, which were done. This was done to make sure that the instruments had covered the topics being investigated.

### 3.6.2 Reliability

According to Best and Kahn (2006, p. 289), "reliability refers to the degree of consistency that the instrument or procedure demonstrates". Whatever it is measuring, it does it consistently. The following criteria were incorporated into the interview questions in an attempt to enhance reliability: Interview questions were formatted as simple as possible to reduce ambiguities; ample time was allocated to answer interview questions and the interview questions were administered to all participants in a consistent manner.

## 3.7 Data collection procedure

The researcher obtained a list of NSSC ordinary level Mathematics teachers from the seven purposively selected schools namely school A, B, C, D, E, F & G. The researcher used semi-structured interviews as the primary research approach. The researcher began with the

interviewing process in the second school term of 2017 specifically in the afternoons to avoid class disturbances in the morning for two consecutive weeks. The interviews began with structured questions, often, with only an occasional question from the researcher for clarification. The participants were able to talk about a wide variety of topics throughout an extended interview. Up to 12 interviews and follow-up interviews were conducted during that period. All interviews were recorded. The interviews were informal and open-ended, and carried out in a conversational style. The researcher wrote field notes in conjunction with the interviews, follow-up interviews and observations. Memoranda were also written while listening to recorded interviews, transcribing and reflecting upon a particular interview. On-going data analysis took place throughout the study. All of the voice recorded interviews, memoranda and field notes were entered into computer files. A coding process was used to designate major categories and subcategories. Hard copies of all computer files of data also were coded using coloured pens to mark the margins with the appropriate numbers and letters if needed. Connections between categories and themes were used to further the researcher's understanding of the teachers' perceptions of the introduction of Computer-Assisted Learning in Mathematics in rural school in the Zambezi education region.

### 3.8 Data analysis

The researcher used a thematic analysis of data. Thematic analysis is a type of qualitative analysis used to analyse classifications and present themes that relate to the data in detail and deals with diverse subjects via interpretations (Alhojailan, 2012). Therefore, this type of analysis involved the following stages. Firstly, reading and annotating transcripts, at this stage the researcher made preliminary observations for the first few transcripts in order to get an understanding of the data. Secondly, the researcher identified themes, at the stage the researcher started to make summarised notes in the margins of each transcript to try to reflect

what the text was. The researcher looked at the data and made a list of themes. Thirdly, the initial themes were gathered together to begin with the development of a coding scheme. This is a list of all the themes, and the codes that were applied to the data. Each broad code had a number of sub-codes. The fourth stage is coding the data, at this stage the researcher started applying codes to the whole set of data.

### 3.9 Ethical Consideration

In line with the University of Namibia requirements for conducting research, the researcher obtained the Clearance Certificate from UNAM Research Ethics Committee and wrote a letter to the Director of Education to request permission to conduct research at selected rural senior secondary schools in the Zambezi Region (see Appendix A). After approval to conduct research was obtained from the Ministry of Education, the researcher sent a copy of an approval letter to the Inspectors of Education for Bukalo, Cincimani, Ngoma and Sibbinda circuit and school principals of the seven rural senior secondary schools (see Appendix B). Consent forms were also signed by all the participants.

Participation in this research was voluntary. Participants were assured that the information received from them would be kept confidential and would only be used for the purpose of the study. Permission to tape record the interviews was also sought from the participants and none of them had a problem with this. Coded names were assigned to all participants instead of real names to protect their identity and to ensure their right to anonymity. In addition, the researcher ensured the participants that their real names would not be associated with the findings of the study.

## 3.10 Conclusion

This chapter provided an overview of the research methodology, study population and sampling used in the study. Other issues discussed include methods and instruments used for data collection. Ethical issues that were adhered to by the researcher were also discussed.

# CHAPTER FOUR: PRESENTATION OF RESULTS

## 4.1 Introduction

A total of twelve Grade 11 and 12 NSSC Ordinary level Mathematics teachers were interviewed from seven rural senior secondary schools in the Zambezi region. The Schools are as follows: SA, SB, SC, SD, SE, SF and SG, and the teachers are T1SA, T2SA, T3SB, T4SB, T5SC, T6SC, T7SD, T8SD, T9SE, T10SF, T11SG and T12SG. The following is the presentation of the Mathematics teachers' responses obtained from the individual and group interviews. The teachers answered six questions; the purpose was to find out how rural senior secondary school Mathematics teachers perceive the introduction of Computer-Assisted Learning in the Mathematics classroom.

## 4.2 Mathematics teachers' perception of the introduction of Computer-Assisted Learning in the classroom

T1SA looked at the introduction of Computer-Assisted Learning as of great importance. T1SA thinks the introduction of Computer-Assisted Learning will motivate learners to be keen on learning Mathematics as it is considered as a problem subject. The teacher perceived the introduction of Computer-Assisted Learning in the Mathematics classroom in a very positive way, saying that learners are weary of the traditional way of teaching which results in turning them down. T2SA sees the introduction of Computer Assisted Learning as somewhat important because it will give support to both Mathematics teachers and the learners. The teachers said when Computer-Assisted Learning is introduced in the Mathematics classroom, Mathematics will be very easy for learners and they will start to love the subject, as they will be interested in using computers at the same time without realising that they are learning the subject.

According to T3SB perspective, the teacher sees the introduction of Computer-Assisted Learning as something that can assist the situation on the ground. T3SB said the workload in the traditional teaching method is too much.

> *You write notes on the chalkboard, then clean the chalkboard for more notices or work that you want to write on the chalkboard, this takes more time to do in just 40 minutes that is allocated for that specific Mathematics lesson [T3SB]*.

T3SB continued to say that bringing in the use of computers in the Mathematics classroom is something that will minimise teachers' workload. One aspect that T3SB emphasised was the assessment part of Mathematics, the teacher said there are cases in which the Mathematics teacher may lack good knowledge when it comes to assessing learners. The teacher might assess learners on lower level outcomes during internal examination or preparations and when the final examination comes, the learners fail. Therefore, this teacher believes that the introduction of Computer-Assisted Learning will bring standardised class tasks, topic tests and sample examination papers that will prepare learners for external examinations.

In addition, T5SC had the same sentiments as far as Mathematics assessment is concerned. But he felt that, as long as the Computer-Assisted Learning programme is in line with the Namibia curriculum and specifically that of the grades 11 and 12, there is no doubt that it will be of good use, to help the assessment barriers between internal examiners and external examiners. The teachers look at Computer-Assisted Learning as a call for transforming the rural senior secondary schools into a digital world, which are in line with all Mathematics teachers globally. T4SB regards the introduction of Computer-Assisted Learning as good because it assists the teachers to make Mathematics understandable to learners and these learners get exactly what is expected of them. *''It's time we as teachers make sense out of Mathematics. Mathematics is seen as a subject that cannot be understood'' says T4SB.* The

teachers say that the audio-visual of Computer-Assisted Learning will enable a lot of learners to follow and understand the subject content better, as most learners may learn by visualising and at the same time by listening. In the same vein, since Computer-Assisted Learning is a programme that is time bound, it will as well teach learners the value of time unlike in the traditional teaching classroom where the teacher controls time.

T6SC said the introduction of Computer-Assisted Learning is a pleasant thing to have at the teachers' disposal, as it will unpin the challenges faced by learners in the Mathematics classroom. The teacher said that, there are many cases where Mathematics teachers find it difficult to explain some topics in Mathematics due to lack of resources at their disposal, so the introduction of Computer-Assisted Learning is the best medium to fill that vacuum. T6SC echoed the same sentiments as T3SB that since Computer-Assisted Learning works with time, it will train learners to work within the time-bounds when doing topic tasks and topic tests that will help them to do better in their external assessments in terms of finishing on time. T6SC felt that there have been some challenges in the external assessment where learners tend not to finish within the allocated time in the final examination, which resulted in a high failure rate of learners at the end of the day. The introduction of Computer-Assisted Learning will help learners work with time and thus help them do well in their final external examination. Both T6SC and T12SG felt that the introduction of Computer-Assisted Learning is the best learning tool as learners will have an advantage of repeating the lesson if they do not understand, unlike when the teacher instructs in the traditional way if he/she repeats the same lesson he/she might leave out some important components (T6SC and T12SG).

T7SD also emphasised that the introduction of Computer-Assisted Learning will help slow learners understand Mathematics better, as they have the opportunity to repeat the lesson over and over and learn at their own pace at their own time, in case the school can find technical personnel to be on standby to help learners after school hours. The teacher felt that the traditional methods of teaching limits learners to participate fully in the Mathematics lesson as the teacher writes and erases what has been written on the chalkboard and time is not enough to achieve what is expected of them in just 40 minutes. In addition, T7SD felt that there are cases where the teacher is too fast for the learners to follow what he/she is trying to explain. With the introduction of Computer-Assisted Learning, the teacher said that this will be an issue of the past, as the programme will cater for all learners of different abilities in the Mathematics classroom from talented learners to slow learners. For the fast learners, the teacher felt that they have the opportunity to continue learning other topics of interest, as the programme will allow that not just to restrict them to what they already know compared to the traditional method of teaching. From the environmental perspective, T7SD thinks that the introduction of Computer-Assisted Learning is a tool that will help to avoid cutting down of trees and having lots of paper work on the Mathematics teachers' tables thus contributing, in a small way, to the reduction of the use of many papers thus curbing global warming indirectly. Therefore, the introduction of Computer-Assisted Learning was perceived by T7SD in a positive way.

In a very positive way, T8SD thinks the introduction of Computer-Assisted Learning is a step in the right direction as the Namibian government and the Ministry of Education have good policies on ICT integration and implementation in Namibian schools. The teacher feels that this is the right time to execute the strategies in the ICT policies, to help Namibia transform itself to a technology-based country. On the other hand, T9SE thinks the introduction of

Computer-Assisted Learning is of high importance, as this will help capture learners' attention and boost their interest in learning Mathematics unlike doing it the traditional way. The teacher continued to say, *''learners need something new, so that they are curios and will want to know what is happening''* and that forces them to learn more to understand exactly what is put in front of them. T9SE says the Computer-Assisted Learning has an important component of reinforcement of learning, which is key in understanding Mathematics. Learners are taught with little help from the teacher but that the reinforcement part is what plays an important role in making learners in the Mathematics classroom master the content and raise interest in the subject.

T10SF thinks Computer-Assisted Learning especially in the rural schools where learners are not fully exposed to the aspect of the computer environment will be a good element. Learners will be motivated considering the device being introduced to them; as a result, this will enhance performance in Mathematics. Since learners consider Mathematics as a difficult subject, this will unlock that perception to a positive way of thinking towards the subject. T11SG had the same thinking as that of T10SF saying that Computer-Assisted Learning is a good idea towards pushing our learners to a climax point where they feel motivated and in control of their own learning. The teacher added that when learners are in control of their learning, they have the potential to explore more on their own even without the presence of the teacher in class and at the end of the day they will start to feel they are responsible and accountable for their performance. Teachers therefore, feel Computer-Assisted Learning is a step in the right direction.

### 4.3 How the introduction of Computer-Assisted Learning fits in the NSSCO Mathematics curriculum

T1SA feels the introduction of Computer-Assisted Learning is a tool that will complement other programmes initiated in the teaching of Mathematics and in the understanding of it; therefore it will fit perfectly well in the Namibia Senior Secondary Certificate Ordinary level curriculum. The other programme that is being used already in the Mathematics classroom, which are computer based include *Calculator skills*, therefore introducing Computer-Assisted Learning will make the learning even more interesting for learners, as learners have the love for computers already. T2SA also used the *Calculator skills* as software installed on computers and the teacher said the experience from that programme was a motivational aspect attached to Mathematics as a subject. In addition to this, the teacher said there are cases where he simply used a computer and projector in the Mathematics lesson but the results and attention were overwhelming, because learners showed more interest in the subject.

T4SB added the same expressions as T1SA and T2SB; she felt that teachers are already applying Computer-Assisted Learning in one way or another, as there are already certain programmes that are being used in the Mathematics classroom. T10SF also emphasised on the *Casio programme* that was presented to them at a workshop by a company representative from Casio, saying that if the *Casio calculator* can do such wonders, how about a Computer-Assisted Learning programme, saying that Computer-Assisted Learning fits well in the Mathematics curriculum. What is needed to be done is to introduce a Computer-Assisted Learning programme that is in line with the Namibia Senior Secondary Certificate ordinary level (NSSCO) curriculum. Therefore, these teachers believe that the foundation for the introduction of Computer-Assisted Learning is already there.

According to T3SB and T5SC, the teachers said that there are certain topics in the grades 11 and 12 Mathematics curriculum that already need the intervention of Computer-Assisted Learning for learners to understand the subject matter better. One of the topics that the teachers emphasised was transformation which involves translation, reflection, rotation and enlargement. When Computer-Assisted Learning is introduced on these topics learners will understand it more clearer than when doing it the traditional way, for example drawing a grid on the chalkboard and so on. What these teachers said is that there are topics in the Mathematics curriculum for grades 11 and 12 that cannot be understood well enough without Computer-Assisted Learning, therefore its introduction is a green light to the motivation and performance of the current problems facing learners in the Mathematics subject. T11SG added that CAL fits well in the grades 11 and 12 curriculum but for it to be fully implemented; it should start with only certain problem topics and then be rolled out to the whole Mathematics curriculum at a later stage. Therefore, the teachers said the introduction of CAL is welcomed with both hands and is a step in the right direction.

T6SC is of the opinion that the introduction of CAL is fitting in the Mathematics curriculum since it has a logical order that enables learners to learn from basics to a high level, and by so doing learners start to learn pre-requisites. The teacher said in one of the workshops he learned how to do presentations on *PowerPoint*, as he went back to school and tried it, learners were so much involved and that was an indication, at least to him, that the introduction of CAL will fit so well in the Mathematics curriculum for grades 11 and 12. On the other hand, T7SD felt that since there are challenges as far as performance in Mathematics is concerned, especially in rural senior secondary schools, the introduction of CAL will bring equilibrium between the urban and the rural senior secondary schools.

T8SF and T9SE felt that the introduction of CAL fits perfectly well in the Namibia Senior Secondary Certificate Ordinary Level Curriculum as this programme of study has a good foundation for computer programmes already. However, they feel that as CAL is introduced in the Mathematics classroom it should not be the only approach to the teaching and learning of Mathematics, but they should complement each other with the traditional approach for learners to have a good understanding of the subject content.

> *We as mathematics teachers have an advantage already since the learners have the love and interest for computers already it would be easy to take advantage of that aspect to introduce computer-assisted learning in the Mathematics classroom without trouble at all [T8SF]*.

According to T12SG, the introduction of CAL in the Namibian rural school will be a step ahead and will fit perfectly well. On the other hand, she continued to say that CAL is a great tool but should not be used all alone, but she sees CAL programme working well and yielding positive results when used as an aid to the traditional teaching method.

> *I used a computer-assisted learning programme in South Africa where I was a teacher before, what I saw is that Computer-Assisted Learning programmes are designed in a way that is easy to use and easy to integrate in the Mathematics curriculum [T12SG]*.

### 4.4 How Mathematics teachers want the Computer-Assisted Learning lessons to be introduced or implemented

T1SA and T2SA felt that in order to introduce CAL in the Mathematics classroom; firstly, learners should be taught basic computer skills for them to be able to use computers, before CAL programmes are introduced at the school. They continued to say that not only should the learners be taught how computers are used but also the teachers who are supposed to be

behind the introduction or implementation should be trained. Teachers should be trained through workshops on the CAL programme so that it becomes easier for them to execute what is expected of them. It cannot be an effective idea when both learners and teachers do not know what to do when the CAL programme is in their hands.

T3SB felt that for the success of the introduction and implementation of CAL in the grades 11 and 12 Mathematics classroom, one has to think of the lower grades. He said that it is not wise to target grades 11 and 12 alone, but to start the introduction of CAL from Grade 8 so that these learners move with the programme up to Grade 12, by so doing, by the time they are in grades 11 and 12 they fully understand the vicissitudes of the CAL programme. This was echoed by T4SB, to introduce CAL at lower levels is a great idea but she felt that the introduction should start from upper primary so that the learners start the programme from an early stage for a better understanding. In addition to this, T4SB said when introducing CAL plain English should be used for learners to easily follow instructions. She said that Mathematics concepts should be used in the presentations of these lessons but the English language to be used should not turn off learners and discourage them to like the programme.

> *Not all learners are exposed to computers so it would perhaps mean that computer studies or a certain computer literacy programme be introduced at an early stage, may be as a comparison subject. I think introducing computer-assisted learning in grade 11 and 12 will be too late, so to be in line with my initial point of introducing Computer Literacy programme, the Computer-Assisted Learning programme should be introduced at primary level and continue to move up the ladder up to grade 12 [T10SF].*

However, for T5SC he said that since the senior secondary school starts from grade 8 to 12 all learners should be given equal opportunities. He wants the Computer-Assisted Learning programme to be installed in a computer lab, so that equal opportunities are afforded to all

grades. Learners who want to use the facility should book through their Mathematics teachers. The same understanding was echoed by T8SD saying that since his school and most of other senior secondary schools have adopted the introduction of Computer Studies as a subject, it means these learners are ready to start with any computer learning programme without challenges. He felt that CAL can be introduced or implemented at any level without fear and specifically in grades 11 and 12, as teachers and learners are ready. But, as for T9SE she said Computer studies and ICT is being taught in schools but this does not guarantee the introduction of CAL to start at any phase, but should be introduced from upper primary for a good understanding of the CAL system.

T6SC and T7SD were also in support of T4SB to introduce CAL at lower levels specifically upper primary. They said that CAL should be a supplement to the traditional teaching method already in place in school, so that after the presentation of the class, learners can be taken to the computer lab for clarity or emphasis using the CAL programme. These teachers said lower grades should be taken into consideration because Mathematics is like building a house, where you cannot put a roof without a foundation. They referred to the lower levels as the foundation for Mathematics for a good understanding of the subject content, so that by the time they get to grade 11 and 12 they are already exposed to the system.

> *First and foremost before you even think of introducing Computer-Assisted Learning you must have people that are computer literate that will be able to use computers in teaching Mathematics. It will not make any sense to introduce Computer –Assisted Learning and you do not have very competent people who can use computers, unless you have the people first. It should be made as compulsory that every Mathematics teacher must have a refresher course or even attend a workshop to update their skills. Depending on the availability of computers at the school, CAL has to start right from grade 8 so that both learners and teachers are conformable, the moment they go to grade*

*11 everybody knows how to use the programme, everyone is aware of what to do and what not to do. We should identify children who can use these computers, right from grade 8 so that they have the practice [T11SG].*

However, for T12SD she had a different view and understanding, she opined that the introduction of CAL should only be introduced in grades 11 and 12, as this is when learners have serious problems in Mathematics. She said that it is in grades 11 and 12 where topics start to challenge learners and the mastering of the content is always compromised. Although she added on the sentiments of others saying that CAL should be seen as a system to aid the traditional teaching method in the Mathematics classroom.

## 4.5 Mathematics teachers' perception on the type of environment needed for the introduction or implementation of Computer-Assisted Learning in the Mathematics classroom

The type of environment which most of the rural senior secondary school Mathematics teachers are envisaging is an environment with equipped computer laboratories. This included responses from T1SA, T2SA, T4SB, T7SD, T8SD T10SF and T12SG. According to these teachers, they feel it would be of importance to have a computer lab that is not just called a computer lab because it is a room inscribed computer room, but they expect a computer lab with working computers where each learner will have access to the computer. They said that when that environment is created then CAL can be introduced and implemented and it will be guaranteed that the programme will be a success. T2SA added that in some cases when government or the Ministry of Education cannot afford to supply computers for learners in the Mathematics class, then learners should be able to share but with a minimum number, as big numbers on one computer will compromise the effective learning in the Mathematics classroom.

However, as for T3SB he felt that every environment is of importance to introduce CAL. He says that as long as the school has a reliable supply power with a set of computers, either in a set-up of class or storeroom learning can take place there, and it will be a chance to introduce CAL. He believes that if teachers continue to wait for the best environment ever, it will always delay good programmes, which are supposed to benefit the Namibian child. But he as well shared the same sentiments of other teachers, saying for learners to have one to one intervention then learning will give a learner the full control of his/her learning and become accountable for his/her learning.

In addition to the set-up of the computer lab T4SB and T7SD shared the sentiment that CAL as a programme should not only be targeted to fit in the computer labs but also to be installed on personal laptops or tables for learners and their parents, as this will create an environment for learning even outside the premises of the school. They said that, parents should take responsibility for their children's education so that good results can come from CAL intervention. T5SC and T11SG on the other hand, felt that the introduction of CAL cannot be a success if it is an online system without the internet, which might be local area network connection or wireless (WI-FI). As people are moving away from the traditional way of doing things, the internet helps both teachers and learners to learn more and for teachers to prepare effective lessons even if the CAL programme is offline. The teachers felt that, Mathematics teachers should always be one-step ahead of their learners. Looking at the geographical locations of these rural senior secondary schools it is a bit harder to access the libraries every day, so the internet becomes a virtual library. The teacher also feels that the best environment for intervention when it comes to CAL is a one to one interaction with computers, but since the country is going through a tough economic crisis and adequate supply of computers might not be there.

As for T6SC, he said that the best environment for the introduction of CAL does not only depend on the existence of computer labs and internet connectivity but also on the technical personnel support that the school has, for learners to have access to those labs even after hours and weekends. T9SE argued that the best environment for the introduction of CAL according to her experience (based on the traditional teaching method), is the group approach, where learners are introduced to CAL in a set of groups of slow learners who will have an opportunity to learn from others and this will enable them to understand the subject content better. She continued to say that when these slow learners are on their own, their learning is minimised as they get trapped at almost every point, although the system might be designed to help them, but much effort is required from a group member, as long as the groups are not too big to handle.

> *I think the lab approach works much better because as teachers we do not actually decide how many learners we should have in a class that is something that is determined by the admission of learners, so it just happens that this is the number of learners I have in class. For learners to be covered they should be a computer for everybody and this needs enough computers, which is a challenge in our current state. One on one intervention with the computer will be fine only for learners who are good, as it will help the learners master quickly. However, I think groups for me will do but not very big groups at least maximum 3 and minimum 2, because in groups learners will be able to learn from each other with the guidance of the teacher [T10SF].*

Furthermore, T12SG felt that the computer lab should be in order, meaning it should be equipped as it is supposed to have internet connectivity, but learners should be taught the traditional teaching way and only to be taken to the computer lab for specific problems in specific topics. However, to make it easier and for the learners to love CAL, there should be room to install this programme on their own mobile phones for them to have access all the

time. It is a well-known fact that contemporary learners spend much of their time on cell phones, by so doing they will also have time to access the programme during their interventions with their own cellular phones.

### 4.6 The roles of a teacher during Computer-Assisted Learning lesson

Almost all the Mathematics teachers in the rural senior secondary schools of Zambezi region see teachers in the introduction of CAL as both instructors and at the same time facilitators. T1SA and T2SB added that when learners do not understand certain aspects in a CAL lesson it is the duty of the teacher to pair or align them with others, as they should move in the same direction. These teachers feel that, it is the role of the teachers to motivate the learners, so that they work extra harder for them to achieve the basic competencies of the lesson. T3SB looks at the role of the teacher during the CAL lesson as someone that gives guidance to learners, when individual learners need clarity on certain issues then the teacher should reach out to each and every individual learner.

> *The teacher will be both an instructor and at the same time as a facilitator. Mostly when you are dealing with learner centred teaching which in this case Computer-Assisted Learning. Learners do most of the work, you actually become like a coordinator, checking the work that is going on, whether the children are doing it right and instructions come when you are actually explaining hoping the children understand, that is why the teacher is both the instructor and the facilitator [T11SG].*

T4SB, T5SC and T6SC on the other hand said that the role of the teacher during CAL is to explain to the learners how to access the information, introducing them to the programme step by step so that they can do it on their own when the teacher is not there. The teacher has to walk around to ensure that learners are doing what they are required to do and helping them when they are stuck with certain content. They continued to say that teachers should

supplement or give more guidance to learners in solving Mathematics problems, may be the system only introduces one method; the teacher should bring other methods to solve the same problem, as one method might favour one learner and another method to favour the others.

> *The role of the teacher is to give guidelines, to give instructions, to give corrections, or to give assistance because some learners have never touched a computer in their lives it will be their very first time if that opportunity was to come for them. As a teacher, you need to tell them where to start, where to go, how to handle the system and where to put a number if required. A teacher is seen as a facilitator because our learners nowadays are interested in computers so they tend to learn on their own and the teacher becomes the facilitator [T7SD]*.

T8SD and T9SE also see the Mathematics teacher in CAL lesson as an instructor and facilitator as others, but they feel that, the teacher's specific and important role as well is to explain the lesson from a Mathematics point of view as some of the concepts may be difficult for learners to understand very well. According to T10SF and T12SG, the role of the teacher during a CAL lesson remains the same as a facilitator as the system or the programme in place requires the teachers to be facilitators and for learners to be champions of their own learning. Therefore, facilitators guide the learning not that the introduction of CAL gets rid of the teachers as others may think, the teacher said:

> *The role of the teacher is to guide, I don't think that this introduction of cCmputer-Assisted Learning should get rid of teachers I am thinking we should work together that's why I was saying I would want CAL for certain topics. Like when you go to the computer lab as the lesson is going on it will be good to pause, and add more and clarify more. The teacher must be there to check if they are doing the right thing and give them room to learn on their own as well [T12SG]*.

## 4.7 Problems that could be encountered in introducing or implementing Computer-Assisted Learning in the Mathematics classroom

Most problems expressed by the rural senior secondary school Mathematics teachers that could be encountered in introducing or implementing Computer-Assisted Learning involve the following: Lack of computers and computer labs; Lack of space to convert into a computer lab; Lack of internet connectivity; Low levels of computer literacy among learners and teachers; Lack of technical support; Power failure; Limited time; ICT Security and Funding. These problems will be discussed in the sections that follow.

### 4.7.1 Lack of computers and computer labs

Almost every rural senior secondary school Mathematics teacher said they had no computers. Those that had gadgets their computers were not in a functional state and just discarded in their storeroom. Moreover, for some schools that had computer sets working, the computers were too few in relation to the computer learner ratio. T8SD said that the ministry should do something, as schools especially in the rural areas are the most affected as far as computer distribution is concerned. He also said that for the schools that have a very small number of these computer sets, those computers are "white elephants", as they are not put to use. According to T5SC, he feels that with the current economic situation facing the Namibian government, it will not be easy to make available these computers and equip the computer laboratories. As of the current financial year the Ministry of Education's budget was cut, which shows a negative impact on the introduction and implementation of CAL in the Mathematics classroom.

### 4.7.2 Lack of space to convert into a computer lab

It was almost every Mathematics teacher's sentiment that space has become a challenge at these rural senior secondary schools. Few schools have a few of these computer sets or in some schools these computers are either working or not working, they do not have space to convert into a computer laboratory, so they end up dumping these computers in their storerooms. T9SE was of the opinion that if they had even an open class that is not utilised as a class; they were going to convert it into a computer lab, where learners could be coming for CAL, as she does not see any other option. Therefore, they said there is no way the introduction of CAL to be a success when these computers are locked in the storeroom.

### 4.7.3 Lack of internet connectivity

Mathematics teachers from the rural senior secondary schools feel that not much effort is put to connect them. A few of them are connected but the Ministry of Education takes months to pay for their internet services and as such these schools stay without internet connectivity almost all the time. T6SC is one of the teachers who believe that rural schools should be connected like those in urban areas, but he does not see this happening. However, there are certain rural senior secondary schools that are outside the connection coverage and there is no hope to connect them even in future said T11SG as this is the answer they always get from Telecom every time they enquire through the regional office.

### 4.7.4 Computer literacy among learners and teachers

The Mathematics teachers at these rural senior secondary schools see the poor level of computer literacy skills as one of the obstacles that may hinder the effective introduction or implementation of CAL. They said that the kind of learners at their disposal are not all literate in using computers as some learners' backgrounds show that they never used a

computer in their entire life. Although the Ministry of Education has introduced Computer Studies and ICT in schools this cannot be the saviour because less training is taking place and in some schools, no training takes place at all due to lack of space and few computer sets. On the other hand, T2SA, T4SB and T11SG, said that they see teachers to be in the same shoes as learners, as most teachers are not well trained in using computers, which is also seen as an obstacle or a problem hindering the effective introduction and implementation of CAL.

### 4.7.5 Lack of technical support

T5SC expressed disappointment as far as technical support is concerned. The teachers said these rural senior secondary schools rely more on the regional support for help, which is seen as not yielding any fruits as the personnel from the regional office take time and in some cases, they never respond to their grievances. T5SC added that they do not have the technical know-how of whether a computer has been broken or infected by a virus. For the effective and successful introduction or implementation of CAL in the rural senior secondary schools the Ministry of Education should hire technical personnel at the cluster level, if not too costly at the school level.

### 4.7.6 Power Failure

T3SB mentioned that power failure in the Zambezi region as a whole is seen as a common denominator, specifically at rural senior secondary schools. He also said that there are cases in which these rural senior secondary schools stay for days without power, due to power failures from the main power station at Katima Mulilo for the reason known by the electricity distribution company, Northern Electricity Distributor (NORED). *This has been a tendency for almost a decade or even beyond. ‘‘We normally have power failure now and then*

*unexpectedly, and we do not have control over this at all"*, said T3SB. This means that the effective introduction or implementation of CAL in these rural schools will be a challenge.

### 4.7.7 Limited Time

T1SA felt that time could be one of the possible challenges or problems that could be encountered with the introduction or implementation of computer-assisted learning in the Mathematics classroom. He felt that the curriculum for NSSCO Mathematics is too big, as it starts from grade 11 to 12, so when CAL is introduced or implemented more time will be needed to train teachers and learners on how to use the system and this will result in less work to be covered in their syllabus. He sees that Mathematics teachers will find it difficult to complete the syllabus. Conversely, T6SC feels that the introduction or implementation of CAL will invite more learners as they will be curious to use the system, so time will not be adequate to train everyone as all grades 11 and grade 12 learners are required to do Mathematics.

### 4.7.8 ICT Security

T7SD said that the CAL programme will not be safe. In his context, he feels there is a need to have an ICT specialist, specialised in programming and security so that at the end of the day personal information of the school or that of the Ministry of Education is not accessed by people on the internet which will end up in the hands of hackers and other people with bad intentions.

### 4.7.9 Funding

For T12SG, she looked at this introduction as a good idea but that the idea has come at the wrong time. She sees Namibia in an economic crisis and for effective introduction of CAL a

lot is needed, from procurement of computer hardware and software, equipping computer labs in terms of internet connectivity and training of learners and teachers. The question she asked was where will the money come from? Therefore, in a nutshell she sees funding as an obstacle or problem to be encountered in the introduction or implementation of CAL in the Mathematics classroom.

> *Problems might be orientation of the learners to the use of computers just in general; we are looking at the ability of the learners to be able to use computers. The second one can or could be the scarcity or unavailability of computers, the school currently does not have any computer labs, due to shortage of building for such facilities. On the other hand, the teachers as people on the ground to fully implement this programme, not every teacher out there may be well oriented to be able to use this programme as much as it is required, so it will also challenging for the teachers to be able to fully implement the programme [T10SF].*

## 4.8 Conclusion

This chapter provided the data on teachers' perceptions of the introduction of CAL in Mathematics in rural senior secondary school in the Zambezi region, Namibia. The data was collected through the interviews. The next chapter discusses the findings of the study.

# CHAPTER FIVE: DISCUSSION OF FINDINGS

## 5.1 Introduction

The main reason for conducting this study was to find out teachers' perceptions of the introduction of CAL in Mathematics in rural senior secondary schools in the Zambezi region, Namibia. This chapter provides and discusses the main findings of this study. The discussion is presented according to the themes outlined in Chapter 4. These themes are:

(i) Mathematics teachers perceptions of the introduction of CAL in the classroom;

(ii) The introduction of Computer-Assisted Learning in the NSSCO Mathematics curriculum;

(iii) Do Mathematics teachers want the Computer-Assisted Learning lessons to be introduced or implemented?

(iv) The type of environment needed for the introduction or implementation of Computer-Assisted Learning in the Mathematics classroom;

(v) The roles of a teacher during Computer-Assisted Learning lesson; and

(vi) Problems that could be encountered in introducing or implementing Computer-Assisted Learning in the Mathematics classroom.

## 5.2 Mathematics teachers perceptions of the introduction of Computer-Assisted Learning in the classroom

The findings of this study show that Mathematics teachers in rural senior secondary schools in the Zambezi region perceive the introduction of CAL in the Mathematics classroom in a positive way and as being very important. Hartley and Treagust (2014), did a study on perceptions to CAL, their findings indicate that learners and teachers considered the application of computers as a positive step as it increased their involvement in the

Mathematics classroom, gave them more exercises in problem solving in Mathematics and provided them the opportunity to assess their own learning. The findings of this study also indicate that Mathematics teachers see the introduction of Computer-Assisted Learning as a motivation and something that will give support to learners and boost their understanding towards the subject because they will be more interested and curious to learn something new. Ardic and Isleyen (2017), in their study found that teachers saw CAL programme implementation in their teaching as motivating and very interesting to learners.

It is revealed in the findings that the introduction of CAL could help teachers set standardised assessments in terms of topic tasks and topic tests; as a result, the performance of learners will be increased. The findings show that Mathematics teachers see the introduction of CAL in a context of helping learners value time, unlike in the traditional teaching methods where time does not matter that much. Learners will start to value time because the activities they will be doing are time-bound, which means they will need to be done within the stipulated time. Hartley and Treagust (2014) found that time plays an important role in CAL lessons because if learners take long to answer a particular item or question the computer would flash to show that the learner took longer than the required time.

The teachers also perceive that the introduction of CAL as a system will bring down the workload compared to the traditional way of teaching, there is so much paperwork, the actual teaching involves writing on the chalkboard and erasing, which is time-consuming. Jamil (2012) also found that CAL saves teachers time unlike the traditional methods of teaching and it also improves learners' understanding on the subject content. Iipinge (2010), in his research "The integration of ICTs in the preparation of teachers at colleges of education in Namibia" came up with the summary of the expressions of positive perceptions on the use

and integration of ICT. The summary shows ICT integration into the teaching and learning as a noble and excellent idea as it equips teachers with technological skills, makes communication easier, is the way to go for the realization of vision 2030, makes the workload manageable, allows learners to work at their own pace and very useful as it facilitates the dissemination of up to date information.

In conclusion, it can clearly be seen that Mathematics teachers from these rural senior secondary schools see CAL introduction in the Mathematics classroom as a very positive move, but we have to address some of the shortcomings. Mathematics teachers expressed concerns as far as resources are concerned, teachers buy personal computers from their own pockets, and this results in a few number of teachers owning personal computers. According to Tezci (2011), the perceptions of teachers who do not own a computer are always found to be much more negative than those who own computers. Tezci (2011) continues to state that those who do not own personal computers would need external support in their efforts to integrate computers in their teaching. Therefore, how can we help the mathematics teachers who find themselves in the rural areas but with a positive line of thinking towards CAL introduction and implementation for them to remain with a positive perception?

### 5.3 The introduction of Computer-Assisted Learning in the NSSCO Mathematics curriculum

The findings revealed that the Mathematics teachers from the rural senior secondary schools see CAL fitting well in the NSSCO Mathematics curriculum. Mathematics teachers see CAL programmes as easy to use and integrate in the Mathematics classroom. The findings also revealed that some teachers had the opinion that for CAL to fit perfectly well in the NSSCO curriculum and lower grades too, not all topics are to be introduced all at once, but they

should first identify problem topics and introduce CAL to those topics and move gradually to all topics in the grade 11 and 12 curriculum. The findings revealed that CAL as a programme should not be used in isolation but with the integration of traditional teaching. Teachers feel it is good for CAL to be seen as a supplement to the traditional teaching method as such it will benefit the learners in a very positive way.

Ramani and Patadia (2012) found that Computer assisted instruction plays a very important role of supplementing the normal classroom teaching to enable learners to understand better. According to Ramani and Patadia (2012), computer assisted instruction should identify certain topics that learners find challenging and not easily understood by many, this is where teachers should bring in the application of computer assisted instruction. If computer assisted instruction is applied to all topics in the curriculum the effect that it is supposed to have on learners might not be the same compared to when it is introduced to specific topics (Ramani & Patadia 2012). Hartley, Treagust and Ogunniyi (2008) found that the teachers conducted the CAL classes as supportive of their teaching because it served as an additional resource that helped them in their preparation of classes and the computers served as an additional tool to their daily teaching. What teachers did was to make use of the computer centre for revision and reinforcement purposes by planning exercise sessions for students prior to the time they were supposed to be in the computer centre (Hartley, Treagust & Ogunniyi, 2008).

The findings revealed that Mathematics teachers feel CAL fits perfectly well in the NSSCO curriculum as it is designed in a way that the topics are logically connected to each other. Therefore, CAL as a programme will involve the learners in their learning and take responsibilities of their own learning, as learners will be in the forefront of their learning. The results show that Mathematics teachers also feel that the introduction of CAL is one-step

ahead compared to other programmes, which are already on the market and already introduced in the Mathematics classroom. All they want to see with the CAL programme is whether it is in line with the NSSCO Mathematics curriculum or not.

Therefore, we can clearly see that the findings are in line with the reviewed literature. Mathematics teachers see CAL as a neuro-transmitter that will bridge the gap between the urban senior secondary schools and the rural senior secondary schools by creating equilibrium as urban schools are always advantaged as seen in their results in Mathematics. Witte et al., (2014) found that schools with lower educational attainments improve when they use CAL programme more frequently in their teaching and learning programme. However, what we need to ask ourselves is what would be the effective way to introduce CAL in the NSSCO curriculum for the benefit of the Namibia child?

## 5.4 Do Mathematics teachers want the Computer-Assisted Learning lessons to be introduced or implemented

The findings of the study revealed that most of the Mathematics teachers from the seven rural senior secondary schools in the Zambezi region want CAL to be introduced or implemented in the Mathematics lessons. They also want to see Mathematics teachers well prepared in terms of the actual introduction or implementation stages. They recommend that Mathematics teachers should attend workshops on the system to be used so that they do not experience difficulties in the coordination of the CAL programme. The findings also revealed that the Mathematics teachers as implementers request to undergo refresher courses in fundamental computing so that they are aware of what is expected of them. They request that they be introduced to the actual CAL programme itself so that they have a test of the actual

programme and be ready with the introduction or implementation of these CAL lessons in the Mathematics classroom.

The findings indicate that Mathematics teachers propose the introduction or implementation of CAL lessons in lower grades as this will enable learners to understand content much earlier in their academic journey. It will also enable them to understand instructions used by the CAL programme. Others feel that lower grades are a foundation for Mathematics, once the CAL programme is introduced or implemented at those levels, learners will start to love the subject more and their interest will be aroused to a climax level. The Mathematics teachers see CAL introduction or implementation as a success. When learners are introduced to a computer literacy programme at an early stage, there is a high probability that these learners will be able to master computer skills much better later. Thus resulting in better computer skills for the efficient usage of the CAL programme in the Mathematics lesson.

However, the findings further revealed that some Mathematics teacher dispute the introduction of CAL at lower grades, as it is will be a waste of time and resources. They want to see the introduction of CAL in grades 11 and 12, because this is where learners have serious problems in Mathematics not in lower grades. They see CAL as an additional resource to help learners understand better, they want to see CAL as aiding the traditional teaching done in the Mathematics lessons. Furthermore, they argue that teachers should identify problem topics where CAL lessons are needed for better understanding. These Mathematics teachers want to see the CAL programme installed in the computers lab in order to give an opportunity to all learners.

In conclusion, the recommendation by the Mathematics teachers is that teachers should design a timetable for all grades that require the use of CAL so that when their time comes, they go to the computer lab and find meaning to what they did in their normal teaching setup. Hartley, Treagust and Ogunniyi (2008) in their study of "*The application of a CAL strategy in Science and Mathematics for disadvantaged Grade 12 learners in South Africa*" found that teachers planned their annual timetable to allow for double periods during which time the computer centre could be used and so they took turns to use the computer centre. The computer programmes were mostly used for reinforcement for what was already taught in the class. These sessions would be planned around a particular topic that would provide students with the opportunity to hone their ability to work quickly and accurately. The centre was not used as a classroom in the strict sense but as an additional resource centre. The researchers also found that students would come during intervals, when they had a free opportunity and after school, to work on the computers (Treagust & Ogunniyi, 2008).

## 5.5 The type of environment needed for the introduction or implementation of Computer-Assisted Learning in the Mathematics classroom

The findings of this study indicate that most of the Mathematics teachers from the rural senior secondary schools are looking at the computer lab approach for the effective introduction or implementation of the CAL programme in the Mathematics classroom. They want the computer laboratory that is not just given the name because it's a class serving the purpose of the computer lab but they want to see a computer lab well equipped with working computers. The computer lab should also have internet connection to enable teachers to read and research more in preparation for lessons, as teachers should be ahead of learners all the time. Brun and Hinostroza (2014), in their study, reviewed that adequate infrastructure and the availability of technical and pedagogical support are necessary conditions to integration

ICT into educational institutions. Their findings also revealed that the computer learner ratio and internet access play an important role in efficient implementation or integration of ICT. On the other hand ,Goktas, Yildirim, S, and Yildirim, Z, (2009), also revealed that, providing access to ICT is not enough, but what is needed is a big investment in purchasing hardware and software for the schools in need, including updating and upgrading them. Therefore, funding for new ICT resources should be increased in order to provide adequate ICT equipment and resources.

The findings also revealed that Mathematics teachers are looking at the environment that is powered with electricity, as computers need power to function. If the schools are not connected to electricity grid then there should be a provision for a generator or some other form of power. In addition, the findings revealed again that Mathematics teachers see the efficient introduction or implementation of CAL lessons when these schools have technical support. Qualified computer personnel are needed to help these rural senior secondary schools when the need arises. According to Goktas, Yildirim, S, and Yildirim, Z, (2009), their findings indicate that technical support should form part and parcel of the teaching and learning as it supports the teaching staff and is referred as a cost-effective method, without technical support the schools will always drag behind the progress.

On the other hand, this study also revealed that some Mathematics teachers do not see a need for a computer approach only. However, they feel it is a good idea if the CAL programme could be installed in learners' laptops, so that these learners have access to the learning material at all time and be responsible for their own learning. This is because rural schools do not have technical personnel to help learners after hours and weekends, so learning should not be held up because of these challenges. Hartley, Treagust and Ogunniyi (2008) found that students wanted more computers at their centres and emphasised their individual needs to

have a computer of their own in order to improve their own learning. With the interactions with the computers, the students expressed the view that the amount of time spent to discuss problems with each other was counterproductive to their own personal learning needs. Most students were satisfied with the way that they were involved in computer-assisted classes and indicated that they readily participated in discussions with fellow students and with the teacher about the work on the computer. Teachers reported that more students were willing to share their ideas and thoughts on topics that were based on the work from the computer but reluctant to participate in the formal classes (Hartley, Treagust & Ogunniyi, 2008).

In conclusion, the findings revealed that most Mathematics teachers want an environment where the intervention in terms of CAL lessons is one on one, as this will enable learners to focus and better understand the subject content. Thus, learners will take full control of their own learning and become accountable for their own failure or success. Although other teachers feel that a one to one approach does not benefit slow learners, as such they feel that the group approach will be the best, as talented learners will be able to pull slow learners so that they are par with each other. In addition, since the country is in an economic crisis sharing computers will be the best solution to make CAL available to the Namibian child.

### 5.6 The roles of a teacher during Computer-Assisted Learning lesson

The findings of this study revealed that Mathematics teachers in rural senior secondary schools see themselves during the CAL lessons as instructors and at the same time as facilitators. They are instructors in the sense that they should have a prepared activity plan which the learners have to follow, in order to achieve the objectives and competencies of the specific lesson. And as facilitators, because they see CAL as learner oriented approach where the teacher coordinates the learning and explains to the learners where they struggle to

understand. As learners at some point will be challenged, so it is the duty of the teacher to align the learners so that at the end of the day they are moving in the same direction.

The findings also revealed that Mathematics teachers also see themselves during CAL lessons as people who are supposed to motivate learners so that they work extra hard, thus resulting in improving the efforts and performance towards the subject. In addition to motivating learners, Mathematics teachers see themselves responsible for guiding, correcting and explaining to the learners when certain concepts are not clear to them, and when they cannot continue because they do not know what to do next. Bhalla (2013) found that the role of the teacher in the CAL lesson is to provide guidance to students when using the CAL programme independently and as a self-instructional material on a computer at school or at home. Dina and Ciornei (2013) found that the teacher's role is irreplaceable when it comes to providing moral guidance, to being a mentor who shapes career and social development and encouraging intellectual growth.

The findings revealed that it is the duty of the teacher to give other possible methods in solving the same problem, as learners' needs are different. Also to identify slow learners and assist them to finish certain problems, but considering that they do much on their own work and are responsible for their own learning. There are cases where you have learners who never used a computer in their entire life, it is the duty of the Mathematics teacher to bring these learners close, so that they benefit equally as others. Dina and Ciornei (2013) argued that the role of the teacher in the classroom is very important and even though computers have become part of the learning process, it is the duty of the teacher to help students with information. It is the teachers that can provide valuable feedback and offer valuable

information to their students, teach them how to correctly choose the right and genuine sources of information on the internet and also be creative (Dina & Ciornei, 2013).

The findings revealed that Mathematics teachers see the CAL lessons as a supplement of the traditional teaching methods, so the actual traditional teaching should continue and be complemented by the CAL programme. The teachers should not replace the traditional teaching methods with the CAL lessons; there is a need to integrate the two systems together so that the success and the subsequent improvement in the results in the area of the Mathematics is realised. According to Man (1997), teachers play important roles by designing and using appropriate teaching aids, using them in a suitable way to suit and challenge students' learning, offering the appropriate degrees of assistance to promote students' development and learning.

## 5.7 Problems that could be encountered in introducing or implementing Computer-Assisted Learning in the Mathematics classroom

The findings revealed problems or challenges that could be encountered in the introduction or implementation of CAL in the Mathematics classroom. These include, lack of computers and lack of computer laboratories, lack of space to convert into computer laboratories , lack of internet connectivity, low levels of computer literacy among learners and teachers, lack of technical support, power outage, limited time, ICT security and funding. In line with available literature Mogire (2013), indicated that there was minimal use of computers in teaching and learning of Mathematics due to lack of Mathematics software, fewer computers per school, lack of computer skills by teachers and students, power blackouts and inadequate computer laboratory space to accommodate Mathematics students. The introduction of CAL

cannot be effective if these obstacles are not addressed on time in the rural senior secondary schools.

The findings revealed that some schools have very few computers and others that are seen to have enough, have computers that are not in a working state and the computers are either in boxes or dumped in the storerooms. Hartley and Treagust (2014) found that, because rural schools have a shortage of computer sets, more computers should be made available as this would allow learners to work individually thereby being able to spend more time on the computer. The findings also revealed funding as an issue of concern because the Namibian government is going through tough economic times as far as the economic index is concerned; the Ministry of Education at the moment does not have money to procure computer sets or repair the broken ones.

Moreover, most senior secondary schools in the Zambezi region are faced with a challenge of space. There are no classes that can be converted into computer labs, so the few computers they have are now seen as white elephants because they do not serve their purpose. The other problem facing many schools in the rural areas as revealed by the findings is the poor or lack of internet connectivity. Rural schools do not have the equal opportunity as those in towns, as these schools are not all connected to the internet and power grid. Some schools are completely left out because they are outside the access points for internet connection. Besides, those that are connected face problems in terms of payments by the Ministry of Education. They sometimes stay for months without connection.

The findings revealed that teachers see the possible challenge in learners, because some of the learners in their Mathematics classes have never used a computer in their life. Therefore,

computer literacy is the anticipated problem and at the same time not all the teachers have the ability to work comfortably with the computers, they too need to be capacitated in terms of computer skills. Agyei and Voogt (2011) found that lack of knowledge about ways to integrate ICT in lessons and lack of training opportunities for ICT integration knowledge acquisition are some of the challenges Mathematics teachers face. Mathematics teachers cannot introduce or implement CAL in the Mathematics classroom if they do not have the right skills and understanding to do so (Agyei & Voogt, 2011). Hismanoglu (2012), in his study of ‘‘*Prospective EFT Teachers' Perceptions of ICT Integration*’’ also found that his participants expressed lack of exposure to lessons fully designed with ICT tools as an obstacle that limit the introduction or implementation of CAL in teaching and learning of Mathematics.

Lack of technical support is one of the identified problems that could hinder the effective introduction or implementation of CAL in rural senior secondary schools. The results gave a clear picture that rural senior secondary schools do not have appointed personnel as computer specialists that could help them in some technical problems that might arise in the CAL lessons in the Mathematics classroom. The findings also revealed that the Mathematics teachers realise that there is a need to have computer specialists not only to help in the efficiency of the programme implementation but also to oversee that personal information of the schools is not exposed to the internet users out there. According to Stensaker, Maassen, Borgan, Oftebro and Karseth (2007), technical support and technical skills are crucial components to implement ICT in teaching and learning. They continued to argue that technical personnel have a better understanding of the language used in the ICT world than the academic staff, which will make life easy for the benefit of the learners.

The findings also identified power failure as a problem; the rural senior secondary schools are always cut off time and again. Therefore, the CAL programme cannot work without power, as computers need to be powered for the beneficiaries to have access to the programme. At the same time, some teachers see CAL as a programme that will consume much of the time for both learners and teachers, especially in the first few years of implementation, as teachers and learners are still learning the system and this will result in the Mathematics curriculum not to be completed on time. Hismanoglu (2012) in the study "*Prospective EFT Teachers' Perceptions of ICT Integration*" revealed the matching of the ICT learning system to the curricula as one of the challenges that could be witnessed in the ICT integration. If the CAL programme is not perfectly matched to the curriculum then the syllabus will not finish on time or even finish at all. Moreover, when the system or the programme is new the delivery is not easy in the first few years of implementation (Hismanoglu, 2012).

In conclusion the findings of this study and available literature are summarised below using visual drawing illustration by Iipinge (2010), as factors perceived as the most problems that could hinder the effective implementation of CAL.

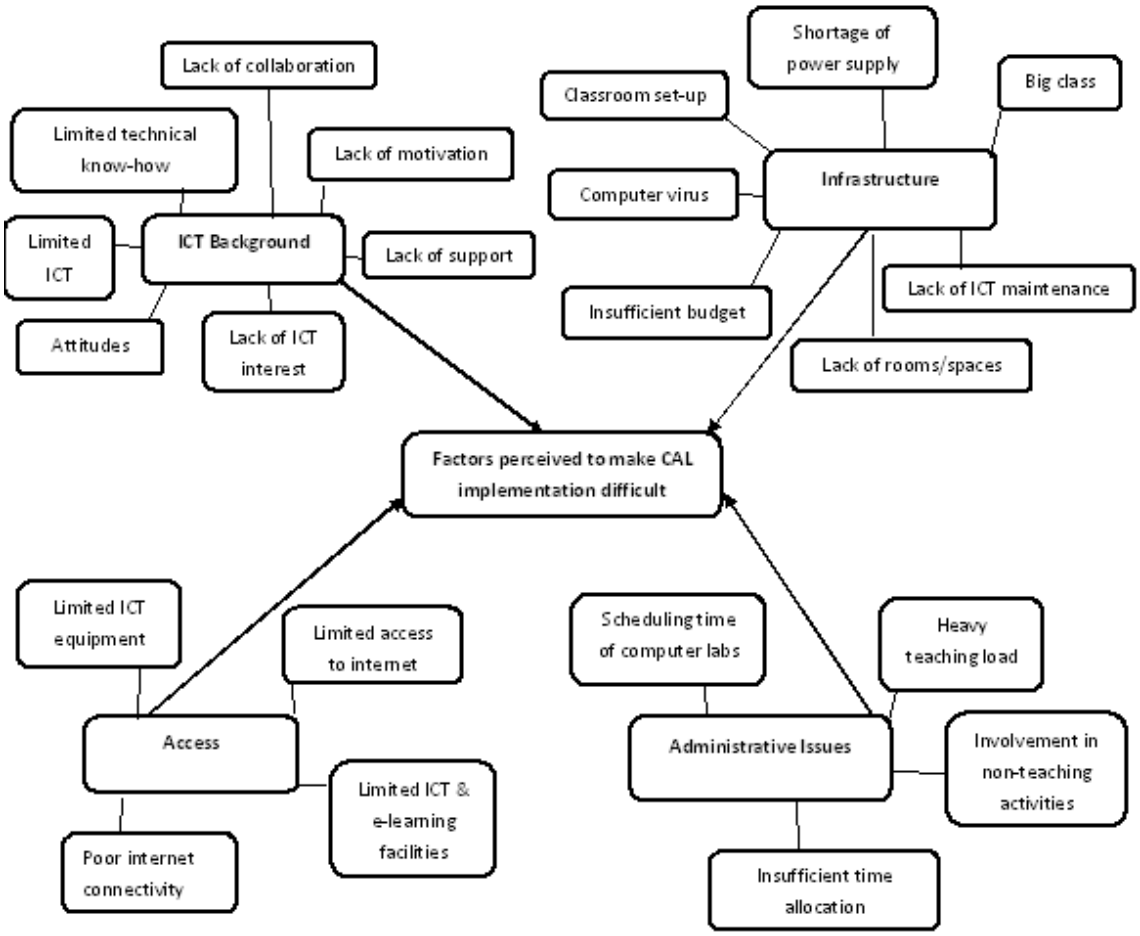


**Figure 3: Visual drawing illustrating the factors perceived as problems that could be encountered in the implementation of CAL (Iipinge, 2010)**

## 5.8 Conclusion

This chapter discussed the main findings of this study using the framework of the research questions and theories that informed the study. The next chapter summarizes, concludes the study and also provides recommendations in order to improve introduction of CLA in the rural senior secondary schools.

# CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 6.1 Introduction

This chapter provides a summary of the findings; it also provides a conclusion and makes recommendations based on the findings of the study. This chapter also identifies possible areas for further research.

## 6.2 Summary of the findings

This study investigated the teachers' perceptions of the introduction of Computer-Assisted Learning in Mathematics in rural senior secondary schools in the Zambezi Region of Namibia, as the Region is faced with a very high failure rate as far as Mathematics is concerned.

The findings of this study indicate that Mathematics teachers in the rural senior secondary school were interested in the introduction of CAL in their teaching in the Mathematics classroom. The Mathematics teachers perceived the introduction of CAL in the Mathematics classroom in a very positive way despite lack of resources. The findings also revealed that the Mathematics teachers see the introduction of CAL as a programme that will make life easier for both teachers and learners as it will motivate learners, give support to the teaching and learning of Mathematics and reduce the workload of Mathematics teachers.

It was also found that the Mathematics teachers from the rural senior secondary schools see the introduction of CAL as a programme that has room to fit perfectly well in the NSSCO Mathematics curriculum. The teachers see CAL programme as one-step ahead towards technology acceptance in comparison to the other system in place, which includes *Calculator*

*skills.* Their argument is that, if a calculator can do wonders how much more for a computer programme that is designed to teach, assess and reinforce teaching and learning.

The study also found that the Mathematics teachers from the rural senior secondary schools wanted the implementation or introduction of CAL to start from the lower grades. Specifically from upper primary because it will enable learners to feel more comfortable by the time they are in grade 11 or 12, where Mathematics problems are getting a bit tougher for them. However, a small fraction of these teachers felt there was no need to introduce CAL at that early stage and they viewed it as a waste of time and resources. These teachers see CAL as a supplementary tool to the traditional teaching methods. Therefore, according to them, CAL should only be introduced in grade 11 and 12 respectively.

The type of the environment perceived by Mathematics teachers as an important aspect for the introduction and implementation of CAL is an environment that have equipped computer laboratories, an environment with internet connectivity and environment with electricity available at all time. On the other hand, they also want an environment with technical personnel appointed for the purpose of helping and supporting the rural senior secondary schools. The findings also show that the Mathematics teachers want an intervention where learners are one on one with the computers and in cases where computers are few the small groups would do, with a maximum of 3 learners and a minimum of 2 learners. They also want an environment in which the learners can have access to the programme on their laptops or tablets even after hours and weekends.

The findings of this study revealed again that the Mathematics teachers see themselves as instructors and facilitators during their computer-assisted lessons. They see themselves as

instructors because preparations and instructions will be done prior to the CAL lesson which should be followed by the learners. Moreover, they also see themselves as facilitators because they will be responsible to give guidance, corrections and supplementary comments to aid the learning of learners during the CAL lessons.

Finally, the study also indicated possible problems or challenges that Mathematics teachers see as obstacles that could hinder the effective introduction or implementation of the CAL in the Mathematics classroom. Among other aspects, this involves the following: lack of computers and computer laboratories, lack of space to be converted into computer laboratories, lack of internet connectivity, low levels of computer literacy among learners and teachers, lack of technical support, power outage, limited time, ICT security, and funding.

## 6.3 Conclusion

This section presents the most significant conclusions drawn from the study. There was a general observation that Mathematics teachers from the rural senior secondary schools perceive the introduction of CAL in the Mathematics classroom in a very positive direction. All the Mathematics teachers see the introduction or implementation of CAL in the Mathematics classroom as fitting perfectly well in the NSSCO Mathematics curriculum. Most Mathematics teachers from the rural senior secondary schools want to see the introduction of CAL in the Mathematics classroom starting from the lower phases, specifically upper primary. A small fraction of the Mathematics teachers want the CAL programme to be introduced or implemented in grade 11 and 12, where Mathematics content is a bit challenging. The Mathematics teachers perceived an environment with computer laboratories, internet connection, electricity and technical personnel as important environmental variables when introducing CAL. Most of them revealed that the one on one intervention with the

computer could be the best scenario as well. However, a few considered the use of groups to work well as learners will learn from each other, especially slow learners. All Mathematics teachers see themselves as instructors and facilitators during the CAL lessons. They revealed some of the possible problems to hinder the effective introduction and implementation of CAL in the Mathematics classroom, which include lack of computers and computer laboratories, lack of space to convert into a computer laboratory, lack of internet connectivity, computer literacy among learners and teachers, lack of technical support, power outage, limited time, ICT security and funding.

## 6.4 Recommendations

The recommendations emanating from this study are directed to Mathematics teachers from rural senior secondary schools and to the Ministry of Education's regional management team in the Zambezi region.

Firstly, Mathematics teachers should give assignments to learners that require typing so that the learners learn how to operate the computers. Secondly, Mathematics teachers need to capacitate themselves in terms of basic computer skills and the Ministry of Education should send these teachers to workshops in order to for these teachers to have adequate pedagogical understanding of ICT integration as well as understanding ICT concepts for them to be comfortable in using CAL programmes. Thirdly, the Ministry of Education should also invest more in terms of procurement of technical resources, such as computers and equipping computer laboratories at rural senior secondary schools and connect them to the internet for the benefit of the Namibian child.

Fourthly, the Ministry of Education should build more classes in the rural areas to cater for these senior secondary schools that do not have space or a class that they can convert into computer laboratories. Moreover, the Ministry of Education should appoint technical personnel, who are qualified as computer specialists to help the senior secondary schools in terms of the technical support they need and also ensure ICT securities. And finally, the Regional Council management team together with the Ministry of Education management team need to look at the power outage issue affecting schools through the electricity distributor company, NORED, to solve this problem once and for all, because it is affecting the rural senior secondary schools more.

### 6.5 Recommendations for further research

Future research should investigate the effect of Computer-Assisted Learning on learners' performance in Mathematics in the rural senior secondary schools in the entire Zambezi Region, Namibia.

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# APPENDICES

## APPENDIX A: Letter to the Ministry of Education requesting permission to conduct research in rural senior secondary schools in the Zambezi region

Mr Evans Bainga Nchindo

PO Box 1789

Ngweze

Namibia

02 October 2017

Mr Austin M Samupwa

Regional Director

Ministry of Education

P/Bag 5006

Katima Mulilo

Namibia

**REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN RURAL SENIOR SECONDARY SCHOOLS IN THE ZAMBEZI REGION**

Dear Mr Samupwa

My name is Evans Bainga Nchindo, and I am an education student at the University of Namibia. The research I wish to conduct for my Master's thesis involves ''Teachers' perceptions of the introduction of Computer-Assisted learning in Mathematics at rural senior secondary schools in the Zambezi Region, Namibia''. This project will be conducted under the supervision of Dr Africa Zulu and Dr David Nkengbeza (UNAM, Namibia).

I am hereby seeking your consent to approach a number of rural senior secondary schools in Bukalo, Cincimani, Ngoma and Sibbinda circuit to provide participants for this project.

I have provided you with a copy of the consent form to be used in the research process, as well as a copy of the approval letter, which I received from the University of Namibia, Postgraduate Studies Committee (PGSC).

Upon completion of the study, I undertake to provide the Ministry of Education with a bound copy of the full research report. If you require any further information, please do not hesitate to contact me on cell no: 081 297 8435 and e-mail: nchindoevans@gmail.com/enchindo@zvtc.edu.na. Thank you for your time and consideration in this matter.

Yours sincerely,

Mr Evans Bainga Nchindo

University of Namibia

**APPENDIX B: Letter of approval from the Director of Education to conduct research in rural senior secondary schools in the Zambezi region**

# REPUBLIC OF NAMIBIA
# ZAMBEZI REGIONAL COUNCIL
## DIRECTORATE: EDUCATION, ARTS AND CULTURE


*Tel: +26466261902/964* | *Ngoma Road* | *Private Bag 5006*
*Fax: +26466253187* | *Govt Building* | *Katima Mulilo, Namibia*


***Enquiries: Adrenah Mukela*** | ***Our Ref:*** | ***Date: 09 October 2017***

PO Box 1789
Ngweze
Namibia

Attention: Mr Evans Bainga Nchindo

**RE: PERMISSION TO CONDUCT RESEARCH IN RURAL SENIOR SECONDARY SCHOOLS IN ZAMBEZI REGION**

Your letter to the office of the Regional Director: Zambezi Region date 02 October 2017 with the caption permission to conduct research in Rural Senior Secondary Schools in Zambezi Region was received.

Kindly be informed that approval is granted to you to conduct a research as requested, but let me draw your attention to the following aspects: **NOTE!**

a) The granted approval should not disrupt the normal teaching and learning at those schools you intend visiting.
b) Be reminded that this is a very crucial time of the year when teachers are busy preparing learners for their end year examination while others have started writing their examination.

**By copy of this letter the Inspectors of Education are notified accordingly of your presence at the school.**

I trust and hope you will find this in order.

MINISTRY OF EDUCATION ARTS & CULTURE
Zambezi Regional Directorate
2017 -10- 09
Office of the Director
Private Bag 5006 · Katima Mulilo

**MR AUSTIN M SAMUPWA**
**REGIONAL DIRECTOR: EDUCATION, ARTS AND CULTURE**

## APPENDIX C: Interview Questions

### Interview Questions

1. What is your perception on the introduction of Computer-Assisted Learning in the Mathematics lesson?
2. How will the introduction of Computer-assisted Learning fit into the NSSCO Mathematics curriculum?
3. How do teachers want the CAL lessons to be implemented?
4. What type of environment do teachers perceive as important for the implementation of computers assisted learning in a mathematics class?
5. What do you think are the roles of a teacher during Computer-Assisted Learning lesson?
6. What do you perceive as problems that could be encountered in conducting Computer-Assisted Learning lessons?