EFFICACY OF ASSISTIVE TECHNOLOGY ON THE VISUALLY IMPAIRED LEARNERS' GRASPING OF LIBRARY INFORMATION RESOURCES: A CASE OF ZAMBIA LIBRARY, CULTURAL AND SKILLS CENTRE FOR THE VISUALLY IMPAIRED (ZLCSCVI) IN LUSAKA, ZAMBIA

By

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A Dissertation submitted to the University of Zambia in Partial Fulfillment of the Requirements of the Degree of Master of Library and Information Science (MLIS)

THE UNIVERSITY OF ZAMBIA

LUSAKA

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DECLARATION

I, Janet Kaulu, declare that this Dissertation

(a) Represents my own work;

(b) Has not previously been submitted for a degree of this or another University; and

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APPROVAL

This Dissertation of **Janet Kaulu** has been approved as fulfilling the requirements for the award of the Degree of Master of Library and Information Science (MLIS) by the University of Zambia.

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ABSTRACT

The objectives were to: Identify the nature of assistive technology available for persons with visual impairment at Zambia Library, Cultural and Skills Centre for the Visually Impaired (ZLCSCVI), Establish the useful library information resources accessed by persons with visual impairment at ZLCSCVI using the available assistive technology, Assess the ease with which persons with visual impairment access the library information resources at ZLCSCVI using the available assistive technology and Assess the efficacy of assistive technology in grasping library information resources by visually impaired persons at ZLCSCVI. The sample size consisted of 17 visually impaired learners and 3 instructors of technology. A mixed-methods approach was employed to investigate the issues involved. Consequently, the concurrent nested strategy was used to mix qualitative and quantitative methods, with the former methods being dominant and thus guiding the study. The Case study design was used for data collection and analysis. Data were captured using: an item checklist, Instructor's questionnaire, Focus Group Discussion guide and an observation schedule. Qualitative data were analysed using themes while Quantitative data were analysed using modes and percentages. The study revealed several Assistive technologies available for visually impaired learners at ZLCSCVI. The most popular one was Job Access with Speech (JAWS), followed by Non-Visual Desktop Access (NVDA) which enabled learners to hear through the speakers what had been displayed on the screen. These technologies helped the learners to access useful library information resources such as e-books, PDF documents, Websites, simulations, e-mail, WhatsApp, Music etc. Though there were few challenges in using the Technologies, the study revealed that they were easy to use by the majority of learners. Finally, all the respondents agreed that JAWS and NVDA helped the visually impaired learners to perform like their sighted peers when the assistive technologies were used well and consistently as a supplement to traditional instruction. The findings implied that pedagogical strategies used by instructors of the visually impaired learners should include suitable assistive technologies such as JAWS and NVDA in order to help the VI learners perform like sighted peers. From the results it was concluded that the main assistive technologies used by the visually impaired learners at ZLCSCVI were JAWS and NVDA. These technologies enabled learners to access academic materials like books and non-academic materials from storage media and the internet. Furthermore, they were easy to use and had high efficacy. In view of the above conclusions the following recommendations were made: Government should consider procuring assistive technology, particularly JAWS, for schools and colleges for persons with visual impairments in Zambia. All teachers of the persons with visual impairments should undergo training in the use of JAWS so that they, in turn, they can assist their learners in the use of such technologies to enable them perform better academically and socially.

Keywords: Efficacy, Assistive technology, Visually Impaired and Library information resources.

DEDICATION

This Thesis is dedicated to my father and my mother, who together worked hard to make me what I am. It is further dedicated to my brothers, who encouraged me to go full distance, regardless of several obstacles that I met on the way.

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There is no one who can finish this kind of work alone. Therefore, I would like to thank several people who contributed to my work.

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ACRONYMS

ZLCSCVI.....Zambia Library Cultural and Skills Centre for the Visually Impaired

TEVETA……..…..Technical Education and Vocational Training Authority

WHO……World Health Organization

JAWS……..Job Access With Speech

NVDA…… Non-Visual Desktop Access

UNESCO…….United Nations Educational, Scientific and Cultural Organization

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CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter introduces the study on the "Efficacy of assistive technology on the visually impaired learners' grasping of library information resources at the Zambia Library, Cultural and Skills Centre for the Visually Impaired (ZLCSCVI) in Lusaka District of Zambia." The chapter comprises the following sections: background and context, statement of the problem, purpose of the study, research objectives, research questions, significance of the study, operational definitions of key terms, theoretical framework, conceptual framework, interpretation of my research model, scope of the study and chapter Summary.

1.2 Background and Context

For many years now, the number of learners becoming visually impaired in the world has been increasing at an alarming rate (Hasselbring and Glaser, 2000). According to global statistics, every minute that passes, approximately one child goes blind, making a total of about 500,000 children who go blind each year worldwide (World Health Organisation-WHO, 2012). In the United States of America alone, the number of school children who are blind is estimated to be more than 485,500 (National Federation for the Blind-NFB, 2012). The problem in that area has been worsened by some school going children getting involved in tobacco consumption which has potential to affect the eyes (Gazmararian, Gaydos, and Beltran, 2007). In Africa the situation is not different, especially with the problem of HIV Aids which has resulted in more people losing their sight. Lupiya (2017) indicates that Zambia has the highest rate of blindness in Southern Africa with over 105,000 learners who are visually impaired. These learners are underprivileged because in many cases they do not have proper access to important resources. Therefore, they require special education and relevant assistive technologies to achieve their fullest academic potential (Ministry of Education-MOE, 1996; Lupiya, 2017).

Use of assistive technology by learners with visual impairment is also supported by the United Nations Educational, Scientific and Cultural Organization, UNESCO (2008), which contends that technological innovations can help level the playing field for the visually impaired persons. The European Union (2002) adds that the usage of electronic information and Communication technologies has become a powerful tool for learning because they offer learners with sight problems opportunities to gather a wide variety of resources and information that enables them to share their thoughts and ideas with others in collaborative learning environments. For example, most blind learners today can use tape-recorded books and lessons, talking calculators and paperless Braille machines for academic purposes (Kiambati, 2015; Gogate, Kalua, and Courtright, 2009). The only set back is that some assistive technologies do not help the visually impaired much, particularly those that do not provide large print. This is because even those with low vision may not read at all without using special computer software or equipment (Gerber, 2013). In addition, diagrams and new vocabulary can be problematic unless an oral description or additional clarification is given (Meijer, 2010).

In an effort to address these and related challenges, computer experts in the world have developed several assistive technology software packages (United Nations Educational, Scientific and Cultural Organisation UNESCO, 2008). Examples are: Job Access with Speech (JAWS), which is meant for computer users whose vision loss, prevents them from seeing screen content. JAWS reads aloud what is displayed on the computer screen. It is compatible with Microsoft Office Suite, MSN Messenger, Corel, Adobe Acrobat Reader, Internet Explorer, Firefox, and many more applications that are used on a regular basis on the job and in school. Other software for the same purpose are: Windows Eyes, which is a leading software application for the blind and visually impaired that converts components of the Windows operating system into synthesized speech allowing for access to Windows based computer systems; Dolphin Super Nova, which is a screen reader that works by reading the screen interactively and communicating through a speech synthesizer or a refreshable Braille display, Non-Visual Desktop Access (NVDA), a free and open source screen reader for the Microsoft operating system. It enables people who are blind or vision impaired to

access computers; Thunder which is free screen reader software for people with little or no sight etc (Dolphin Computer Access, 2017).

In Zambia it is rare to find any of the above assistive technology software packages, except at Zambia Library Cultural and Skills Centre**,** ZLCSCVI (2013). The library is located at Plot No. 4225, Chilimbulu Road, Chilenje, Lusaka. It was a donation from the Finnish Federation for the Visually Impaired (FFVI) in 1993. Since then, the Centre has been receiving a monthly grant from the government through the Ministry of Community Development and Social Services. It is registered with the Zambia Agency for Persons with Disabilities under Act 0.33 of 1996 and Technical Education and Vocational Training Authority (TEVETA), because it has a Computer Centre where visually impaired learners undergo training in how to use assistive technology (Makondo and Akakandelwa, 2017). One of the primary objectives of the library is to impart to visually impaired persons among other things, computer literacy skills so that they can use assistive technologies fully for their academic benefit and in any other appropriate way they would want. By reading aloud and enlarging what is displayed on the computer screen, assistive technology makes it possible for computer users, in this case, the visually impaired learners to access and grasp various academic and non-academic materials.

Most of the learners at ZLCSCVI come from Primary and Secondary schools within Lusaka, like Munali. Students come from colleges and universities e.g Evelyn Hone college, Malcom Moffat College of Education, Mongu college of Education and the University of Zambia (Makondo and Akakandelwa, 2017). According to Mandal (2013) training of this nature in the use of assistive tehnology by the visually impaired persons is important because it is the main impetus through which their education can be achieved easily. If access to such training in ICT is denied, it may be difficult, if not impossible, to bring such learners into the mainstream of development (Cennamo, Ross and Ertmer, 2009; WHO, 2013).

While it is good for the visually impaired learners to undergo training in the use of assistive technology at ZLCSCVI to access and grasp various services, research does

not show the efficacy of assistive technology on grasping of library information resources by visually impaired learners in the Zambian context. Hence, this study investigated this issue in Zambia.

1.3 Statement of the problem.

Research shows that assistive technology is helpful to all learners worldwide, including those with physical disabilities (MOE, 1996). This is why learners with low or no sight in Zambia are encouraged to use technology in their learning (UNESCO, 2008). In view of this, ZLCSCVI in Lusaka provides training to visually impaired learners in the use of assistive technology so that they can be in a position to access and grasp various library information resources on computers. However, research does not show the efficacy of assistive technology on the visually impaired learners' grasping of library information resources in the Zambian context. This creates a gap in knowledge which requires a systematic investigation in order to enable the visually impaired learners to use appropriate resources for maximum academic or social benefit. Hence, this study addressed this issue at ZLCSCVI in Lusaka, Zambia.

1.4 Purpose of the study

The purpose of the study was to assess the efficacy of assistive technology on the visually impaired learners' grasping of library information resources in the Zambian context.

1.5 Research objectives

The specific objectives of the study were to:

i. Identify the nature of assistive technology available for persons with visual impairment at ZLCSCVI
ii. Establish the useful library information resources accessed by persons with visual impairment at ZLCSCVI using the available assistive technology
iii. Assess the ease with which persons with visual impairment access the library information resources at ZLCSCVI using the available assistive technology

iv. Assess the efficacy of assistive technology in grasping library information resources by visually impaired persons at ZLCSCVI.

1.6 Research questions

The research questions were as follows:

i. What assistive technology is available for persons with visual impairment at ZLCSCVI in Lusaka?
ii. What useful library information resources are accessed by persons with visual impairment at ZLCSCVI using the available assistive technology?
iii. How easy is it for persons with visual impairment to access library information resources at ZLCSCVI using the available assistive technology?
iv. What is the efficacy of assistive technology in grasping library information resources by persons with visual impairment at ZLCSCVI?

1.7 Significance of the study

It was hoped that this study might help the policy makers in Zambia to be aware of the usefulness, ease of use and effectiveness of assistive technology so that they could be in a position to make informed decisions. Secondly, it might help government through the Ministry of Community Development and Social Services, Zambia Agency for Persons with Disabilities and ZLCSCVI to procure effective assistive technology for learners with visual impairment in Zambia. The study might also help the visually impaired learners countrywide to use appropriate assistive technology to acquire knowledge and perform like sighted peers. Lastly, but not the least, it will add to the existing literature on the use of assistive technology by people with visual impairment in Zambia.

1.8 Operational definitions of key terms

The key terms in the current study were defined operationally by the researcher as follows:

- **Assistive Technology** referred to any device and/or software that enables a computer to provide library information resources to learners with visual impairment
- **Library information resources** referred to any academic or non-academic resources that could be accessed on computers by visually impaired learners.
- **Grasping** referred to acquisition (accessing and understanding/using correctly) of library information resources by the visually impaired learners
- **Learners with visual impairment** in the study referred to partially or totally blind people, who were trained to use assistive technology to access library information resources.
- **Efficacy** referred to the ability of an assistive technology to enhance the acquisition of library information resources by a learner with visual impairment. It was **high** if the assistive technology enabled the visually impaired learners to perform like their sighted peers, **medium** if the technology did not change performance of the learners in any way and **low**, if the assistive technology lowered performance of the visually impaired learners.

1.9 Theoretical Framework

This study was guided by the Technology Acceptance Model, proposed by Fred Davies in 1985. Davies did not evolve the model alone but first relied on several other research studies; one of which being the work done by Fishbein and Ajzen (1975) who formulated the Theory of Reasoned Action. Then, he came up with the model shown in Figure 1.1

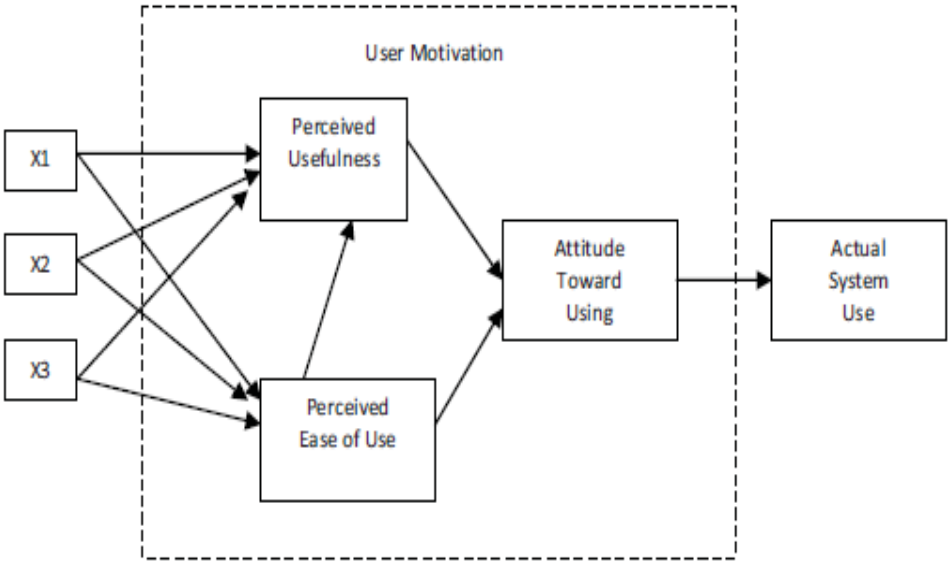

Fig. 1.1: *Technology Acceptance Model* ***Source****:Chuttur (2009) from Davies (1986:24)*

According to this model the user's motivation to use a system can be explained by three factors; *perceived usefulness*, *perceived ease of use* and the *attitude towards using the system* (Davies, 1986; Davis, Bagozzi and Warshaw, 1989). "He hypothesised that the attitude of a user toward a system was a major determinant of whether the user will actually use or reject the system. The attitude of the user, in turn, was considered to be influenced by two major beliefs: perceived usefulness and perceived ease of use" Chuttur (2009). Perceived usefulness refers to the degree to which a person believes that use of the system will enhance his or her performance (Dholakia and Dholakia, 2004). Perceived ease of use refers to the degree to which a person believes that using the system will be free of effort (Dholakia and Dholakia, 2004). Both beliefs were hypothesised to be directly influenced by the system design characteristics represented by X1, X2 and X3 in Figure 1.1.

The Technology Acceptance Model was a significant reference for this study. The summary of the variables reflected in the technology acceptance model formed a crucial summary of variables reflected in the current study of the efficacy of computer

based technology in grasping library information resources by learners with visual impairment as explained in the conceptual framework in the next section.

1.10 The Conceptual Framework

In this study, My Technology Acceptance Model (MTAM), an adjustment of the Technology Acceptance Model (TAM), was used to assess the efficacy of assistive technology in grasping library information resources, by persons with visual impairment. This is illustrated in Figure 1.2.

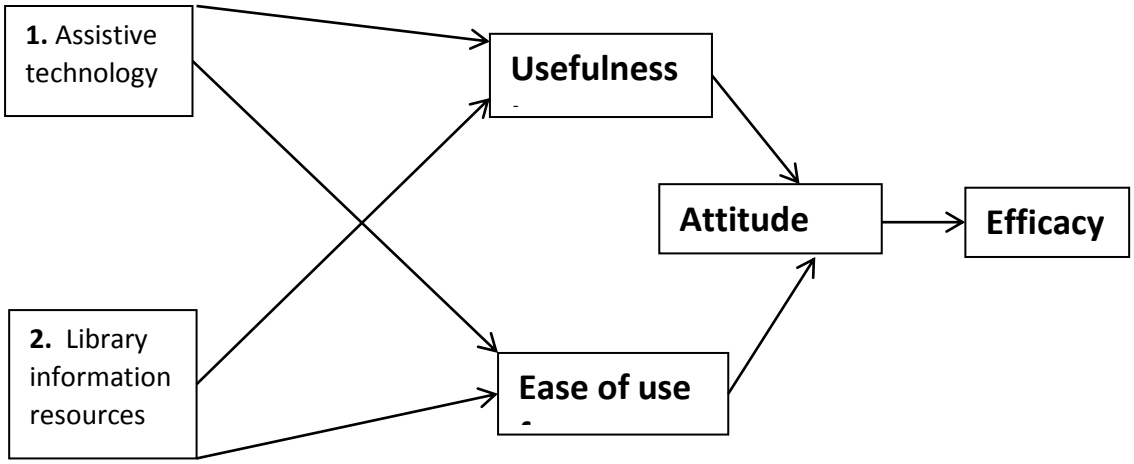

Fig. 1.2: ***My Technology Acceptance Model, Adapted from TAM by Davies(1986:24)***

In My technology Acceptance Model (MTAM), component 1 represents both the hardware and software types of assistive technology such as: key board, mouse, processor, screen, printer, JAWS, NVDA etc. used by learners with visual impairment to access library information resources. Component 2 represents the library information resources that can be accessed and utilised by a visually impaired person for academic and non-academic purposes.

When taken as an action word, "Efficacy" means producing a desired or intended result. In this case, the desired results were for the visually impaired learners to be able to easily grasp library information resources using the various useful components

described above. The section that follows explains my conceptual model in more detail.

1.11 Interpretation of the research model

In the model above, MTAM, the first two boxes show components that make up the sum of the system (Assistive technologies and Library information resources). How effective assistive technology is overall, depends on the sum of the effectiveness of each of the components. Each component's effectiveness can be assessed by its usefulness to the user and how easy users find it to use. These two variables (usefulness and ease of use) are shown by the second (middle) boxes in Figure 1.2. As already explained in the Technology Acceptance Model (TAM), the easier technology is to use, the more likely that users will have a positive attitude towards it. In the same vein, the more useful it is to the user, the more positive the user's attitude towards it. This implies that usefulness and ease of use of the features translate into efficacy of a system.

The main dependent variable in this research is efficacy i.e. the effectiveness of the various components of technology as well as the overall effectiveness of technology. The independent variables are usefulness and ease of use of each component of technology.

1.12 Scope of the study

The study covered one selected library of Lusaka, namely, ZLCSCVI. This was so because it was the only library which provided training in assistive technology to the visually impaired people in Zambia. Due to time factor, the study was conducted within a month and depended on the available technologies at the centre.

1.13 Chapter Summary

Chapter 1 has discussed the background and context, statement of the problem, purpose of the study, research objectives, research questions, significance of the study, operational definitions of key terms, theoretical framework, conceptual framework, interpretation of my research model and the scope of the study. The chapter that follows is a review of relevant literature.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter presents the literature review in line with the research questions under the following headings: Assistive technology available for persons with visual impairment, usefulness of assistive technology to persons with visual impairment, ease of use of assistive technology by visually impaired persons, efficacy of assistive technology in grasping of library information resources by persons with visual impairment and chapter summary.

2.2 Assistive technology available for persons with visual impairment

Several scholars have defined the term Assistive technology (AT) in various ways (Dell, Newton, and Petroff, 2012; Abbott, 2007 ;Abbott et al, 2011; FAST,2001, Becta, 2003; Acaimpes, 2011; Kilda, 2008; Cook and Hussey, 2002; Adcet, 2011; Kitching and Jackson, 1997). One of them is that assistive technology refers to devices and services that are used to increase, maintain, or improve the capabilities of a student with a disability (Dell, Newton, and Petroff, 2012; Abbott, 2007; Abbott et al, 2011). According to the foundation For Assistive Technology (FAST), AT is any product or service designed to enable independence for disabled and older people (FAST, 2001). But the British Educational Communication and Technology (BECTA) states that AT is the software and technology which helps people with disabilities and special needs to overcome the additional barriers they face in communication and learning (Becta, 2003; Acaimpesd, 2011; Kilda, 2008). Others add that AT is an interdisciplinary field of knowledge comprising products, resources, methodologies, strategies, practices, and services that aims to promote functionality for people with regard to visual disability independence, quality of life, and social inclusion (Cook, 2002; Adcet, 2011; Kitching & Jackson, 1997).

The current study appreciated all these definitions because they include devices and software that would help enhance performance of disabled persons. However, since the focus of the study was on a particular type of disability (visual impairment), the term AT was given an operational definition as “A device and/or software that enables

a computer to provide library information resources to learners with visual impairment." Examples of assistive technology are: Computer, JAWS, Dolphin pen and Learning Access Suite. Examples of library information resources are: electronic books, simulations, PDF documents, internet websites, materials on storage media like flashes and CD ROMS, e-mails, music, WhatApp etc.

Research indicates that Assistive technology is available for visually impaired learners in western parts of the world and Asia such as America and Singapore respectively (Ng, 2008). According to the National Center for Health Statistics, more than 17 million Americans used an assistive technology device in 1994 to accommodate for impairment (National Center for Health Statistics, 1997, November 13). Nguyo (2015, p. 45) specifies assistive technology used in such countries as follows:

> Some of the high-tech AT used by persons with visual impairments in today's technologically advanced world consist both hardware and software products including screen readers, screen magnifiers, closed-circuit televisions, electronic magnifiers, scanners and optical character readers, portable and refreshable Braille displays, digital and electronic data, digital readers, and accessible cell phones. No matter the diversity of devices, the power of AT as an enabler in the lives of students with disabilities is unequivocally reported.

In Africa, Assistive technology has been used by the visually impaired learners in various countries like Ghana, Kenya, Tanzania and South Africa. Pilot programmes have been done based on the use of recycled computers and the purchase of various versions of talking software such as Jaws and Dolphin pens (Lynch, 2007; Dwards, 2012; Edyburn, ,2012).

In 2007 Sight Savers International (SSI) launched an AT for visually impaired learners' pilot project in Kenya. This is a project working towards advancement of AT for the blind and low vision learners in secondary and tertiary institutions. Sight Savers is committed to the integration of children with visual disability into mainstream education and supports the Special Education Division (SpED) in the area of capacity building to enhance its ability to monitor report and promote the integration of this disability group (Laga et al., (2006). The Kilimani Primary school

in Kenya and the Mwereni School in Tanzania were provided with a specific assistive technology called Sight Savers Dolphin Pen, which is a cooperative effort between Sight savers International and Dolphin. The main concern was to see the extent to which the assistive device was having an effect on teaching and learning?

It is important to mention that while some students with visual impairments in the world have access to a wide range of blindness and low vision specific assistive technology devices above, others have none at all (Kelly, 2008; Elliot & Gibbs, 2009; Elliot et al., 2003). Furthermore, while some students with visual impairments have access to teachers who are well prepared to deliver special instruction in blindness and low vision specific assistive technology, others do not (Abner & Lahm, 2002).This inequity is not good and must be eliminated. (Nguyo, p 62)

From the literature above it is clear that Assistive technology for visually impaired learners is available in some parts of the world but not all. Furthermore, AT differs from country to country depending on the needs of the people in a particular locality. Therefore, unless an investigation is done, it is difficult to know with certainty the assistive technology available for the visually impaired in a given context such as the one in question.

2.3 Useful services/resources accessed by the visually impaired learners using assistive technology

The aim of technology is to improve the lives of human beings. Persons with visual impairments are no different and require the use of assistive technology (AT) to compensate for their vision loss (Nguyo, 2015, p. 45). In fact, all students with visual impairments are entitled to the independence and efficiency afforded by assistive technology. Appropriate assistive technology enables them to access information and to complete tasks efficiently, thereby enabling them to achieve the highest level of independence possible.

Emerging research suggests that assistive technology promotes acquisition of literacy, provides more equal access to information required for employment, and for access to information, in general, and facilitates social and community networks (Kelly & Smith, 2011; Butterworth et al., 2011; Sarstedt, 2011) determined that there were three primary issues facing individuals with visual impairments: access to information, independent travel, and a lack of meaningful experiences. Assistive technology is used by individuals with visual impairments to compensate for these limitations. Assistive technology can enable students who are visually impaired to achieve educational success and gain competitive employment by providing tools for increased independent access to information and for effective communication (Kelly, 2008; Calder, 2010)

According to the European Union (2002) the usage of technology has become a powerful tool for learning as it offers students with visual impairments opportunities to gather a wide variety of resources and information that enables them to share their thoughts and ideas with others in collaborative learning environments, networked through the Internet. Usage of computers for communication and networking activities via the internet has expanded the learning environment beyond the walls of the classroom and allows the visually impaired learners, to access and send information around the world.

When a computer is fitted with any assistive technology such as: JAWS, window eyes, virtual magnifying glass, ward talk, Non-Visual Desktop Access, Thunder, Web Anywhere, Zoom Text and Soretek among others, it becomes accommodative to a person with visual impairment. He or she can use it for reading, writing, doing assignments, socializing with others on Facebook or email and searching for any new information on the internet. For example, screen enlargement software allows the students to easily read and see what is on the monitor, especially those with poor eyesight. The talking software on the other hand reads the text appearing on the screen for the visually impaired student hence making access to information easier and education possible (Tomei, 2003).

According to D'Andrea and Presley (2009), learners with visual impairments function independently in various activities with appropriate assistive technology. Having a

personal computer acts as a backbone in one's life as it supports a visually impaired user to independently write, edit documents, send and receive e-mails. It creates efficiency and independence to a student with visual impairment who has skills to use it. Therefore, equipping a computer with assistive technology for VI learners serves as a backup for the learners' brain.

The literature above supports the fact that persons with disabilities in various parts of this world find appropriate assistive technology very useful in learning and life in general. However, literature does not specify useful library information resources that may be accessed using the available assistive technology in the Zambian context. Therefore, the visually impaired learners in our country may use technologies without knowing how it will benefit them. Worse still, instructors of the visually impaired can neither encourage the VI learners to use particular assistive technologies nor discourage them because to do so they also need to know the usefulness of such technologies. This is another problem which needs to be addressed seriously if such learners have to use appropriate technologies for their academic and social benefit. The current study endeavoured to do so.

2.4 Ease of use of assistive technology by visually impaired persons

A study by McCathy (2012) analysed the use of screen readers in India and found that JAWS was the most widely used screen reading software with a high use of pirated version. NVDA was the next popular screen reading software which had advantages of being an open-source software, carried on a USB drive and easy to use. However, issues of language support were likely to be of concern, owing to the fact that India is a multilingual country (Alpher and Raharinina, 2006).

Jwaifell and Gasaymeh (2013) did a study on use of assistive technology at Jordan school. The study focused on the "complexity variable" and found that Interactive White Board was easy to use. Rogers (2003, p. 15) defined complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use". Rogers stated that complexity is negatively correlated with the rate of adoption. One

of the hurdles for an individual to adopt a new innovation is its complexity. If the innovation is too complicated or confusing, it takes longer time to achieve acceptance to the innovation and might lead to rejection (Rogers, 2003). These findings agree with those of Hussin (2013) who concluded that visually impaired students who experienced technical difficulties when using Digital Talking Textbooks (DTTs), were discouraged from using DTTs. This finding is further consistent with a study by Holcombe (2000), who concluded that an innovation with less complexity has a higher possibility of being adopted than an innovation with complicated features. Rogers (2003) suggested that although the complexity may not be as important as the other attributes of the innovation, such as relative advantage or compatibility, it is an important barrier to adoption and may influence its implementation and rate of adoption.

A technological innovation might confront faculty members with the challenge of changing their teaching methodology to integrate the technological innovation into their instruction, so it might have different levels of complexity. If hardware and software are user-friendly, they might be adopted quickly for the delivery of course materials (Martin, 2003; Hersh, 2012; Howell & Porter, 2003). When assistive technology appears complex to use this would be expected to reduce its use by the learners..

Literature reviewed indicates that complex assistive technologies may not be easily adopted by the visually impaired learners but those that are easy to use. In Zambia it is not known which assistive technology is easy for the visually impaired and which one is not. Visually impaired learners just use assistive technology that is made available to them, regardless of level of complexity. Hence, the current study sought to investigate this problem.

2.5 Efficacy of assistive technology in accessing and grasping of library information resources by persons with visual impairment

According to Harvey (2004), efficacy is the extent to which an activity fulfils its intended purpose or function. Effectiveness therefore involves producing a desired or

intended result. In the current study, the term **Efficacy** referred to the ability of an assistive technology to enhance the acquisition of library information resources by a learner with visual impairment. It was **high or above average** if the assistive technology enabled the visually impaired learners to perform like their sighted peers, **medium** if the technology did not change performance of the learners in any way and **low** or **below average** if the assistive technology lowered performance of the visually impaired learners.

According to Howell (1996), Kennedy (2002), Merbler, Azar, and Ulman (1999) and Bera (2011), assistive technology has positive effect on students' learning, especially, increasing reading speeds and comprehension rates. It is essential for students with visual disabilities to enhance learning, cognition, and social development (Sze, Murphy, Smith, and Yu, 2004; Wong and Cohen, 201l; Berfield, 2003). Nguyo (2015) supports the above studies in that assistive technology especially JAWS and Dolphin Pen would increase the chances of adoption and have a positive effect on students learning especially increasing their speed of reading. The manual braillewriter is considered effective (or as having had a positive impact on education) because it has provided individuals with visual impairments with access to information (through the ability to write braille) faster than the slate and stylus (Kennedy, 2002; Black, 2011; Mugo et al., 2010).

Wilson (2013) did a study entitled "Students with Learning Disabilities: The effectiveness of Using Assistive Technology". The study focused on the effectiveness of assistive technology devices and software in helping students with learning disabilities. It interviewed an assistive technology specialist and analysed student work samples. The study observed that students with reading and writing disabilities experienced difficulties with literacy tasks throughout the school day. The outcome of the study was that the use of assistive technology supports help to level the playing field for these students.

Kapperman, Stickern and Heinze (2002) describe a study which reviewed experimental group designs. The study was a replication, follow-up and continuation

of the original study by kapperman et al. on the "Effectiveness of the Nemeth code'' that evaluated the effectiveness of a tutorial on a Braille Note for learning the Neth code of braille mathematics notation. Each of the two kapperman studies showed that treatment groups had significantly greater growth in both math reading and math writing than the control group. These two experimental studies identified by this exhaustive review of the literature documented the effectiveness of assistive technology designed specifically to help braille students learn Nemeth math symbols. However, these studies were done in different contexts other than the Zambian context and so the findings may not necessarily apply to Zambia.

Another study on this issue was done by Oira (2016) of Kisumu University Kenya. The main objective was to establish the influence of assistive technology devices (ATDs) on performance of activities by visually impaired school children. The study population comprised six visually impaired school children aged 12 to 14 years old. The participants were subjected to an eye examination, prescribed assistive technology devices comprising optical and non-optical devices, and were provided with orientation on the use of computers. The participants were assessed based on eye/object distance, font size, and time to read a computer screen and printed text. Results were that the ophthalmological conditions included corneal opacity, retino choroiditis, retinopathy of prematurity, aniridia, and congenital cataracts. Far visual acuity varied from 20/200 to 20/800 and near visual acuity from 0.8 to 6 M. Telescopes, spherical lenses, and support magnifying glasses were prescribed. Three out of five participants with low vision after intervention could decrease the font size on the screen computer, and most participants (83.3%) reduced their reading time at the second observation session. Relative to the printed text, all the participants with low vision were able to read text written in smaller font sizes and reduced their reading time at the second observation session. The conclusion was that Reading skills improved after the use of assistive technology devices (ATDs), which allowed the participants to perform their school tasks equal to their classmates. Indeed assistive technology can enable a learner to do things that would not be feasible otherwise and will also enable the student to have a normal or near normal level of fluency. It opens access to activities not available or possible for the disabled learner and will allow a

child to persevere at tasks that would otherwise be too frustrating and time-consuming.

UNESCO (2011, p.30) describes a small survey which was conducted in Grenada on the need for the provision of assistive technology to assist students who were visually impaired. Students were transferred from their special school for the blind into a mainstream school and provided with assistive technology to aid learning such as: Braille printers, specialised keyboards, magnifiers, audio player/recorders and software such as screen readers and text to audio converters. Staff development training was conducted for teachers in the participating schools. Support was provided for teachers and students during the early phase and there were `specialist instructors from the school for the blind to provide support to the teachers and students on a regular basis. The Ministry of education provided all the assistive tools necessary for the study. The Ministry also provided a trained instructor who visited the schools and assisted with the training of the students. The parents of the students were very supportive and indeed so were the staff and the student population. Screen readers proved useful, but they had different strengths and finding the ideal one was also difficult. However, the students were happy to use them. The students remained in the mainstream schools for just over two years before they could take the Caribbean Secondary Education Certificate examinations (CSES). They received an examination that was prepared in Braille and someone was available to read the printed instructions to the students. Five students did very well with four of them attaining a pass rate of 80% and above. The Ministry monitored the project and documented several outcomes including the increased number of students entering mainstream schools, the increased number of blind students taking CSEC Examinations, and also the greater appreciation for technology in education among students and teachers. A conclusion of this initiative was that students with visual impairments are often better off in mainstream schools if the correct assistive tools can be used to enhance how visually impaired learn as well as improve their self-concept and self-esteem.

It is clear from the literature highlighted by UNESCO (2011) about a survey conducted in Grenada that use of relevant effective assistive technology has great potential to enable people with visual impairment to perform like their sighted peers in academic and non-academic work.

A report compiled in Kenya by the Kenya Union for the Blind (2009) shows that Kenya Union of the Blind in conjunction with Sight Saver international enabled education to be accessible to persons with visual impairment, with a view of coming up with youths who had the capacity to carry out training in the use of assistive technology in secondary institutions. Within a period of one year the Kenya Union of the Blind was able to reach at least 30% of the secondary schools and ensured that both the student and the teacher had obtained skills, knowledge and positive attitude to enable them achieve better results. In the programme, effective use of gadgets such as the Dolphin pen was taught and other assistive software such as: JAWS, Non Visual Desktop Access (NVDA) and thunder. These technologies were found to be useful for visually impaired Students. It was also discovered that students with visual impairment should be given every opportunity to participate in school activities to the same degree as any other typically sighted student. The finding in the last study that visually impaired people could be given every opportunity to participate in school activities to the same degree as any other typically sighted student also agrees with the findings from UNESCO (2008) on the usefulness of assistive technology to the visually impaired learners.

Five other studies carried out around the world between 2002 and 2007 investigated the use of computers and role of assistive technologies on quality educational outcomes. The studies administered tests for students with a variety of disabilities, but no consistent findings emerged (Johnstone, Zinesky and Sireci, 2007). Studies indicated that test validity may be compromised under certain accommodated conditions because of interaction effects for students with some disabilities (Fletcher et al., 2006), or because accommodations had a positive scoring effect for all students (Kettler et al., 2005), thus negating the equalizing effect that technology based

accommodations are supposed to produce. Despite the inconclusive nature of accommodations research, exploratory research on technology-enhanced assessments may provide some insights into future directions.

Hansen, Lee, and Forer (2002) conducted a preliminary evaluation of speech output technology tests for individuals with visual impairments and found that self-voicing" testing systems (systems that provide audio cues on demand) have potential and may be capable of replacing human readers in certain testing situations. Likewise, researchers from the Center for Applied Special Technology (CAST) studied impact on student scoring when computer-based read-aloud testing accommodations were used (Dolan, Hall, Banerjee, Chun, and Strangman, 2005). Results of the study indicated a significant increase in scores when students read passages greater than 100 words using technological aids. This clearly indicated that if used carefully, assistive technology could enhance performance of the visually impaired learners in their academic work.

An approach of accommodating students with visual impairments using multi-sensory approach aids was studied by Landau, Russell, Gourgey, Erin, and Cowan (2003). The Talking Tactile Tablet (a math tool with speech output) had a positive impact on the mathematics performance of students who were visually impaired or had difficulty visualizing graphics and diagrams. This study also found that students performed better on five of the eight items when using the Talking Tactile Tablet, and performed the same on the remaining three, indicating that a multi-sensory approach may be an effective approach for assessing students with visual impairments. Therefore, whether technology should be used in classrooms for the visually impaired learners or not, should no longer be the issue in education. Instead, the current emphasis should be on ensuring that technology is used effectively to create new opportunities for learning and to promote student's achievement (Kelly and Stacy, 2009).

There is growing recognition that a person with disability can do equally better in classroom and workplace if equipped with the necessary adaptive and assistive technology (UNESCO, 2008). Siligo (2005) did a study on teaching nonacademic

students with visual impairment and focused on many of the practical tools and information that could make this experience possible. The tools and information discussed by Siligo were intended to enable music educators to fully include students who were visually impaired in the ensemble experience. The study revealed that assistive technology devices developed and built the talents among children with visual impairment in performance arts such as music. Assistive technology devices facilitated social inclusion and enhanced quality of life by helping persons with disabilities to become capable, independent and live a more satisfactory life (Ring 2003).

Whereas all the studies above highlighted a lot of things about the effectiveness of assistive technologies in helping the visually impaired learners in several ways, they did not say anything about the efficacy of such technologies in grasping library information resources by the visually impaired learners in the Zambian context. Hence, this study which addressed among others, the issue of efficacy of assistive technology in grasping library information resources by persons with visual impairment in Zambia. Unless, this is known in the Zambian context, it may not be necessary to use technologies just because they have been effective elsewhere. This is because what is effective in one country may not necessarily be effective in every other country, as effectiveness is dependent on several factors.

2.6 Chapter Summary

Chapter 2 was a review of relevant literature on the subject in question. Although, several studies have been done on the effectiveness of assistive technology, little or nothing is known about the following: effective assistive technologies for grasping library information resources by persons with visual impairment in Zambia; useful library information resources accessed by persons with visual impairment in this country using the available assistive technology; ease of use of assistive technology by persons with visual impairment to grasp library information resources in Zambia and the efficacy of assistive technology in grasping library information resources by persons with visual impairment in this country. Hence, this study addressed the issues above. The chapter that follows describes the research methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Overview

This chapter starts by highlighting philosophical assumptions made by the researcher. After that it describes the research approach, research design, study population, data collection instruments, data collection procedure, validity and reliability of instruments. It also describes how trustworthiness of the findings and data analysis were achieved. Finally it outlines some limitations and delimitations of the study and ends with a chapter summary.

3.2 Philosophical assumptions

The current study generally followed philosophical and methodological pragmatism, which is based on the belief that theories can be both contextual and generalizable by analysing them for transferability to another situation ((Maxcy, 2003, Tashakkori and Teddlie, 2003). According to Morgan (2007, p. 67), pragmatism emphasizes creating ‘‘shared meanings and joint action’’. In the current study, this emphasis pointed to the underlying belief in complementarity, that was, qualitative and quantitative approaches could be combined in order to ‘‘compliment’’ the advantages and disadvantages present within each.

Pragmatism offered several ways to bridge dichotomies that existed in the mixed methods approach used in the study. It broke down the hierarchies between positivist and constructivist ways of knowing in order to look at what was meaningful from both (Biesta, 2010). Addressing the connections between theory and data, the researcher used ‘‘abduction,’’ which ‘‘moved back and forth between induction and deduction—first converting observations into theories and then assessing those theories through action’’ (Morgan, 2007, p. 71).

In ontological terms, the researcher avoided arguing about metaphysical terms such as truth and reality (Tashakkori and Teddlie, 2003). According to her, the value of evaluation was not based on whether she discovered the truth, but on the

demonstration that the results worked with respect to the problem that was being studied (Mertens and Wilson, 2012). Epistemologically, the researcher was free to develop whatever type of relationships with stakeholders which were appropriate for the matter under investigation. She maintained both subjectivity in her own reflections on research and objectivity in data collection and analysis. The nature of the relationship was judged in terms of its ability to get the results of the evaluation used by the intended stakeholders. Methodologically, this philosophical stance had been used to justify the use of mixed methods in evaluation (Morgan 2007, p.80; Tashakkori and Teddlie, 2003). Use of Pragmatism accommodated both the value-free and value-laden nature of the study.

3.3 Research Approach

The study employed a mixed methods approach (i.e. both qualitative and quantitative). Qualitative research is the collection of extensive narrative data on many variables over an extended period of time, in a naturalistic setting, in order to gain insights not possible using other types while Quantitative research is " the collection of numerical data in order to explain, predict and/or control phenomena of interest" (Gay, 1996; p. 623; Gay, 1997). The two approaches are based on the purpose of research, 'different ontological, methodological, axiological and epistemological views', research methods, typical studies, the researcher's role and the importance of context in the study (White, 2005; p. 63).

The study was primarily **qualitative** but with some **quantitative** features to address a particular question. It used the ***concurrent nested strategy*** to mix qualitative and quantitative methods. This involved simultaneous collection of qualitative and quantitative data but with the qualitative methods being dominant and thus guiding the study (Creswell, 2003). The qualitative methods were dominant because the study dealt with data that were principally non numerical (Leedy, 1993). In addition, qualitative research was used because whatever the researcher studied was happening in the real world of participants. Therefore, respondents were expected to describe their everyday experiences relating to their use of assistive technologies in accessing library and information resources at ZLCVI. Where need was, the researcher

interacted with the participants to do the Item Check, present questionnaires, observe the visually impaired learners as they used the assistive technologies and do a Focus Group Discussion with few of them.

On the other hand there were quantitative features to address the fourth research question. The method entailed a deductive approach to determine the relationship between theory and research; It incorporated the practices and norms of the natural scientific model and embodied a view of social reality as an external, objective reality (White, 2005).

The combination of the two research paradigms (qualitative and quantitative) was very helpful in getting sufficient information that would enable the researcher to understand the research problem better (Creswell, 1994).

The research strategy used can be represented diagrammatically by an inner and an outer rectangle as shown in Fig. 3.1.

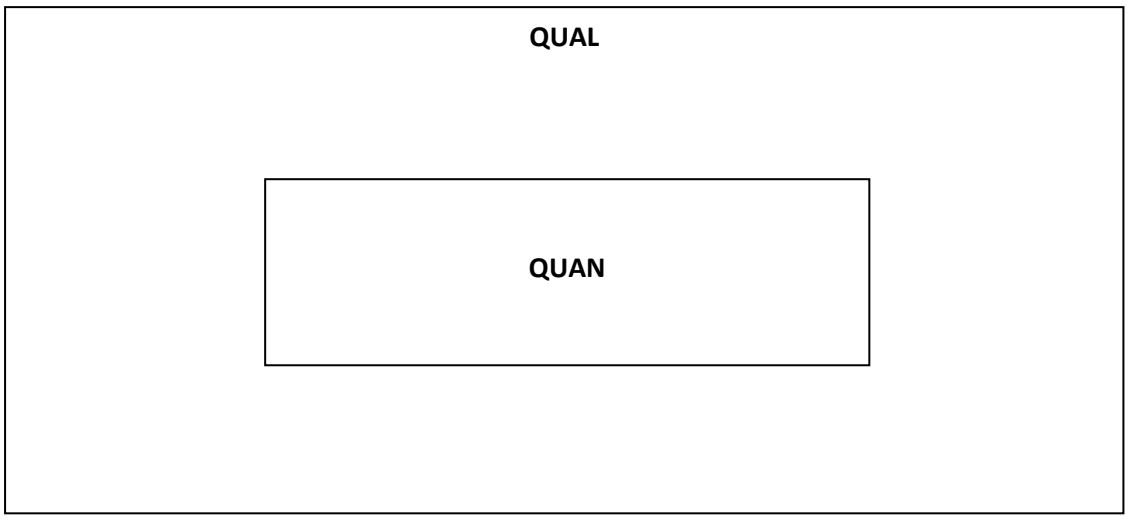

Fig. 3.1: *Concurrent Nested Mixed Methods Strategy with Qualitative Methods Dominant* ***Source:*** *Creswell (2003).*

Here, the outer rectangle represents the dominant set of methods, that is, the qualitative methods indicated by the letters QUAL, while the inner rectangle the less dominant quantitative methods, denoted by the letters QUAN. This approach to research generally follows philosophical and methodological pragmatism (Maxcy, 2003).

The mixed methods strategy above has some advantages: it makes it possible to gain perspectives from different research methods and allows the researcher to collect quantitative and qualitative data simultaneously in a single data collection phase (Creswell, 2003). Despite this, the strategy is limited in the sense that there isn't enough literature to explain how to integrate the data within the analysis phase of the study or how to resolve discrepancies that might occur between qualitative and quantitative data (Creswell, 2003). However, it is not necessary to worry about such limitations because as Ritchie (2003, p. 43) explains, the purpose of mixing qualitative and quantitative methods is not to get the same results from different angles, but rather " to achieve an extended understanding that neither method alone can offer." It is then up to the researcher to explain why the data and their meaning are different". In fact, this is the reason why Darlington and Scott (2002) advised that obtaining such discrepancies should be viewed as an opportunity rather than a constraint, as it may simply indicate that further work is required to understand what is going on, work that can lead to more interesting findings.

3.4 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure (Claire et al., 1962). This means that decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design.

The current study used an Embedded Single-Case study design to obtain in-depth information so as to answer all the questions concerning the current state of the

subject of the study. Creswell (2008) noted that a case study is essential when one is interested in conducting an in-depth exploration of a bounded system for example activity, events, process or individual based on extensive data collection. The choice of this design was driven as noted by Creswell by the unique characteristic of the response to this study.

A case study can be qualitative or/and quantitative (Creswell, 2008). This suited the current study since it collected and analysed both qualitative and quantitative data. A case study can also enable the researcher to get an in-depth understanding of an entity, issue or theme. The ability of a case study to investigate a case or cases in depth and to employ multiple sources of evidence makes it a useful tool for any context where generalisability is less important like this one (Stake, 2008). Case studies can also be used to research questions about process because the use of multiple data sources supports the retrospective investigation of events. These are some of the reasons why the design was used in the current study. Figure 3.2 illustrates the general steps which were used to formalise the research design.

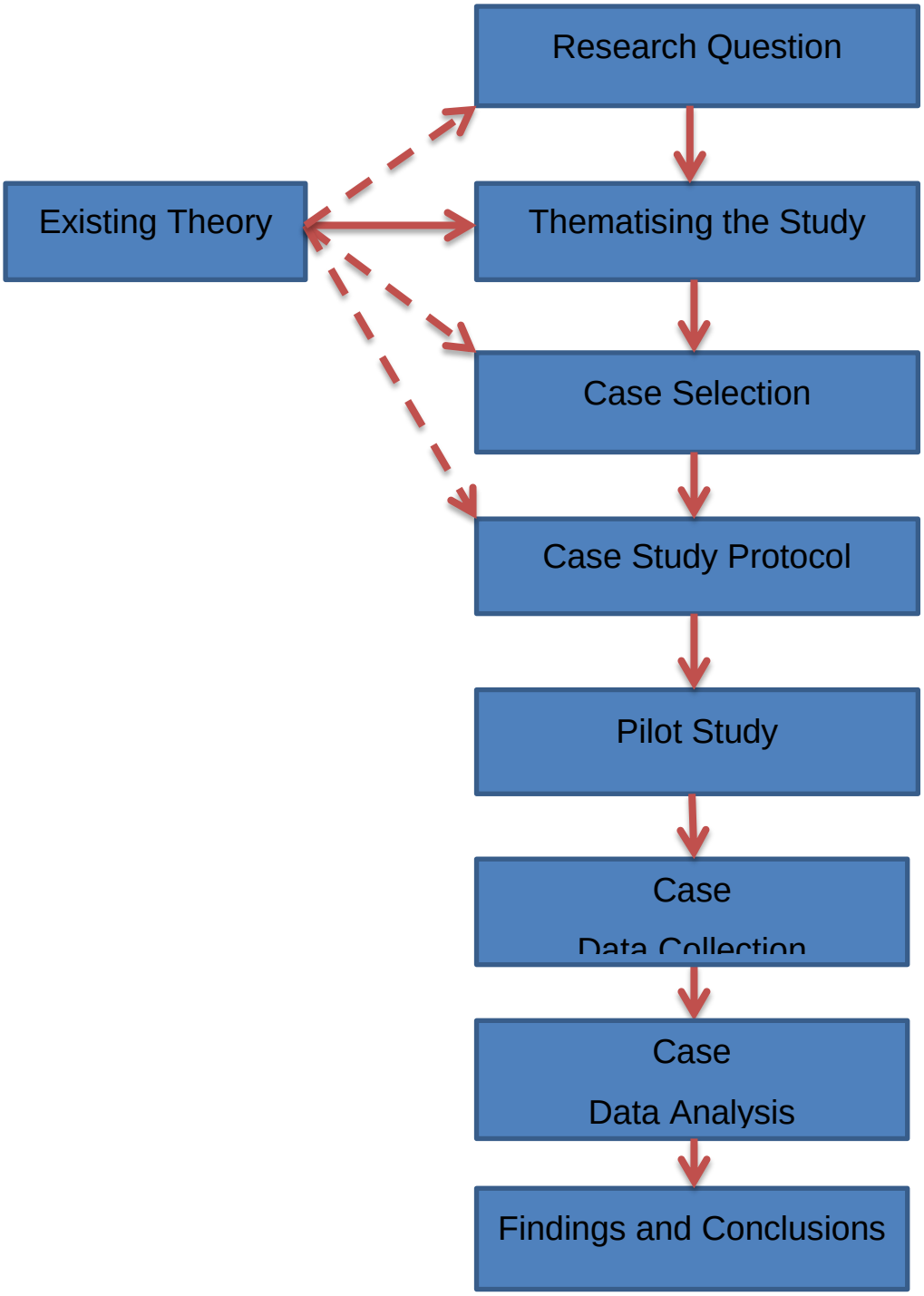

Fig.3.2 *Steps in the embedded single case study research design used in the current study* ***Source:*** *Rose, S; Nigel , N and Canhoto, A.I (2015)*

The design began with formulating appropriate research questions that would shape the structure of the study to come. The Case in the current study was defined as the "**Assistive technology** used by the visually impaired learners at ZLCSCVI". The case formed the unit of analysis for the study. Research questions made it clear what aspects of the case were of interest as it was not feasible to investigate every aspect of the chosen case. The design also involved engaging with existing theory by Davies (1996). In practice the degree of formal theorising varied and so the step was called 'thematising', borrowing the term from Kvale and Brinkmann (2009, p.106) to recognise that prior theory may be used in various ways in case study research. Theory was commonly used as an initial guide to design and data collection, to create a theoretical framework which took account of existing knowledge in the area.

Before starting the field research, the researcher prepared **a case study protocol**. This was a written statement of what she was trying to achieve and how she was planning to achieve it. It was a project plan for her case study fieldwork. It provided a clear link between her research questions, the data needed to answer those questions, and her plan for collecting and analysing that data. Preparing the protocol allowed the researcher to anticipate potential problems in the proposed research so that she could devise strategies in advance for dealing with them. The aim was to facilitate systematic data collection across the different data sources, whilst still allowing flexibility to respond to emerging issues during fieldwork. Typical headings for the case study protocol were as shown in Appendix E.

Before starting on the main cases, the researcher carried out a pilot study to explore both the substantive topic and method issues. This sharpened the focus of the research and ensured that the researcher's intended field procedures were effective.

Data collection for the individual case studies followed those rules and guidelines for collecting data relevant to each of the types of data to be used. A uniform way of recording data was used since that would help with both analysis and reliability. The researcher set up a case study database to manage the evidence that was collected, whether this evidence was in electronic or paper format. The database acted as a

repository for her own emerging ideas, for example initial thoughts on possible answers to the research question. Analysis proceeded iteratively with data collection, although the researcher was careful to avoid 'premature closure' by reaching conclusions too early without thorough evaluation of all of the data (Hartley 2004). Cross-case analysis was carried out when the analysis of individual cases was completed.

Finally, findings and conclusions were presented. Description and narrative were included as much as possible. Individual cases were described around objectives. Cases were described separately. Tabular presentation, summarising key features of each case, were also useful.

One of the greatest strengths of the case study design is its adaptability to different types of research question and to different research settings. The use of multiple sources of evidence allows triangulation of findings which, according to Yin (2009), is a major strength of the case study design. Case studies also offer the benefit of studying phenomena in detail and in context, particularly in situations where there are many more variables of interest than there are observations. Another potential advantage of case studies is that the format may make the research accessible to wider readership than some other designs.

Nevertheless, case study research has its limitations. One technical issue is a variant of what is known as **selection bias** whereby the choice of cases biases the findings of the research, particularly with respect to excluding cases that contradict favoured theory. Another concern raised is generalisability, particularly of single case studies. Certainly, if the research findings need to be generalised statistically then a case study approach is not suitable although other forms of generalisation may be employed. A further concern about case study design is that since neither experimental nor statistical controls can be used in case study research, internal validity (at least as it is understood in quantitative research) may be hard to establish. Many of these concerns apply to qualitative research more broadly and it is important when evaluating case study research not to interpret them exclusively through the 'prism of statistical methods' (George and Bennet 2005, p. 22).

3.5 Study sites

The Research was conducted at the Zambia Library, Cultural and Skills Centre for the Visually Impaired, ZLCSCVI, in Lusaka. This place was chosen because at the time of the study, it was the only library that offered training in the use of assistive technology for accessing library information resources by the visually impaired learners in Zambia.

3.6 Study population

The population comprised learners with visual impairment who did training in assistive technology at ZLCSCVI for accessing library information resources and all the persons who trained them.

3.7 Sample size

The sample consisted of 3 persons who provided training in assistive technology at ZLSCVI and 17 learners ZLCSCVI. A total of 20 people were picked as a sample because they had the required characteristics for the study and according to Gay (1996).

3.8 Sampling technique

Purposive sampling was used to select participants (both users and providers of technology at ZLCSCVI so that reliable data could be collected during the study in order to answer the questions objectively. Purposive sampling represents a group of different non-probability sampling techniques**.** Also known as judgmental**,** selective **or** subjective sampling, purposive sampling relies on the judgement of the researcher when it comes to selecting the units (e.g., people, cases/organisations, events, pieces of data) that are to be studied. The technique was used because the sample being investigated was quite small, especially when compared with probability sampling techniques**.**

Unlike the various sampling techniques that could have been used under probability sampling (e.g., simple random sampling, stratified random sampling, etc.), the goal of purposive sampling is not to randomly select units from a population to create a

sample with the intention of making generalisations (i.e., statistical inferences) from that sample to the population of interest. This is the general intent of research that is guided by a quantitative research design. The main goal of purposive sampling is to focus on particular characteristics of a population that are of interest, which will best enable you to answer your research questions. The sample being studied might not have been representative of the population, but for researchers pursuing qualitative or mixed methods research designs, this is not considered to be a weakness. Rather, it is a choice, the purpose of which varies depending on the type of purposive sampling technique that is used. Specifically, the study used homogeneous sampling, in which units were selected based on their having a similar characteristic (all visually impaired or being instructors of technology) because such a characteristic was of particular interest to the researcher.

3.9 Data collection instruments

The study used four data collection instruments. The first one was a technology checklist for instructors of technology shown in appendix A, on page 90. The document contained a list of assistive technologies. Participants were to tick Yes or No depending on whether they had such a technology at ZLCSCVI or not. The findings would help the researcher to identify the nature of technologies available for persons with visual impairment at the named place.

The second instrument used in the study was a focus group discussion guide for learners with visual impairments, as shown in appendix B, on page 92. The document had 8 main questions, some of which had sub questions used for probing. The findings from this instrument helped to answer all the four research questions.

The third instrument used in the study was the semi structured questionnaire for instructors of technology at ZLCSCVI, shown in appendix C, on page 96. The instrument had 8 main questions, some of which had sub questions. The questions and their sequence were determined in advance. The findings from this instrument helped to answer all the research questions of the study.

The fourth and last instrument used by the researcher was an observation schedule for the researcher, in appendix D, on page 101. This was used in order for the researcher to physically observe the assistive technologies at ZLCSCVI, how useful they were, how easy it was to use them and their efficacy. The instrument had four key questions which guided the researcher. The findings helped to answer all the research questions of the study. Four instruments were used so that findings from various sources could be triangulated in order to check for their trustworthiness.

3.10 Data collection procedures

The researcher got permission from the University of Zambia to conduct a study at ZLCSCVI. After that she obtained permission from the Officer in charge of the Library at ZLCSCVI to conduct research there. Then, she explained the purpose of the study to participants. During the study, she looked at the available technologies using the Technology checklist; observed the use of technology by the visually impaired learners (who did assistive technology training there), conducted a focus group discussion with the visually impaired learners who used the technologies and finally administered a semi-structured questionnaire to persons in charge of technology.

3.11 Validity and reliability of instruments

Before the main study, a pilot study was done to ensure that the instruments were checked for validity. Three experts went through the instruments and helped to improve them by editing the grammar and refining few questions which were not good enough. A test-retest method was used to determine the reliability of the instruments. In order to do that, the instruments were administered to four people who were not part of the sample and then administered to them again a week later. The two sets of responses were correlated in Excel to get coefficients of reliability. The values obtained were above 0.81, 0.83, 0.83 and 0.85), a clear indication that the instruments were reliable.

3.12 Trustworthiness of findings

The researcher checked for trustworthiness of findings by: triangulating the findings, considering rival explanations for the same issues, prolonged engagement, persistent observations, peer debriefing and member checks. Triangulation and member checks were the primary and commonly used methods to address credibility.

Triangulation was accomplished by asking the same research questions of different study participants and by collecting data from different sources and by using different methods to answer those research questions. Member checks occurred when the researcher asked participants to review both the data collected by research assistants and the researchers' interpretation of that interview data. Participants were generally appreciative of the member check process, and knowing that they would have a chance to verify their statements tended to cause study participants to willingly fill in any gaps from earlier discussions. Trust was an important aspect of the member check process.

3.13 Data analysis

(a) Analysis of qualitative data

Analysis of qualitative data

The study analysed qualitative data thematically, for the following reasons:

- Firstly, thematic analysis is flexible in both inductive and deductive methodologies (Frith and Gleeson 2004; Hayes 1997).
- Secondly, thematic analysis is appropriate when the study like this one aims to understand the current practices of any individuals
- Finally, thematic analysis provides the opportunity to code and categorise data into themes. Processed data is displayed and classified according to its similarities and differences (Miles and Huberman 1994). The process includes coding, categorisation and noting patterns.

The current study used the **Miles** and **Huberman** (1994) model of the ***thematic analysis process***. The analysis was done in three link stages or ‘streams’, namely: data

reduction, data display and data conclusion-drawing/verifying as illustrated by Table 3.3.

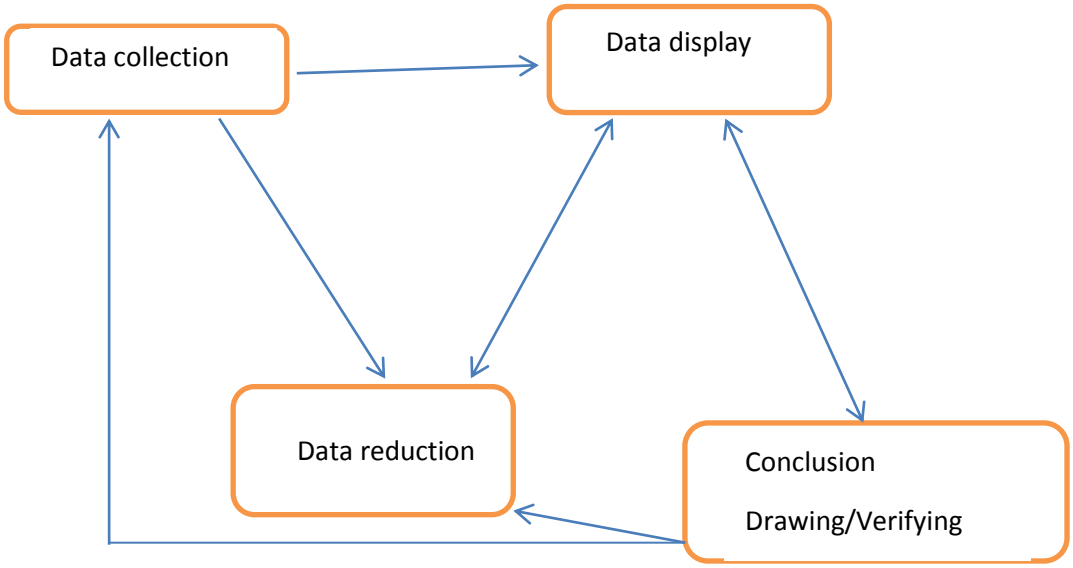

Fig. 3.3 ***Miles*** *and* ***Huberman*** *(1994) model of the* ***thematic analysis process****.*

Data reduction here refers to the process of choosing, focusing, simplifying, building and transforming data (Miles and Huberman, 1994). During this stage, new thoughts and ideas were developed in terms of what should be included in the data display. Data display is described by Miles and Huberman (1994) as,"An organised, compressed, assembly of information that permits conclusion drawing and action" (p. 11).

Importantly this stage focused on visualising the data by using a number of different display techniques, such as, narrative text, figures and tabulating differences. The advantage of utilising different data display techniques made the description of the comparisons. In addition, it also increased the overall validity and reliability of the research. Presenting different techniques aimed to provide evidence, support and validate interpretations.

The final stages of the data analysis process were linked by arranging and organising the research's concepts and thoughts. This was achieved by building coherent findings and drawing structures of the results from the data that were displayed (Creswell,

2007;Miles and Huberman, 1994). The following sub sections explain how thematic analysis was done in detail.

(a) Data Reduction

As already mentioned, data reduction was the first stage in data analysis. It was done to *sharpen, sort, focus, discard, and organize data in such a way that "final" conclusions could be drawn and verified.* It involved **selecting**, **simplifying** and **transforming** the data. Reducing and transforming data were achieved in different ways, such as *through selection and through summary or paraphrase.* The procedure of data reduction was performed in such a way that conclusions were drawn and verifications were completed. Furthermore, coding was done by assigning table units to the data that could be collected from the participants whether it was a single statement or a longer answer. The main purpose of coding was to make connections between different parts of the data. Coding was derived from the participants' responses, e.g. statements and reports and it categorised information with the aim of framing it as theoretical perceptions. Coding allowed the researcher to review the whole of the data by identifying its most significant meaning or to put it simply what the data tried to say or told the researcher. There were three phases in Data reduction, each reducing the data in a different way.

First phase for data reduction:

After collecting the data, the researcher tabulated it using Microsoft Word prior to preparing and organizing the content of data. This meant that the data were ready to be analysed word-by-word, using the tables to show any significant patterns or themes. Data were read twice, which was done for the following reasons:

i. It allowed the researcher to appreciate the full picture and make connections between the participants' thoughts, ideas and the data collected through observations.

ii. Reading prior to starting analysis allowed the researcher to identify and have more time to evaluate the data thereby preventing precipitous conclusions.

Second phase of data reduction

This phase involved highlighting the sentences from each participant that could be used, for example, e.g. to answer the study's questions by taking 'excerpts from the participant's full text'.

Keeping an eye on the study's questions during data collection and analysis assisted the researcher to identify accurately '*excerpts'* that related to the research's objectives.

Third phase of data reduction

This phase involved using the highlighted sentences and then breaking the data into smaller segments or themes. These segments or themes referred to the sentences of a paragraph. This established the first themes from the data.

The researcher read the full content again in order to compare, contrast and/or search for missing information that had not appeared in the first level of the themes. This procedure made the themes clearer and more understandable in terms of the researcher's focus.

(b) Data display

The second main step of the Miles and Huberman Model (1994) is data display, which is "*the organized, compressed assembly of information"*. In the current study, it aimed to make sense of the data that was collected. Data display organised data, helped to arrange concepts and the thoughts.

Following theme reduction, the researcher reviewed the research questions to identify any information that related to similar concepts. In addition, displaying the data served a number of purposes such as:

i. The ability to view and enhance the data more clearly for the research
ii. To avoid data overload during the process of analysis
iii. Making sense of the data that had been collected by displaying related concepts from different statements

All the data that related to each question was organized and presented in order. This allowed the researcher to explore any differences, similarities and interrelationships by entering the data into conceptual clusters for analysis. Data display was used

descriptively to gain conceptual coherence by collating items that related to each research question.

Data was displayed using a variety of techniques in order to facilitate its analysis i.e. figures, tables, graphs, charts, narrative text and quotations with the aim of a*ssembling organised information into an accessible and compact form so that the* researcher *could see what was happening and either drew justified conclusions or move on to the next step of analysis.*

Displaying the data in a variety of ways e.g. tables, figures and theme maps provided opportunities to gain an extra in-depth understanding of the data. In addition, direct quotations provided supportive meaning to the data's interpretation for some statements (Patton 2002). Utilizing different data display techniques and gradually framing it, enabled the researcher to focus and organise her thoughts by linking and comparing the information to reach conclusions (Miles and Huberman 1994).

(C) Data drawing and conclusions

This was the third and final step of this analysis. It included:

i. The notation of any patterns or themes and the relevance of any statement especially if similar or contrasting
ii. Grouping or establishing categories of 'information that could go together'
iii. Identifying interrelations among factors and variables
iv. Building conceptual coherence and consistency, which at the end was used to explore the validity of the findings so that they could fit the theoretical framework of the study.

(b) Analysis of quantitative data

Quantitative data on efficacy was analysed using descriptive statistics, namely modes and percentages. Firstly, as already indicated in chapter 1, the term efficacy in this study referred to the ability of an assistive technology to enhance the acquisition of library information resources by a learner with visual impairment. It was **high** if the assistive technology enabled the visually impaired learners to perform (access and grasp things on computers) like their sighted peers, **medium** if the technology did not

change performance of the learners in any way and **low**, if the assistive technology lowered performance of the visually impaired learners. Therefore, to determine efficacy of assistive technology, the current study first used a likert scale and from the responses both the instructors and visually impaired learners gave, modes and percentages were computed, which indicated whether the efficacy was high, medium or low.

An experimental design could have provided more evidence in which assistive technology should have been used as a treatment between pre and post-tests for visually impaired learners. This could have helped the researcher to see if there was a statistically significant difference in performance after administering the treatment to learners but time could not allow. However, to confirm the level of efficacy, during the observation, the researcher compared what the visually impaired learners did to those normally done by sighted peers on computers. Furthermore, she compared the time they took to access library information resources on computers using assistive technology to that normally taken by sighted peers.

Quantitative data on the ease with which persons with visual impairments access library information resources was analysed using modes computed from responses given in the likert scale.

3.14 Limitation of the study

The study was limited by the design, that could not allow generalisation of the findings to a larger context.

3.15 Delimitation of the study

The study took a month as the researcher was a student and so needed to complete the work in a shorter period of time so that she could attend to other academic issues.

3.16 Ethical Issues

In research, certain types of behaviour that may cause damage to participants in any way are not allowed. Therefore, in the current study, ethical clearance was sought and respondents remained anonymous in the sense that they did not use their actual names but ID numbers for record purposes. As a result, no one could easily identify a response with a given respondent.

Secondly there was a lot of confidentiality as no information from respondents was made public. Information was given anonymously to ensure that there was privacy. All possible methods of protecting the respondents were applied. They were also informed that participation or non-participation in the study had no effect on their training programme. The researcher ensured that no participant experienced mental or physical discomfort. Informed consent was obtained after placing a lot of emphasis on accurate and complete information so that subjects fully understood and consequently were able to make a voluntary, thoroughly reasoned decision about their possible participation. Therefore, participants were not forced to take part in the study but did so willingly. They were aware of their entitlement to refuse any stage for whatever reason and to withdraw data just supplied. All the questionnaires were issued and collected by the researcher. Finally, there was no deception that is, representing the research as something other than what it was because that was undesirable in the study.

3.17 Chapter summary

This chapter presented the methodology of the current study. The chapter that follows presents the findings in line with the objectives of the study.

CHAPTER FOUR

FINDINGS OF THE STUDY

4.1 Overview

Chapter 4 presents the findings of the study in line with the research questions. It starts with findings on Assistive Technologies available at ZLCSCVI in section 4.1. This is followed by section 4.2 which presents the findings about the useful library information services accessed by the visually impaired learners at ZLCSCVI. Section 4.3 presents the findings on ease of use of the available Assistive Technologies at ZLCSCVI. The last section, 4.4, presents findings on the efficacy of the available Technologies at ZLCSCVI in grasping library information resources.

4.2 Assistive Technologies available at ZLCSCVI

Below is the first research question which the study sought to answer:

" What assistive technology is available for persons with visual impairment at ZLCSCVI in Lusaka?"

In order to answer this question, the researcher used findings from four research instruments, namely: Technology checklist, Instructor's questionnaire, Focus Group Discussion guide and observation schedule as shown in the following subsections:

4.2.1 Findings from technology checklist

The technology checklist contained a list of assistive technology as shown in appendix A, on page 88. Participants were to tick **Yes** or **No** against each technology depending on whether they had such a technology at ZLCSCVI or not. The findings were to help the researcher identify the nature of technologies available for persons with visual impairment at the named place. Participant I1 ticked the technologies shown in Table 4.1.

Table 4.1 *Assistive technology available at ZLCSCVI as indicated by participant I1*

Assistive Technology	**Available at ZLCSCVI**		
	Yes	**No**	**Do not know**
Closed–circuit Television Magnification (CCTV)	✔		
Eye Pal Solos		✔	
Victor Reader Stream		✔	
Victor Reader Stratus		✔	
Screen Reader	✔		
Windows Magnifier	✔		
Windows Narrator	✔		
JAWS (Job Access With Speech)	✔		
Zoom Text Magnifier	✔		
NUDA		✔	
Thunder	✔		
Super NOVO			✔
Optical Character Recognition	✔		

Non-Visual Desktop Access	✔		
Peckins Brailler	✔		
Transcriber	✔		
Writing frame	✔		

Participant I2 ticked the assistive technology shown in Table 4.2.

Table 4.2 *Assistive technology available at ZLCSCVI as indicated by participant I2*

Assistive Technology	**Available at ZLCSCVI**		
	Yes	**No**	**Do not know**
Closed–circuit Television Magnification (CCTV)	✔		
Eye Pal Solos		✔	
Victor Reader Stream		✔	
Victor Reader Straturs		✔	
Screen Reader	✔		
Windows Magnifier	✔		
Windows Narrator	✔		

JAWS (Job Access With Speech)	✔		
Zoom Text Magnifier	✔		
NUDA		✔	
Thunder	✔		
Super NOVO		✔	
Optical Character Recognition	✔		
Non-Visual Desktop Access	✔		
Peckins Brailler	✔		
Transcriber	✔		
Writing frame	✔		

Participant I3 ticked the technologies shown in Table 4.3

Table 4.3 *Assistive technologies available at ZLCSCVI as indicated by participant I3*

Assistive Technology	**Available at ZLCSCVI**		
	Yes	**No**	**Do not know**
Closed–circuit Television Magnification (CCTV)	✔		
Eye Pal Solos		✔	
Victor Reader Stream		✔	
Victor Reader Strators		✔	
Screen Reader	✔		
Windows Magnifier	✔		
Windows Narrator	✔		
JAWS (Job Access With Speech)	✔		
Zoom Text Magnifier	✔		
NUDA			✔
Thunder	✔		

Super NOVO			✔
Optical Character Recognition	✔		
Non-Visual Desktop Access	✔		
Peckins Brailler			✔
Transcriber	✔		
Writing frame	✔		

It was clear from the findings in Tables 4.1, 4.2 and 4.3 that the following technologies were available at ZLCSCVI for visually impaired learners: Closed–circuit Television Magnification (CCTV), Screen Reader, Windows Magnifier, Windows Narrator, JAWS (Job Access With Speech), Zoom Text Magnifier, NVDA, Thunder, Super NOVO, Optical Character Recognition, Non- Visual Desktop Access, Peckins Brailler, Transcriber and Writing frame as all the participants (3) ticked these technologies in the checklist. Peckins Brailler and Super Novo were probably there but not availed to all instructors for reasons best known to the Centre staff. NUDA, Eye Pal Solos, Victor Reader Stream and Victor Reader Stratus were not there and if they were, no instructor knew about them.

4.2.2 Findings from Instructors' questionnaire

Instructors were given a questionnaire shown in appendix C, page 96, in which the first two questions aimed at verifying the findings in Tables 4.1, 4.2 and 4.3. The questions and participants' responses were as follows:

Question 1:

Are there assistive technologies at this library for learners with visual impairment?

	Yes	No
Please tick		

Responses:

Participant	Yes	No
I1	✔	
I2	✔	
I3	✔	

All participants **I1**, **I2 and I3** ticked the answer **Yes**. This meant that ZLCSCVI had assistive technologies for visually impaired learners.

Question 2

If your answer to question 1 is Yes, in the table below state the assistive technologies and their purpose.

Responses

Participant I1 indicated the responses shown in Table 4.4.

Table 4.4 Assistive technologies and their purpose as indicated by participant I1.

S/N	Assistive Technology	Purpose
1	Closed –circuit Television Magnification (CCTV)	Makes text and graphics look big and reads aloud what is displayed on the screen.
2	Screen Reader	Changes letters, words and sentences to digital speech
3	Windows Magnifier	Makes screen big so that words and images are easier to see

4	Windows Narrator	Reads aloud the text that appears on screen, and describes error messages.
5	JAWS (Job Access With Speech)	It reads aloud what is displayed on the computer screen. It narrates everything one is viewing on the computer
6	Zoom Text Magnifier	It enlarges font and other things to suit the reader.
7	NVDA	Enables the VI persons to use PCs without any assistance from anyone by reading what is on the screen.
8	Thunder	This behaves like JAWS and NVDA
9	Super NOVO	This one enlarges Icons on a computer
10	Optical Character Recognition	Reads out what is on the screen.
11	Non-Visual Desktop Access	Reads aloud what is being presented
12	Peckins Brailler	This is used as a typewriter
13	Transcriber	This is used to install data on a flash and then remove the data into braille.
14	Writing frame	This is used for writing

Participant I2 indicated the responses shown in Table 4.5

Table 4.5 Assistive technologies and their purpose as indicated by participant I2.

S/N	**Assistive Technology**	**Purpose**
1	Closed –circuit Television Magnification (CCTV)	This enlarges text and other things on a computer screen.
2	Screen Reader	Reads what is on a computer
3	Windows Magnifier	Makes things on a screen look big
4	Windows Narrator	Reads aloud things on the screen
5	JAWS (Job Access With Speech)	It reads aloud things on the computer screen.
6	Zoom Text Magnifier	Makes things on a screen look big.
7	NVDA	Reads aloud what is on the screen.
8	Thunder	Reads aloud what is on a screen.
9	Super NOVO	Makes things on a computer look big
10	Optical Character Recognition	Reads things on the screen.
11	Non-Visual Desktop Access	Reads things on ascreen
12	Peckins Brailler	Used for typewriting

13	Transcriber	Used for transcribing data
14	Writing frame	Used for writing

Participant I3 indicated the responses shown in Table 4.6

Table 4.6 Assistive technologies and their purpose as indicated by participant I3.

S/N	**Assistive Technology**	**Purpose**
1	CCTV	Can enlarge anything on a screen for people to see clearly.
2	Screen Reader	Enables blind students to read what is on the screen. They will know the sentences well.
3	Windows Magnifier	This magnifies what is on the screen
4	Windows Narrator	This reads screen content.
5	JAWS (Job Access With Speech)	This reads what is on a screen loudly for students to hear.
6	Zoom Text Magnifier	Magnifies screen content
7	NVDA	Reads screen content
8	Thunder	This reads screen content loudly
9	Super NOVO	This magnifies screen content

10	Optical Character Recognition	This reads screen content.
11	Non-Visual Desktop Access	This reads screen content
12	Peckins Brailler	This serves as a typewriter for the visually impaired
13	Transcriber	This serves to transcribe
14	Writing frame	This is mainly for writing

It was clear from the responses given by participants I2 and I3 in Table 4.5 and 4.6 respectively that several assistive technologies were available at ZLCSCVI. Below is an extract from Table 4.6 indicating the available assistive technologies at ZLCSCVI.

CCTV
Screen Reader
Windows Magnifier
Windows Narrator
JAWS (Job Access With Speech)
Zoom Text Magnifier

NVDA
Thunder
Super NOVO
Optical Character Recognition
Non-Visual Desktop Access
Peckins Brailler
Transcriber
Writing frame

The main purposes of such technologies were to: enlarge screen content for those who were partially blind and read the same content aloud for those who could not see. In that case all the visually impaired learners could access and grasp what was on the computer without any problems.

4.2.3 Findings from Focus group discussion with the visually impaired learners

The researcher had a focus group discussion with the visually impaired learners (**Appendix B, page 92**), in which the first two questions aimed at verifying the findings from instructors on the assistive technologies available at ZLCSCVI. The questions and participants' responses were as follows:

Question 1:

Are there any assistive technologies at this library that you have been trained to use?

	Yes	**No**
Please tick		

Response:
All of them (17) agreed that there were assistive technologies at ZLCSCVI that they had been trained to use. This showed that ZLCSCVI had assistive technologies for visually impaired learners.

Question 2

Since your answer to question 1 is Yes, state the technologies and their purpose.

Responses

Participants gave the answers as paraphrased in Table 4.7

Table 4.7 Assistive technology and their purpose as indicated by VI learners.

S/N	**Assistive Technology**	**Purpose**
1	Closed –circuit Television Magnification (CCTV)	Magnifies text and graphics. Furthermore, it reads aloud what is displayed on the screen.
2	JAWS (Job Access With Speech)	Reads aloud what is displayed on the computer screen.
3	NVDA	Enables learners to use computers without any assistance from instructors by reading what is on the screen.
4	Super NOVO	This one enlarges what is on a computer
5	Peckins Brailler	This is used for typewriting
6	Transcriber	For storing and retrieving data from

		storage media like flashes
7	Braille note takers	For writing any material

Findings from the visually impaired learners on the questions above indicated that although their instructors claimed that there were at least 14 assistive technologies at ZLCSCVI, very few (7) were availed to the learners to help magnify the text and graphic material and read aloud what was displayed on the computer screen for all them to know.

4.2.4 Findings from Observation schedule

After administering a technology checklist to the instructors, questionnaire to the instructors and the focus group discussion guide to visually impaired learners, the researcher was on the ground to observe the assistive technologies all the participants claimed the institution had. She was only shown JAWS installed on the computers in the photo that follows. She was informed that JAWS was the assistive technology mostly used by learners at ZLCSCVI followed by NVDA. Figure 4.1 below shows the inner part of the computer room observed at ZLCSCVI during the study.

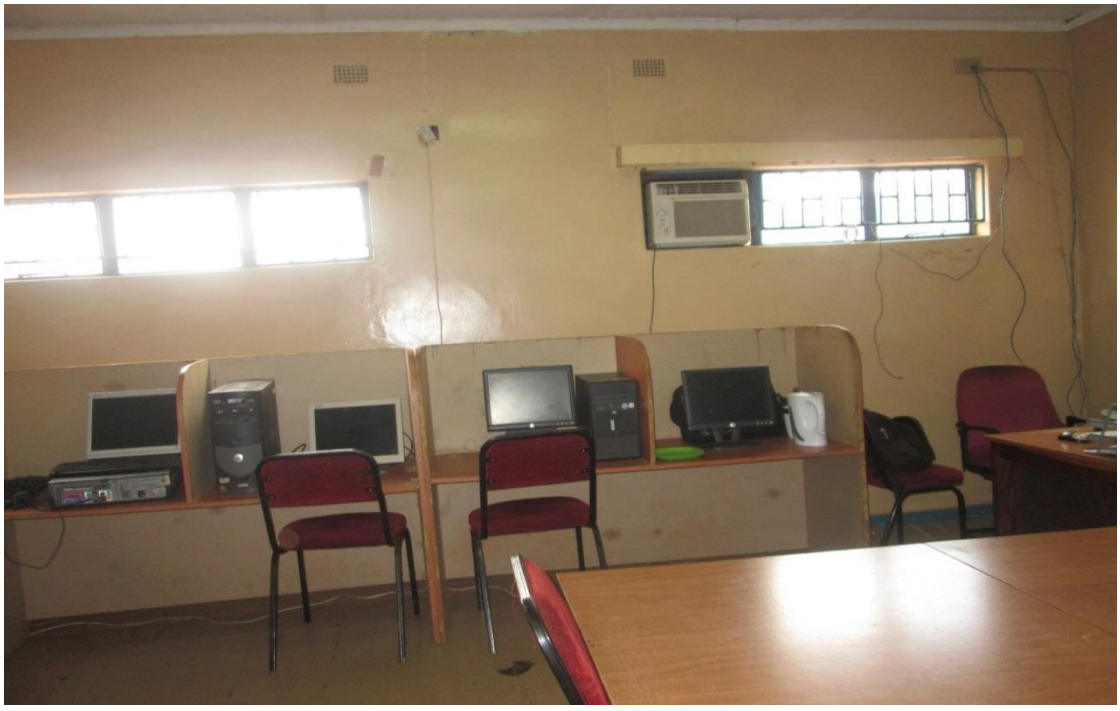

Fig. 4.1 *Photo of the inner part of the Computer room observed in the study*

This findings meant that although there were several technologies at ZLCSCVI, most of them were not in use. The most popular ones were JAWS followed by NVDA. It could be that these technologies were the best at that library in terms of magnifying and reading aloud computer screen content.

4.3 Useful library information resources accessed by the visually impaired learners at ZLCSCVI using the available assistive technology

Below is the second research question which the study sought to answer:

"What useful library information resources are accessed by persons with visual impairment at ZLCSCVI using the available assistive technology?"

In order to answer this question, the researcher used findings from two research instruments, namely: Instructor's questionnaire and the Focus Group Discussion guide as shown in the following subsections:

4.3.1 Findings from Technology Instructors

In the questionnaire (Appendix C, page 96), instructors of technology were asked several questions regarding useful library information resources accessed by visually impaired learners at ZLCSCVI using the available assistive technology. Their responses indicated that JAWS and NVDA enabled learners to access academic materials such as e-books, websites, simulations, PDF documents and other materials in all subjects, music for entertainment, WhatsApp for socialisation, E-mail for communication, Word documents for writing assignments, spreadsheets for calculations and all other things which the sighted peers accessed on computers

They made the following narratives:

I1:

- *"Our learners use JAWS and NVDA to access academic materials such as books and other kinds of literature both academic and non-academic." These technologies manage to do so by reading aloud what is displayed on the computer screen".* Learners *are able to follow e.g. if the VI is typing or*

calculating something on the computer he/she is able to hear whatever is displayed on the screen."

I2:

- *"At ZLCSCVI, JAWS and NVDA help learners with visual impairment who have been trained to use these technologies in research on academic assignments for those in secondary schools and tertiary education using the internet websites, PDF documents." In turn learners perform better in class than they do without such technologies.*

I3:

- *"JAWS helps learners at our institution to socialise, communicate and in their daily activities through e-mails, WhatsApp, Music etc.". Learners can share their experiences and help each other in many ways including school work.*

It was clear from these narratives that with the help of JAWS and NVDA on computers, learners accessed various useful academic and non-academic materials and were able to communicate and socialise with each other because the assistive technology read aloud whatever the learners did on computers. This also helped instructors to ensure that teaching of whatever content they presented to learners was effective. Learners were able to access and grasp whatever was accessed because of the assistive technologies, without which this could not have been possible.

4.3.2 Findings from Learners

In questions 1 to 6 of the focus group discussion (Appendix B, page 92), all learners stated that there were assistive technologies at ZLCSCVI which they had been trained to use. The majority of them (84%) stated that most of the assistive technologies at ZLCSCVI provided useful academic and non-academic resources, as shown by the following narratives made by participants L1 to L11:

L1: *"Using assistive technology, we find almost all the materials we need to move forward in our academic work. We are knowledgeable on how to search for materials on computers in time."*

This point was consolidated by other respondents who gave examples of assistive technologies and the services they provided as follows:

L2: ***NVDA*** *– When writing our academic essays (assignments) and trying to browse through PDF copies they do assist us to get the information we need because they are the ones that read aloud through the software embedded inside and then we are able to access the accurate information that we need. They act as our readers especially JAWS. "With* ***JAWS*** *am able to communicate with sighted people. When given an assignment about anything, I just type and send them to the other person with the help of JAWS" by E-mail.*

*L3****:*** ***Transcriber_*** *With the help of the transcriber I have been able to read any form of literature whether social or academic. It has helped me not to remain behind in my daily activities."*

L4: ***Peckin's Brailler*** *_ This has been useful in the sense that we are now able to type materials in our language. There is no need for a third party. We just type or calculate and read the material on our own.*

L5: ***Brail Notetakers*** *_ We are able to write any material that we want. This has really been useful because we choose what we can write and how to phrase it on our own. We write notes that are valuable and authentic in our studies."*

*L6: "****CCTV and Super NOVO*** *have been helping us to go through our work and perform just like our friends who can see by way of enlarging the text. We are able to compete just like our friends who can see in class because without its help it cannot be possible to clearly see the text."*

It was clear from these narratives that with the help of assistive technologies learners were able to: access any material they wanted on computers, type academic work such as assignments, read any documents, do some calculations, write notes and communicate by E-mail.

L7 added the following, "*We access all academic materials, everything that we find in the school syllabus; We access Biology, science, English, civic education, R.E, Geography, History textbooks etc; Anything school related while L8 said that assistive*

technologies enabled them to access modules for: psychology, curriculum studies, etc." The former was from a secondary school while the latter was from a tertiary institution. Their expressions confirmed what other learners had already stated that assistive technologies assisted learners to access academic materials.

L9 added something slightly different by saying " *We get information sometimes that is in form of just illustrations on a topic may be in form of a video with illustrations and like that we get a clearer picture of what is being talked about with the help of CCTV of course".* This meant assistive technologies provided material that served as visual or learning aids to learners.

The learners reiterated that the services accessed using the available technologies at ZLCSCVI were useful. L10 said *" They are able to help us when studying, they read out the materials, also when typing we are able to detect mistakes with their help. But there are also times when the software cannot read certain pages online.* This could mean that even though the technologies were useful, in some cases learners experienced some challenges.

L11 also added something new by saying, *"Software like JAWS and NVDA have made our lives easy. There is no need to focus on braille, which is a bit involving. Apart from being easy to use and providing academic materials we also use NUDA and JAWS for socialising via WhatsApp."* This meant that learners did not only use assistive technologies for academic work but also for socialising.

The researcher observed learners using assistive technology to access a lot of information on desk and laptop computers like sighted people. Computers read aloud everything that was accessed in a way for the visually impaired learners to understand. They downloaded materials in various subjects and courses and used those in their studies. When asked any question about what they accessed, learners answered as if they had no disability. They accessed music and used it for entertainment and socialised via WhatsApp. It was true that assistive technology, particularly JAWS was very useful to learners as it enabled them to access various useful library information services as highlighted above.

4.4 Ease of use of the available Assistive Technologies at ZLCSCVI

Below is the third research question which the study sought to answer:

"How easy is it for persons with visual impairment to access library information resources at ZLCSCVI using the available assistive technology?"

In order to answer this question, the researcher used findings from three research instruments, namely: Instructor's questionnaire (Appendix C, page 96), Focus Group Discussion guide (Appendix B, page 73) and the observation schedule.

4.4.1 Findings from Technology Instructors

In question 7 of the questionnaire (Appendix C, page 96), instructors were asked to state the ease of use of assistive technology at ZLCSCVI using a likert scale. The question read:

How easy is it for visually impaired learners to use the assistive technologies so as to access various library information resources at ZLCSCVI?

The responses from participants were as shown in Table 4.7.

Table: 4.7 Responses from instructors on ease of use of assistive technology by the VI.

Instructor	Very easy	easy	Don't know	difficult	Very difficult
I1		✔			
I2		✔			
I3		✔			

All the participants ticked the second option, indicating that the visually impaired learners found it easy to use the assistive technology. In the second part of question 7 in appendix C, instructors were asked to explain their answers and they gave various responses indicating that the ease of use of assistive technology by the visually impaired learners at ZLCSCVI depended on the type of training they received, their commitment to work and practice.

According to I1 *" It depends on the training learners are given. If you train them very well they use the assistive technology very well but if not, they also face some challenges*." I2 added that " *technologies are easy to use but it depends on learners. Those who are committed find the training easy and use the technology easily*." I3 also stated that " *learners need practice but some relax and they forget certain skills. Therefore, they use technology but with some few difficulties."*

4.4.2 Findings from learners

In question 7 of the Focus group discussion guide (Appendix C, page 96), the visually impaired learners were asked to state the ease of use of assistive technology at ZLCSCVI using a likert scale. All the learners (17) said that it was easy to access and grasp the library information resources using assistive technology at ZLCSCVI, particularly JAWS followed by NVDA and they were observed doing so as shown in figure 4.2.

Fig. 4.2 *Photo of two visually impaired learners accessing library information resources on computers using JAWS*

In justifying their answer, they explained that once you understood how to use an assistive technology like JAWS, it was possible to access and understand anything on a computer.

4.5 Efficacy of the available Technologies in grasping library information resources

Below is the fourth research question which the study sought to answer:

"What is the efficacy of assistive technology in grasping library information resources by persons with visual impairment at ZLCSCVI?"

In order to answer this question, the researcher used findings from two research instruments, namely: Instructor's questionnaire (Appendix C, page 96) and the Focus Group Discussion guide (Appendix B, page 92) as shown in the following subsections.

4.5.1 Findings from technology instructors about efficacy of assistive technology

In the questionnaire, the last question (8) for instructors of technology read as follows:

"In the table below indicate if you Strongly agree, agree, are Neutral, disagree or Strongly disagree to each of the following statements"

Then, the table was given with the statements shown in appendix C, on page 96. The responses given by instructors to the statements were as shown in Table 4.8.

Table 4.8 Findings from technology instructors on efficacy of assistive

technology

S/No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Assistive technology used at ZLCSCVI by the VI enabled them to access any information on a computer like sighted peers	3(100%)				
2	Assistive Technology used at ZLCSCVI by the VI enabled them to perform like their sighted peers academically and socially	2(67%)	1(33%)			
3	Assistive Technology used at ZLCSCVI by the VI did not change their performance academically and socially				1(33%)	2(67%)
4	Assistive Technology used at ZLCSCVI by the VI made them perform below average sighted peers academically and socially					3(100%)

N=3

All the instructors of technology (3) strongly agreed that Assistive technology used at ZLCSCVI by the VI enabled them to access any information on a computer like sighted peers. Furthermore, all of them either strongly agreed or agreed that Assistive Technology used at ZLCSCVI by the VI enabled them to perform like their sighted peers academically and socially.

From the findings above, it was clear that the assistive technologies at ZLCSCVI helped the visually impaired learners to perform like sighted peers academically and socially, which they could not do without such technologies. This is because those

who used such technologies performed like sighted peers academically and socially. When asked to explain how the technologies had improved performance of the visually impaired learners at this library, I1 said " Most of the *learners can work independently. They are able to use the computer just like any other person to understand work in any subject but still it depends on the persons themselves*." I2 said "*The use of JAWS has made it easy for them to use computers in class online or off line which has helped them to work on assignments and other activities like their peers with no eye problems." I3 said learners trained in assistive technologies perform like sighted peers which they cannot do without technologies.*

4.5.2 Findings from learners

In the focus group discussion guide, the last question (8) for visually impaired learners read as follows:

"Show by raising your hand if you Strongly agree, agree, are Neutral, disagree or Strongly disagree to each of the following statements"

Then, the statements were read one at a time as shown in appendix C, on page 96. The responses given by learners to the statements were as shown in table 4.9

Table 4.9 *Learners' responses on efficacy of assistive technology* *N = 17*

S/No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Assistive technologies that I have used at ZLCSCVI enabled me to access any information on a computer like sighted peers	17(100%)				
2	Assistive Technologies that I have used at this library made it possible for me to perform like the sighted peers academically and socially	14(82%)	1(6%)	2(12%)		

3	Assistive Technologies that I have used at this library did not change my performance in any way.					17(100%)
4	Assistive Technologies that I have used at this library lowered my performance. I now perform below average academically and socially					17(100%)

All the visually impaired learners (17) strongly agreed that Assistive technology used at ZLCSCVI enabled them to access any information on a computer like sighted peers. Furthermore, the majority of them (15) either strongly agreed or agreed that Assistive Technology used at ZLCSCVI enabled them to perform like their sighted peers academically and socially. Only two (2) remained neutral.

From the findings above, it was clear that the assistive technologies at ZLCSCVI helped the visually impaired learners to perform like sighted peers academically and socially, which they could not do without such technologies. Therefore, the efficacy of assistive technology was high because according to participants, the assistive technology enabled them to perform like the sighted peers.

4.6 Findings from observations made by researcher

Few computers in the computer room had no assistive software while the rest had. Learners were asked by the instructor to use computers without JAWS and later with JAWS. When computers with JAWS were used, the researcher observed the visually impaired learners accessing materials, studying accessed materials, responding to questions well on accessed materials, using some accessed materials for games and music, using the internet for communication etc just like sighted peers. The other finding was that they did all these in the same time as sighted peers and in few cases even faster, which was not the case before the assistive technology were used. Table 4.10 was a record of activities in which the visually impaired were involved.

Table 4.10: Comparison of time the VI learners took to access resources on computers

S/NO.	Activity done by the visually impaired on a computer with and without JAWS.	Time estimate without JAWS	Time estimate with JAWS	Efficacy of JAWS
1	Reading notes	Varied but long	Shorter time	High
2	Writing notes	Varied but long	Shorter time	High
3	Accessing music	Varied but long	Shorter time	High
5	Playing games	Too long	Short time	High
6	Writing exercises	Varied but long	Shorter time	High
7	Doing calculations	Varied but long	Shorter time	High
8	Understanding concepts	Varied but long	Shorter time	High
9	Drawing diagrams	Varied but too long	Shorter time	High
10	Teaching each other	Varied but long	Shorter time	High

Therefore the efficacy of assistive technology, in this case JAWS, was high because it enabled participants to access resources on computers faster.

4.7 Chapter Summary

Chapter 4 has presented the findings of the study. It has shown that the assistive technology commonly used by visually impaired learners at ZLCSCVI was JAWS followed by NUDA. The technology helped the visually impaired learners to access and grasp library information services such as academic materials and non-academic materials. It was easy to use and its efficacy was high. The next chapter discusses these findings.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Overview

Chapter five discusses the findings of the study. It starts with a discussion of Assistive Technology available at ZLCSCVI in section 5.1. This is followed by section 5.2 which discusses findings on the useful library information resources accessed by persons with visual impairment at ZLCSCVI using the available assistive technology. Section 5.3 discusses the findings on ease of use of the available Assistive Technologies at ZLCSCVI. The last one, 5.4 is a discussion of findings on the efficacy of the available Technology in grasping library information resources.

5.2 Assistive Technology available at ZLCSCVI

Below was the first research question of the study.

" What assistive technology is available for persons with visual impairment at ZLCSCVI in Lusaka?"

In order to answer this research question, instructors of technology were first given a technology checklist containing several assistive technologies and were asked to tick the ones available (if any) at ZLCSCVI. All the instructors I1, I2 and I3 ticked the following: Closed–circuit Television Magnification (CCTV), Screen Reader, Windows Magnifier, Windows Narrator, JAWS (Job Access With Speech), Zoom Text Magnifier, NUDA, Thunder, Super NOVO, Optical Character Recognition, Non-Visual Desktop Access, Peckins Brailler, Transcriber and Writing frame.

In addition, Instructors I1 and I2 ticked Peckins Brailler and Super Novo while I3 did not. This meant that these two assistive technologies were probably available at ZLCSCVI but not availed to all instructors. No instructor ticked NUDA, Eye Pal Solos, Victor Reader Stream and Victor Reader Stratus a clear indication that the assistive technology were not there and if they were, no instructor knew about them. There was a provision for instructors to add any more assistive technology which they thought was available at ZLCSCVI but did not appear on the checklist and nothing

was added. This indicated that there were no more assistive technology at ZLCSCVI apart from the ones indicated.

In order to verify findings from the technology checklist, instructors of technology were also given a questionnaire to answer. The first question in the questionnaire was to find out if there were assistive technology at ZLCSCVI and all the instructors (03) agreed. The second question requested the instructors to state the assistive technology available at ZLCSCVI and they wrote the following: Closed –circuit Television Magnification (CCTV), Screen Reader, Windows Magnifier, Windows Narrator, JAWS, Zoom Text Magnifier, NVDA, Thunder, Optical Character Recognition, Peckins Brailler, Transcriber and Writing frame. Participants went further to state that the main purpose of such technology were to: enlarge screen content for those who were partially blind and read the same content aloud for those who could not see. In that way all the visually impaired learners could access and grasp what was on the computer without any problems.

On the other hand, during the focus group discussion, learners with visual impairment were asked similar questions as above. They agreed that there were assistive technology at ZLCSCVI and stated the following: Closed –circuit Television Magnification (CCTV), JAWS (Job Access With Speech), NVDA, Super NOVO, Peckins Brailler, Transcriber and Braille note takers. But when the researcher was on the ground to observe the assistive technology participants claimed the institution had, she was only shown JAWS installed on the computers. Instructors of technology explained that JAWS was the assistive technology mostly used by learners at ZLCSCVI followed by NVDA. This suggested that the most available assistive technology at ZCSCVI at the time of research was JAWS followed by NVDA.

Use of JAWS to help the visually impaired learners has been reported by several researchers (Kapperman and Sticken, 2003; Rout, 2019; Elkind, Cohen, and Murray, 1993; Tomei, 2003). Kapperman and Sticken (2003) contended that the effectiveness in studying foreign languages by students who are blind can be greatly increased with the use of a properly configured screen reader, Job Access With Speech (JAWS), and a braille dis-play. According to Rout (2019) JAWS is the best example of screen

reading software used widely by the visually impaired students to read the text appearing on the screen. It is operated by keyboard commands. This software has both the options of Braille display and a synthetic voice.

Use of JAWS by visually impaired learners is also encouraged by Elkind, Cohen, and Murray, (1993) who indicate that JAWS is a screen reader that reads aloud everything on computer screens, including text, pull-down menus, icons, dialog boxes, and web pages and so enables the visually impaired learners to access whatever they need on computers. When a computer is fitted with JAWS, it becomes accommodative to a person with visual impairment. He or she can use it for reading, writing, doing assignments, socializing with others on Facebook or email and searching for any new information on the internet (Tomei, 2003).

A study by McCathy (2012) analysed the use of screen readers in India and found that JAWS was the most widely used screen reading software with a high use of pirated version. NVDA was the next popular screen reading software which had advantages of being an open-source software, carried on a USB drive and easy to use. However, issues of language support were likely to be of concern, owing to the fact that India is a multilingual country (Alpher and Raharinina, 2006).

It is clear from the findings that although there are several assistive technology at ZLCSCVI, the ones mostly available for visually impaired learners are JAWS and NVDA. Others are not commonly used probably because they are not as useful as the above two and could be challenging to use.

5.3 Useful library information resources accessed at ZLCSCVI using the available assistive technology

Below was the second research question of the study.

"What useful library information resources are accessed by persons with visual impairment at ZLCSCVI using the available assistive technology?"

In order to answer this question, the researcher used findings from two research instruments, namely: Instructor's questionnaire and the Focus Group Discussion guide. In the questionnaire (Appendix C, page 95), instructors of technology, I1, I2 and I3 were asked several questions regarding useful library information services accessed by visually impaired learners at ZLCSCVI using the available assistive technology. Their responses indicated that JAWS and NVDA enabled learners to write academic material, communicate with others, do calculations, read text easily, download and interact with videos, edit work, socialise etc.

Findings from learners confirmed those from instructors as the former also indicated that assistive technology were very helpful to them. They cited JAWS and NVDA as the most useful because they helped visually impaired learners in writing academic essays (assignments) and in browsing PDF documents on the internet. JAWS also helped them to communicate with sighted people. Therefore, there was no doubt that JAWS and NVDA were very useful to learners at ZLCSCVI and that was why they were commonly used. This finding is supported by literature which stipulates that teachers use technology in the classroom only when they see that it has value in their instruction (Finley, 2003; McKenzie, 2001). If it does not, they cannot adopt it in teaching and learning. The finding is further supported by the theoretical framework used in the study which indicates that the attitude of the user to a system, is influenced by perceived usefulness (Chuttur (2009). Perceived usefulness refers to the degree to which a person believes that use of the system will enhance his or her performance (Dholakia and Dholakia, 2004). In this case, visually impaired persons mainly used JAWS and NVDA because they believed that these two assistive technologies will help them to perform better in their academic and non-academic work.

5.4 Ease of use of the available Assistive Technology at ZLCSCVI

The third question of the study read as follows:

"How easy is it for persons with visual impairment to access library information resources at ZLCSCVI using the available assistive technology?"

In order to answer this question, the researcher used findings from three research instruments, namely: Instructor's questionnaire (Appendix C, page 96), Focus Group Discussion guide (Appendix B, page 92) and the observation schedule.

Instructors of technology, I1, I2 and I3 stated that ease of use of assistive technology by the visually impaired learners at ZLCSCVI depended on the type of training they received, their commitment to work and how much they practiced the skill. This meant that learners who were well trained, committed themselves to work and practiced what they learnt found the assistive technology very easy to use and vice-versa.

During the focus group discussion guide learners said that it was easy to access the library information resources using assistive technology at ZLCSCVI. The justification for this was that once a person understood how to use an assistive technology like JAWS, it was possible to access and understand anything on a computer.

The researcher observed visually impaired learners accessing information on computers with JAWS, like their sighted peers and in the same time. They showed a lot of interest and often used the system to access and grasp whatever information they wanted on a computer. These findings agree with the theoretical framework which stipulates that the attitude of a user toward a system is influenced by perceived ease of use (Chuttur (2009). Perceived ease of use refers to the degree to which a person believes that using the system will be free of effort (Dholakia and Dholakia, 2004). In this case, visually impaired persons mainly used JAWS and NVDA because they believed that these two assistive technologies were easy to use compared to others in order for them to perform better in their academic and non-academic work.

One of the hurdles for an individual to adopt a new innovation is its complexity. If the assistive technology is too complicated or confusing, it takes longer time to achieve acceptance to the innovation and might lead to rejection (Rogers, 2003). This finding is consistent with a study by Holcombe (2000), who concluded that an innovation with less complexity has a higher possibility of being adopted than an innovation with complicated features. Rogers (2003) suggested that although the complexity may not

be as important as the other attributes of the innovation it is an important barrier to adoption and may influence its implementation and rate of adoption.

If hardware and software are user-friendly, then they might be adopted quickly for the delivery of course materials (Martin, 2003; Hersh, 2012; Howell and Porter, 2003). But when Assistive technology appears complex to use, this would be expected to reduce its use by the learners (Askar, Usluel, and Mumcu (2006). Therefore, the fact that visually impaired learners mostly used JAWS and NVDA at ZLCSCVI is convincing enough that the two technologies were easy to use as they themselves stated compared to other assistive technology.

5.5 Efficacy of the available technologies in grasping library resources

Below is the fourth and last question of the study:

"What is the efficacy of assistive technology in grasping library information resources by persons with visual impairment at ZLCSCVI?"

In order to answer this question, the researcher used findings from three research instruments, namely: Instructor's questionnaire (Appendix C, page 96), Focus Group Discussion guide (Appendix B, page 92) and the observation schedule.

It was clear from the responses of all Instructors (100%) and nearly all the learners (88%) including the observations made by the researcher that the assistive technology at ZLCSCVI enabled learners in class to perform like the sighted peers academically and socially in the same time. This was in line with the literature reviewed, which indicated that when used carefully, assistive technologies enhance performance of learners in various ways (Harvey, 2004; Wilson, 2011). These findings are consistent with the theoretical and conceptual frameworks which indicated that if a given technology is easy to use and is useful, learners will have a good attitude towards it; They will use it more and in turn it will be effective as it will enhance their performance. This is what happened at ZLCSCVI. The visually impaired learners who had better attitude to assistive technology particularly JAWS performed like the sighted peers academically and socially in record time. However, there were 2 visually impaired learners (12%) who did not express the same feeling above but decided to be

neutral. The fact that they had not said anything contrary to what the peers above had stated indicated that they had benefited from the assistive technology but probably not as much as others (88%) had done.

Assistive technology has positive effect on students' learning, especially, increasing reading speeds and comprehension rates like what happened in the current study (Corn et al., 2002; Howell, 1996; Kennedy, 2002; Merbler, Azar, and Ulman, 1999; Bera, 2011). Assistive technology is essential for students with visual disabilities to enhance learning, cognition, and social development (Sze, Murphy, Smith, and 33 Yu, 2004; Wong and Cohen, 201l; Berfield, 2003). This study supports the above studies in that assistive technology would increase the chances of adoption and has a positive effect on students learning especially increasing their speed of accessing and grasping library information resources.

5.6 Chapter Summary

This chapter discussed the findings of the current study. It justified why JAWS was the assistive technology commonly used at ZLCSCVI by learners with visual impairments. The reasons were that the technology was not only useful and easy to use by visually impaired learners but also had high efficacy. The chapter that follows presents the conclusions and recommendations of the study.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

This study investigated the Efficacy of assistive technology on the visually impaired learners' grasping of library information resources at the Zambia Library Centre for the Visually Impaired in Lusaka District of Zambia". The objectives were to: Identify the nature of assistive technology available for persons with visual impairment at Zambia Library, Cultural and Skills Centre for the Visually Impaired (ZLCSCVI), Establish the useful library information resources accessed by persons with visual impairment at ZLCSCVI using the available assistive technology, Assess the ease with which persons with visual impairment access the library information resources at ZLCSCVI using the available assistive technology and Assess the efficacy of assistive technology in grasping library information resources by visually impaired persons at ZCSLCVI. Section 6.1 presents the findings.

6.2 Conclusions

At the time of the study the main Assistive Technology available at ZLCSCVI was JAWS followed by NVDA. Other assistive technologies which were said to be there but rarely utilised by learners were:

Closed – circuit Television Magnification (CCTV), Screen Readers, Windows Magnifier, Windows Narrator, JAWS (Job Access With Speech), Zoom Text Magnifier, Thunder, Super NOVO, Optical Character Recognition, Non-Visual Desktop Access, Pecking Brailler, Transcriber and Writing frame. All the respondents emphasised the availability of JAWS at ZLCSCVI. This indicated that JAWS was the most popular assistive technology to both the staff and the learners at ZLCSCVI.

Assistive technology at ZLCSCVI, particularly JAWS helped learners to access useful library information resources such as: e-books, websites, simulations, PDF documents and other academic materials in all subjects, music for entertainment, WhatsApp for socialisation, E-mail for communication, Word documents for writing assignments,

spreadsheets for calculations and all other things which the sighted peers accessed on computers. This was because the technology read aloud whatever learners accessed in order for the learners to know and so enabled them to use computers like sighted peers.

Among the Assistive Technologies available for learners at ZLCSCVI the easiest to use was JAWS, followed by NVDA.

The efficacy of assistive technology, particularly, JAWS was high because it enabled the visually impaired learners to perform like their sighted peers academically and socially.

In view of these conclusions, subsection 6.2 presents the recommendations of the study.

6.3 Recommendations

i. Government through the Ministry of Community Development and Social Services should consider procuring JAWS for more schools and colleges for persons with visual impairments in Zambia.
ii. All teachers and instructors of the persons with visual impairments should undergo training in the use of JAWS so that they, in turn, can assist their learners in the use of such technology for better performance of the visually impaired learners academically and socially.

Below is the implication for a further study.

6.4 Implication for further research

The researcher recommends for a quantitative study on a large scale, on the effectiveness of JAWS assistive Technology in the learning of the Visually Impaired persons in Zambia.

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APPENDICES

APPENDIX 'A'

TECHNOLOGY CHECK LIST

Participant ID:……..…….

Sex:……. Age:…….

Course taught:…….

Instructions:

Table 1 shows a list of assistive technologies row by row. In each row,

- Place a tick in the third column labelled **'Yes'** if the technology is available to learners or a tick in the fourth column labelled **'No'** if the technology is not available.

Table 1: Assistive technologies

S/No.	Assistive Technology (Hardware or Software)	Available to learners at this institution		
		Yes	**No**	**Do not know**
1	Closed-Circuit Television Magnification(CCTV)			
2	Computer Screen Magnification			
3	Descriptive Video Services(DVS)			
4	Screen Readers			
5	Optical Character Recognition(OCR)			
6	Braille Note takers			
7	Windows Magnifier			
8	Zoom Text Magnifier			
9	MAGic			
10	WinZoom USB Screen Reader magnifier			
11	Dolphin Guide			
12	Windows Narrator			
13	JAWS			
14	Windows Eyes			
15	Dolphin SuperNova			
16	Non-Visual Desktop Access (NVDA)			

17	Thunder			
18	Kurzweil 1000			

In table 2 below, indicate any other assistive technologies available for visually impaired learners at this library.

Table 2: Other assistive technologies at this institution available for learners with visual impairments

S/No.	Name of technology
1	
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END OF TECHNOLOGY CHECKLIST

APPENDIX 'B'

FOCUS GROUP DISCUSSION GUIDE

Respondents' IDs:……

Age…….,,,,,,,,,range:……

Sex:……

A reminder to respondents:

As you are aware, this Library Centre offers training in the use of assistive technologies. I have eight questions about such technologies which I would like you to answer. Please be as honest as possible in your answering. In some cases you will just say **Yes** or **No**, while in others you may need to explain. When I ask a question, I will get your answer and if it is clear, write it down before we get into the next question. But if the answer is not clear, I will ask you to repeat it slowly or clarify it so that I can have a correct record. Remember that whatever we discuss here will be confidential and no other person will know about it.

Questions:

1. Are there any assistive technologies at this library that you have been trained to use?

Yes	**No**

2. If the answer to question 1 is Yes, state the technologies and their purpose.

S/No.	**Name of technology**	**Purpose**
1		
2		
3		
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10		
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20		

3. In your opinion, are the assistive technologies at this library useful?

Yes (all)	Yes (but not all)	No

If your answer is Yes (or Yes but not all), state the technologies and ways in which you have found them useful.

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4. Do the assistive technologies at this library help you to access and understand any academic materials? If so name any academic materials accessed and explain how useful they have been to you.

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5. Do the assistive technologies at this library help you to access useful materials on the internet? If so, name the materials accessed and explain how useful they have been to you.

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6. Do the assistive technologies at this library help you to communicate with others in the world and to socialise? If so, mention the technologies and explain how they do so.

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7. How easy is it for you to use the assistive technologies at this library to access various library information resources?

Participant	Very easy	easy	Don't know	difficult	Very difficult

Explain your answer to question **7**……
……..……
……..……
……..……
……..……
……..……

8. Show by raising your hand if you Strongly agree, agree, are Neutral, disagree or Strongly disagree to each of the following statements:

S/No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Assistive technologies that I have used at ZLCSCVI enabled me to access any information on a computer like sighted peers					
2	Assistive Technologies that I have used at this library made it possible for me to perform like the sighted peers academically and socially					
3	Assistive Technologies that I have used at this library did not change my performance in any way.					
4	Assistive Technologies that I have used at this library lowered my performance. I now perform below average academically and socially					

If you strongly agree to any of the statements, name the technologies and explain why you strongly do so.

……

Thank you for your participation

APPENDIX 'C'

QUESTIONNAIRE FOR INSTRUCTORS OF TECHNOLOGY

Instructor ID:……..……

Sex:……. Age:…….

Course taught:…….

Instructions:

This questionnaire has eight questions. Please answer all according to the guidelines given. In some cases you will tick the answer while in others you will need to give some explanation.

Questions

1. Are there assistive technologies at this library for learners with visual impairment?

Yes	No

Please tick

2. If your answer to question 1 is Yes, in the table below state the assistive technologies and their purpose.

S/No.	Name of technology	Purpose
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2		
3		
4		
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3. In your opinion, are the assistive technologies at this library useful to learners with visual impairments?

Yes (all)	Yes (but not all)	No

If your answer is Yes (or Yes but not all), state the technologies and ways in which you have found them useful.

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4. Do the assistive technologies at this library help the visually impaired learners to access and understand any academic materials? If so name any academic materials accessed

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5. Do the assistive technologies at this library help the visually impaired learners to access useful materials on the internet? If so name the materials accessed on the internet and explain how useful they have been to learners

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6. Do the assistive technologies at this library help the visually impaired learners to communicate with others in the world and to socialise? If so, mention the technologies and explain how they do so.

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7. How easy is it for the visually impaired learners to use the assistive technologies at this library to access various library information resources?

Instructor	Very easy	easy	Don't know	difficult	Very difficult

Please explain your answer to question 7……

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8. In the table below indicate if you Strongly agree, agree, are Neutral, disagree or Strongly disagree to each of the following statements:

S/No	Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Assistive technology used at ZLCSCVI by the VI enabled them to access any information on a computer like sighted peers					
2	Assistive Technology used at ZLCSCVI by the VI enabled them to perform like their sighted peers academically and socially					
3	Assistive Technology used at ZLCSCVI by the VI did not change their performance academically and socially					
4	Assistive Technology used at ZLCSCVI by the VI made them perform below average sighted peers academically and socially					

If you strongly agree to any of the statements, name the technologies and explain why you strongly agree.

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Thank you for your participation

APPENDIX 'D'

OBSERVATION SCHEDULE

Library ID:……

1. List of Assistive technologies used by visually impaired learners at this library?

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2. Useful academic and non- academic services accessed by learners using the available assistive technologies and ways in which they are useful

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3. Ease of use of the assistive technologies by the visually impaired learners in accessing academic and non-academic resources.

Technology	Very easy	Easy	Neutral	Difficult	Very difficult

Reasons

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4. Efficacy of assistive technology

S/No	Statement	Strongly agree	agree	Neutral	Disagree	Strongly disagree
1	Assistive technology training offered at ZLCSCVI to the VI enabled them to access any information on a computer like sighted peers					
2	Assistive technology training offered at ZCSCVI to the VI enabled them to understand any information on a computer like sighted peers					
3	Assistive technology training offered at ZCSCVI to the VI enabled them to use any information on a computer like sighted peers					
4	Assistive Technology training offered at ZLCSCVI to the VI enabled them to perform like their sighted peers academically and socially					
5	Assistive Technology training offered at ZLCSCVI to the VI did not change their performance academically and socially					
6	Assistive Technology training offered at ZLCSCVI to the VI made them perform below average sighted peers academically and socially					

Explanation……
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5. Activities done by visually impaired learners on computers with and without assistive technologies and when they take longer

S/NO.	**Activity done by the visually impaired on a computer with and without JAWS.**	**Time estimate without JAWS**	**Time estimate with JAWS**	**Efficacy of JAWS**

APPENDIX 'E'

CASE STUDY PROTOCOL HEADINGS

Overview	The purpose of the study is to assess the efficacy of assistive technology on the visually impaired learners' grasping of library information services in the Zambian context.
Field procedures	The researcher will get permission from the University of Zambia to conduct a study at ZLCSCVI. After that she will obtain permission from the Officer in charge of the Library at ZLCSCVI to conduct research there. Then, she will explain the purpose of the study to participants. During the study, she will look at the available technologies using the Technology checklist; observe the use of technology by the visually impaired learners (who did assistive technology training there), conduct a focus group discussion with the visually impaired learners who use the assistive technologies and finally administer a semi-structured questionnaire to persons in charge of technology. This will take about a month.
Research questions	• What assistive technology is available for persons with visual impairment at ZLCSCVI in Lusaka? • What useful library information services are accessed by persons with visual impairment at ZLCSCVI

<table>
<tr><td></td><td>using the available assistive technology?

• How easy is it for persons with visual impairment to access library information services at ZLCSCVI using the available assistive technology?

• What is the efficacy of assistive technology in acquiring library information services by persons with visual impairment at ZLCSCVI?</td></tr>
<tr><td>Data collection matrix</td><td><table><tr><td>Question</td><td>Data</td></tr><tr><td>1</td><td>Assistive technologies</td></tr><tr><td>2</td><td>Useful library information services accessed using assistive technology</td></tr><tr><td>3</td><td>Ease of use of assistive technology</td></tr><tr><td>4</td><td>Efficacy of assistive technology</td></tr></table></td></tr>
<tr><td>Data analysis and case study reports</td><td>Qualitative data will be analysed</td></tr>
</table>

	thematically while quantitative data will be analysed using modes and percentages and a case study report will be created

APPENDIX 'F'

CONSENT FORM FOR LEARNERS

Researcher: Ms Janet Kaulu, Masters Student, University of Zambia

Research Title: *Efficacy of Assistive Technology on the visually impaired learners' grasping of library information resources: A case of Zambia library, cultural and skills centre for the visually impaired (ZLCSCVI) in Lusaka. Zambia.*

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I **(participant)**..... agree to participate in this study conducted by Ms Janet Kaulu, a Masters Student of the University of Zambia, School of Education, Department of Library and Information Science.

It is clear to me that the purpose of the study is to investigate the eefficacy of assistive technologies in grasping library information resources by visually impaired learners in Zambia.

I have understood that my participation in the study is voluntary and I'm free to withdraw at any time if I'm not happy with anything.

In this study I'm expected to participate in a focus group discussion

There's enough assurance that I will be fully protected in the study and whatever I say will not be revealed to other people.

If I happen to have any questions about the study, they shall be directed to Ms Janet Kaulu (Cell No: 0972906969, e-mail: kaulujanet@gmail.com)

Signature:……

Date:……..…….

APPENDIX 'G'

CONSENT FORM FOR INSTRUCTORS OF TECHNOLOGY

Researcher: Ms Janet Kaulu, Masters Student, University of Zambia

Research Title: *Efficacy of Assistive Technology on the visually impaired learners' grasping of library information resources: A case of Zambia library, cultural and skills centre for the visually impaired (ZLCSCVI) in Lusaka. Zambia.* .

I **(participant)**..... agree to participate in this study conducted by Ms Janet Kaulu, a Masters Student of the University of Zambia, School of Education, Department of Library and Information Science.

It is clear to me that the purpose of the study is to investigate the efficacy of assistive technologies in grasping library information resources by visually impaired learners in the Zambian context.

I have understood that my participation in the study is voluntary and I'm free to withdraw at any time if I'm not happy with anything.

In this study I'm expected to answer a questionnaire

There's enough assurance that I will be fully protected in the study and whatever I say will not be revealed to other people.

If I happen to have any questions about the study, they shall be directed to Ms Janet Kaulu (Cell No: 0972906969, e-mail: kaulujanet@gmail.com)

Name:……..
Signature:……
Date:…….……