ACCESS TO ASSISTIVE TECHNOLOGY BY UNIVERSITY STUDENTS WITH VISUAL IMPAIRMENT IN TANZANIA

BY

MERCY SAID HOZZA

16/X/13581/GMSN/PE

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DECLARATION

This research thesis is my original work and has never been presented in any other university/ institution for consideration or any certification. This research has been complemented by referenced from other sources duly acknowledged. Where, text, data (including spoken words) have been borrowed from other sources, including the internet, these are specifically accredited and references cited using current APA system and in accordance with ant- plagiarism.

3/12/2018 Author

Date Signature

Full Name: Mercy Said Hozza

Reg. No. 16/X/13581/GMSN/PE

Supervisor's Approval

We as university supervisors confirm the work reported in this thesis was carried out by the candidate under our supervision as University supervisors.

Signature ..... Date: 4th/12/2018

Dr. Niyisabwa Odette Tumwesigye

Department of Community and Disability Studies

Kyambogo University

Signature ..... Date: 4/12/2018

Dr. George Willy Kutosi

Department of Special Needs Studies

Kyambogo University

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ABBREVIATIONS AND ACRONYMS

AFB	American Foundation for the Blind
AT	Assistive Technology
CCTV	Closed-Circuit Television
CRPD	Convention on the Rights of Persons with Disabilities
FGD	Focus Group Discussion
IDEA	Individuals with Disabilities Education Act
ICT	Information and Communication Technology
IEP	Individualized Education Programme
LV	Low Vision
MOEVT	Ministry of Education and Vocational Training
MOEST	Ministry of Education Science and Technology
OUT	Open University of Tanzania
PWDs	People with disabilities
RNIB	Royal National Institute for the Blind
SWVI	Students with visual impairment
TLB	Tanzania League of the Blind
URT	United Republic of Tanzania
UN	United Nation
UDSM	University of Dar es Salaam
UNICEF	United Nations Children's Fund
VI	Visual Impairment
WHO	World Health Organization

ABSTRACT

The purpose of this study was to explore access to assistive technology by university students with visual impairment in Tanzania. The study was conducted in two public universities within Dar es Salaam region in Tanzania. The study was based on Human Activity Assistive Technology (HAAT) model by Cook & Hussey (2008). The study employed case study research design where qualitative methods were used. The study targeted a population of students with visual impairment enrolled in public universities, Braille transcribers and an officer working with Tanzania League of Blind (TLB). A sample of thirteen respondents was selected from nineteen people. Purposeful sampling procedure was applied to all the participants. The instruments used for collecting data were interview schedules, Focus Group Discussion (FGD) guides and observational schedule. To ensure validity and reliability of the instruments, a pilot study was conducted. Findings were presented using thematic analysis. The major finding was that assistive technology is generally not yet being accessed by all students with visual impairment in universities in Tanzania. The study concluded that government should guarantee good quality assistive technology to students with visual impairment in public universities within Tanzania by providing human and financial resources as a way to reinforce the Education and Training Policy (1995) which was geared towards achieving education for all.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Vision is the most important avenue in accessing information for human beings. There is enough information showing that over 75% of what we learn is accessed through sight (Sawyer and Bright 2008 & Hurt 2012). However; when a person has lost sight, he/she may benefit from assistive technology (AT). It is estimated that 110-190 million people in the world, which corresponds to 15% of the world population have some form of disabilities. The rate of disabilities has been increasing yearly due to population ageing as well as global increase in chronic health conditions (WHO, 2013). Report shows that, only 5-15% of people with visual impairment have access to assistive devices and technologies in many low income and middle income countries. Assistive technology may be helpful for visually impaired learners especially those in higher university of learning. (Rose, Hassel bring, Stahl, & Zavala, 2005) have observed that, assistive technology increases, improves, or maintains the functional capabilities of students with disabilities. The world is in the era of science and technology which has great influence on the lives of human beings both in developed and developing countries. As a result, there has been rapid increase of the need for assistive technology to people with disabilities (PWDs).

The report by United Nations (UN) 2015 shows that, assistive technology has been found to be the first step for children with disability to play with other children, go to school and be educated, to become successful citizens and contributing members of the society (UNICEF & WHO, 2015). From the above view, the need arises to enhance PWDs including students with visual impairments to be efficiency, confident, independent and to facilitate their learning.

The United Nations – Convention of Rights of the People with Disabilities (2007), emphasises the use of assistive technology in accessing information. Article 21 clearly of the UN-CRPD stipulates the rights of PWDs to get access to information in an accessible formats and technologies appropriate to different kinds of disabilities in a timely manner. Furthermore, article 7 of the convention stresses that, member states should ensure availability of assistive technology and at an affordable cost (CRPD, 2007).

In the United States, The Individuals with Disabilities Education Act (IDEA) 1997, recognises the potential of assistive technology in education of children with disabilities, and specifies assistive technology as one of the special factors that Individualized Education Programme (IEP) teams must consider in IEP development. According to amendment made by IDEA requires assistive technology devices and services to be considered in the Individualized Education Programmes (IEP) process in order to meet educational goals (IDEA, (2004) and Georgia, (2014).

In similar view, United Kingdom under the Equality Act 2010 recognizes the education and training providers and other related services to have the duty of making reasonable adjustments for PWDs according to their needs. These reasonable adjustments include provision of auxiliary aids and services for students with disabilities. The Act considers

the adjustments that should be made to ensure that PWDs access the different things such as education according to their disabilities. The Act insists that students with visual impairment should use Assistive technology, like closed-circuit television, computers with speech synthesizers, magnification, Braille note takers, and text scanners. (Disability Rights UK, 2012)

In East Africa, The Kenyan Ministry of Education, Science, and Technology (MOEST) has formally recognized the potential of ICT to improve access to the academic curriculum, facilitate job training skills and promote future employment for children (MOEST, 2005). However, the National ICT Strategy for Education and Training provides guidance in several areas that are necessary for integration of ICT into educational sectors including policies, implementation planning, leadership, infrastructure needs, sustainability, training, and research (Republic of Kenya, 2006). Efforts are also made to ensure availability of ICT to students with visual impairments in increasing their possibilities for learning. However, a study done in Kenya by Wachiuri, (2015), Koweru et al. (2015), & Bruce et al. (2014) on the use of assistive technology, shows pitfalls that assistive technology devices are too expensive and are not available in all schools in the country.

Tanzania is among the countries with National ICT Policy. The National ICT Policy was formulated in 2003 and reviewed in 2016 within the context of national Development vision 2025 which clearly stipulates that "These technologies are a major driving force for the realization of the Vision. They should be harnessed persistently in all sectors of the economy.

This track demands that adequate investments are made to improve the quality of science – based education and to create a knowledge – based society in general" (URT, 2003; URT, 2016). In line with this, the ministry of education science and technology (MoEST) is struggling to expand the use of ICT in education. The Ministry believes that the use of ICT in teaching, learning, administration and management represents a powerful tool with which to achieve educational and national development objectives. The Ministry of Education and Vocational Training (MoEVT) also pays attention to give appropriate education to children with disabilities, and to provide education facilities to disadvantaged areas (MoEVT, 2007). Statistic data results in Tanzania (2012), on the type of disability revealed that difficulty in seeing was the most reported type of disability that is equivalent to 1.9 percent (URT 2018)

Teaching and learning of students with VI requires proper techniques in terms of methods and communication between teacher and the students. The Persons with Disabilities Act of 2010, Section 38 (2) observed the importance of accessible communication to university students with visual impairment through the use of adaptive technology. Section 49 (2) of the Act stipulates that: "The information service and documentation shall be made accessible to different groups of persons with disabilities in such form as; Braille, tactile services and large print, spoken information, appropriate technologies, sign language and computerized information" (URT, 2010). Despite the governments' effort, little is known on how assistive technology works to assist university students with visual impairments in accessing their education. Currently, few studies have been conducted in area of ICT in Tanzania. For instance; (Mangasini (2014), TLB (2015) and

Nsimbilla (2014) are among of the few scholars who conducted studies on ICT to students with visual impairment in higher university of learning.

However; none of these studies focused on investigating to what extent assistive technology can support education of students with visual impairment in higher institution of learning. The current study therefore intends to explore access to assistive technology by university students with visual impairments.

1.2 Statement of the problem

Despite the fact that there are various assistive technology devices which have been put in place by the universities, students with visual impairment are not capable of accessing them. A number of policy documents in Tanzania support the right of persons with disabilities to access educational facilities for instance, National Constitution, (URT, 1977); Persons with Disabilities Act (URT, 2010) and National ICT policy (URT, 2003) and others. In particular ICT Policy for Basic Education (URT, 2007); stipulates that, the potential of all individuals (including the mentally and physically challenged) can be enhanced by the use of multimedia packages and other electronic learning tools.

The WHO-UNICEF 2015, report from Global survey WHO (2005) on government action on the implementation of the Standard Rules on the Equalization of Opportunities for Persons with Disabilities' found that, 114 countries have taken action on the assistive technology 50% had not passed relevant legislation and 48% did not have policies in place relating to the provision of assistive technology (58). Despite the Education and Training Policy (URT, 1995) recognising the significance of ICT universities in Tanzania

still have no specific policy guidelines on disability (Nsimbila, 2014). The report by TLB indicates that, 68 people with visual impairments were trained in the use of ICT, from 2011-2014 and TLB (2015). This report does not specify how many university students with visual impairment attended the training.

1.3 Purpose of the Study

The purpose of the current study was to explore the access to assistive technology by university students with visual impairment.

1.4 Objectives of the Study

The specific objectives of the current study are:

i. To investigate the assistive technology available for university students with visual impairments in accessing education.
ii. To determine students' opinions on the value of assistive technology in supporting their learning.
iii. To find out the challenges experienced by students with visual impairment in accessing assistive technology.
iv. To find out the strategies for increasing access to assistive technology by university students with visual impairment.

.5 Research questions

i. What is the assistive technology available for university students with visual impairments which facilitate learning?

ii. What are the students' opinions concerning the value of assistive technology to support their learning?

iii. What are the challenges experienced by university students with visual impairment when utilizing assistive technology in learning?

iv. What are the strategies for increasing access to assistive technology by university students with visual impairment?

1.6 Significance of the study

It is the hope of the researcher that the current study will look forward to increasing awareness in Tanzanian universities by providing proper assistive technologies and services that support students with visual impairment to access their learning. The findings of the current study will enhance the understanding of policy makers, lecturers, administrators, and other education stakeholders on how access to assistive technology facilitates learning. Furthermore, the current study will form a body of knowledge on the use of assistive technology to students with visual impairment for reference. It will pave way for other researchers to conduct more research on the same field for the sake of improving academic performance and integrating them in the global world.

1.7 Delimitations of the study

The current study focuses on the access to assistive technology by university students with visual impairments. Although there are many public and private universities, hence current study is focus on two public universities enrolling students with disabilities and special needs, specifically students with visual impairment, namely; University of Dar es Salaam (UDSM) and Open University of Tanzania (OUT). The current study intends to involve undergraduate students with visual impairment because they are the ones who can be directly supported with assistive technology in their academic activities. The current study has collected information from Braille transcribers because these are the people who directly provide services to students with visual impairments.

Representative of Tanzania League of The Blind (TLB) was also contacted to get information about how they organize ICT training to their member

1.8 Limitations

Regardless of how carefully researchers may plan to conduct their study with a lot of concern and more accuracy there are still some of the obligation which the study have to come across that's why Moura (2017) has gone further through illustrating that every study has limitations; therefore, clarifying the limitations of a study allows the reader to understand better under which conditions the results should be interpreted. In addition, the clear descriptions of limitations of the study also show that the researcher has a holistic understanding of his/her study. And this is something very positive.

The current study had faced various challenges, which had occurred during the research one of them was about the participants; the study had planned to conduct two focus group discussions (FGDs) which contained eight students' participants from each institutes. The researcher managed to conduct one group discussion from UDSM because the numbers of students from OUT who participated were just three in number. Through overcoming this challenge, the researcher decided to carry on face to face and telephone interview to conduct the study from OUT. Another challenge was schedule in that students were getting lecture in different time hence this situation was really interfering with the time which was planned for the research to be done. To concur with this situation the study had to find time when most of the student's participants were free to meet in the discussion.

A lot of time was required in conducting interview to all participants. The researcher worked under tight schedules and also sought the help of students in helping the other participants to commit themselves. Finally, the researcher transcribes and translates interviews which were really consuming a lot of time.

1.9 Definition of Operational Terms

1.9.1 Access according to the current study is knowledge, skills and ability of students with visual impairment to use assistive technology devices effectively and independently in their daily life.

1.9.2 Assistive technology is a device or system that provides students with visual impairment to solve their daily activities. They promote independence and efficiency by enabling them to perform educational tasks that were unable to accomplish on their own.

1.9.3 Assistive devices are tool that adapted by students with visual impairment to assist them in performing educational tasks. For examples, screen readers and screen magnifiers, speech text and Braille conversion technology, computer install with screen reading software, digital tape recorder, braille notetaker, braille embosser, refreshable braille display, word processors, talking dictionary, talking watch, screen reader software, closed-circuit television (CCTV), large print, video magnifiers, telescopic assistive and handheld magnifiers.

1.9.4 Visual Impairment means all students who have loss of vision i.e. blindness and partial sight which affects their educational performance. Due to the impairment they need assistance in their learning such as assistive devices.

1.9.5 Information and Communication Technology (ICT) the term Information and Communication Technology (ICT) refers to type of technology that are used by students with visual impairment to operate computer systems, to use software for preparing and presenting their work, to use internet to access information and use that information independently, effectively and efficiently in learning.

1.10 Conceptual Framework

This current study aims at to exploring the access to assistive technology by university students with visual impairments to ascertain the level of flexibility and independence. The current study intends to employ the Human Activity Assistive Technology (HAAT) model by Cook and Hussey (2008).

Cook and Hussey define assistive technology as a system that enables a person to perform an activity in the context of a social environment with the possible aid.

The HAAT model is proposed as a framework for understanding the place of assistive technology in the lives of persons with disabilities.

The main belief of Cook and Hussey are; assistive technology, human, activity and contexts.

HAAT model by Cook and Hussey (2008)

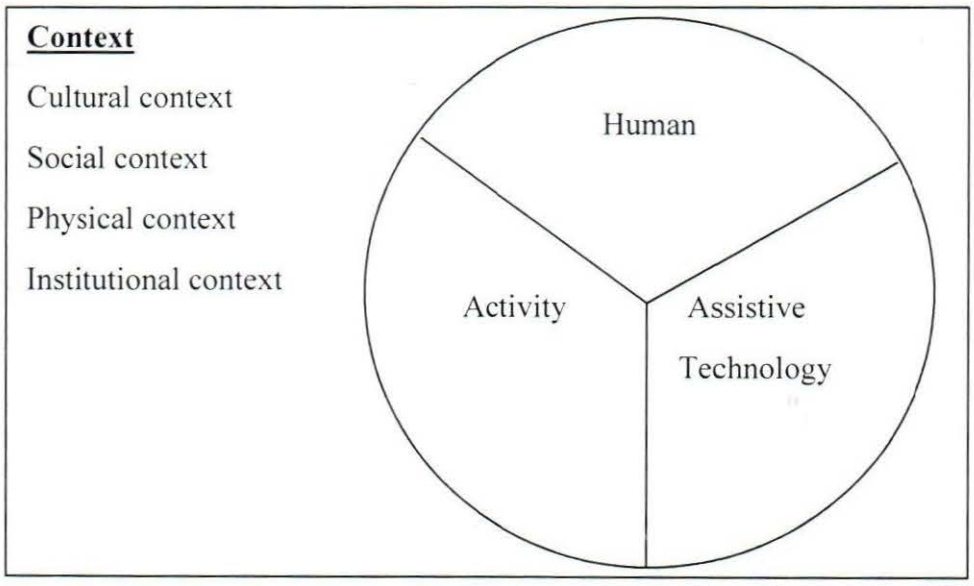

Figure 1: HAAT model Adopted from Cook & Hussey (2008)

As the above diagram indicates, the HAAT model consists of four components namely; human, activity, assistive technology and context. In this model, assistive technology is used to enhance activity of learning to human. According to the model above, a student with visual impairment is the human and the institution is the context.

This current study borrowed HAAT model from Cook and Hussey (2008) which describes the relationship between human (student), assistive technology (AT) devices and their activities done by students with visual impairment facilitated through the access of assistive technology.

The conceptual framework in figure 2 describes the relationship of independent variables, intervening variable and dependent variable. There were four independent variables and one dependent variable.

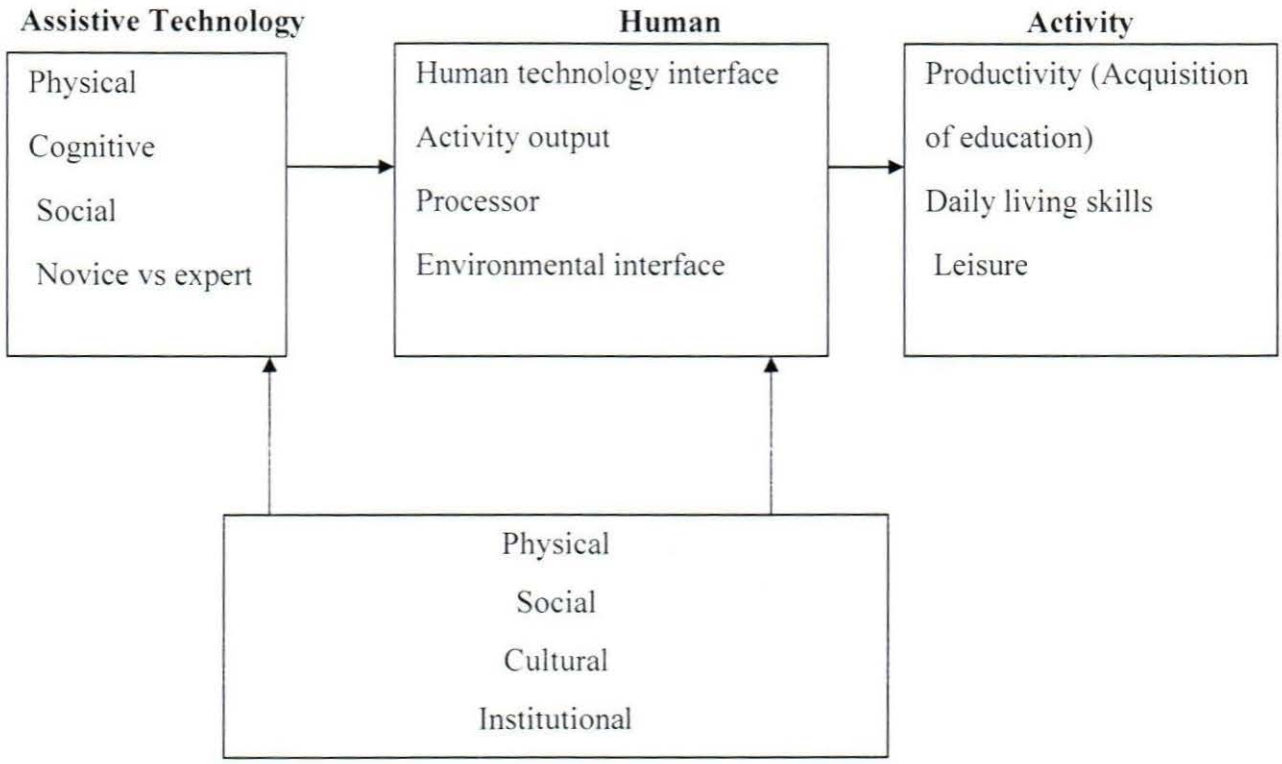

Figure 2: Access to assistive technology by university students with visual impairment

Independent Variables Intervening Variable Dependent Variable

Independent variables are Physical, cognitive, social and novice vs expert. These variables are derived from HAAT model from Cook & Hussey (2008). Physical is about environment, when technology can be used when there is conducive environment in terms of social, physical, institutional and cultural (Context). Cognitive is about students intellectual abilities to explore the AT devices and services. Social is about SWVI can be facilitated by suitable social environment, support from peers and other people around is crucial to enable student with VI to respond positively to AT. Attempts to use AT yield in the actual use of hardware and or software all the activities depend on proper organized rooms, devices, and light intensity, temperatures, sound among others. It also depends on

the background knowledge of the student and novice vs expert is when suitable contest allows the student with VI to utilize skills they possess and get from AT experts.

The Independent variables would be expected to affect university student with visual impairment. Direct utilization of AT devices enables the processing of learning materials in an organized manner. The outcomes of using AT are:

The process of learning is simplified and students' performance improved. Successful use of assistive devices can allow the students to enjoy other benefits such as games, music and other entertainments. Similarly, some devices may enable students to perform their activities of daily living.

1.11 Summary

This chapter identified the background to the study, and the statement of the problem, it intended to identify the objectives of the study, research questions formulated to investigate the study. It also highlighted the purpose of the study, significance of the study, and limitation of the study which may affect the data collection. The chapter also specified the delimitation of the study, definitions of the study's key terms and the conceptual frame work of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter intends to review related literatures bearing on the problem under the current study. The current study explores access to assistive technology by university students with visual impairments. Hence, the review of related literatures was highlighted the themes above under the following sub-headings; assistive technology available for students with visual impairment, value of assistive technology in supporting students' learning, challenges experienced by students with visual impairment in accessing assistive technology and strategies for increasing access to assistive technology by SWVI. Lastly, it has explains the conceptual framework of the current study.

2.1 Assistive Technology Available for students with visual impairment

Assistive Technology is essential to support students with visual impairment in their learning in order to perform different tasks and enable them to be efficiency, confident and independent in their life. According to (WHO, UNICEF, 2015 & Willings, 2015) assistive technology includes products and related services that improve the functioning of children with disabilities. These include communication, mobility, self-care, household tasks, family relationships, education, and engagement in play and recreation. In relation to that, Boucher (2018) elaborated that, several ATs are available to support the blind and

visually impaired in accessing information and communication technologies such as televisions, computers, the internet, telephones and smart phones.

Studies indicate that, there are kinds of assistive technology as illustrated by Perras (2014), Chester, (2012) and Willings (2015) that, although assistive technology is commonly thought of as computers, hardware and software, there is actually a continuum of technology, ranging from "low tech" to "high tech". On other hand, studies indicate that, visual impairments vary in types, levels and time of onset (WHO, 2007). For that matter, even the kind of assistive technology requirements may differ accordingly. According to Hersh & Johnson (2008), students with blindness require Screen Readers and ‚Screen Magnifiers, Speech, Text and Braille Conversion Technology„ computer install with screen reading software, digital tape recorder, braille notetaker, braille embosser, refreshable braille display, word processors, talking dictionary, talking watch, screen reader software to access education. On other hand those with low vision require closed-circuit television systems (CCTV), large print, video magnifiers, Telescopic Assistive and handheld magnifiers.

Some of important assistive technologies for the visually impaired students include; screen readers, screen magnifiers, speech recognition software, Text-to-speech (TTS) software and optical character recognition (OCR) software. Others useful technologies are like large monitors, closed circuit magnifiers, dictation devices and transcription; scanners, standalone reading machine, refreshable braille displays, braille embossers, braille writers, braille translation software, alternative keyboards and Digital books (RNIB, 2014); Hersh & Johnson, (2008); Willings, (2015); and Smith et al., 2011).

Many researchers emphasize the consideration of appropriate assistive technology which will enable PWDs to perform different tasks specifically students with visual impairment.

Appropriate assistive technology enables students who are visually impaired to access information and to complete tasks efficiently, thereby enabling them to achieve the highest level of independence possible (Smith et al. (2011), WHO-UNICEF, (2015) and Willings, (2017).

Studies done by Willings (2015); Wiazowski (2009) AFB (2017) and IDEA (2004) show that, there are different types of Assistive Technology a person with a visual impairment may use in order to access print on paper as well as electronic forms and also provides a means for producing written information. These include; non-optical low vision devices specific for persons with low vision, low and medium technology devices for tactual learners. Others are optical devices for near viewing and for distance viewing, video magnifiers, screen enlargement and readers, braille, tactile graphics and auditory access devices.

However, most of the assistive technology devices that are used by individuals with visual impairment seem to be helpful. Empirical studies show that, students with visual impairments may require assistive technology which focuses upon their unique needs such as accessibility of braille, speech, print and tactile communication systems or any combination of these access modes (Smith et al. 2011 & Woods, 2014).

2.2 Value of Assistive Technology in supporting students' Learning

Today the use of assistive technology is crucial in all educational levels and at work. Assistive technology has potential to be the "great equalizer" for persons with visual disability (Michaels & McDermott, (2003) and Hasselbring & Glaser, 2000).

Studies show that, the access of assistive technological devices can enhance, empower and build the ability of students with visual impairment to perform different educational tasks. Ring (2008) noted that, assistive technologies facilitate social inclusion and enhance quality of life by helping persons with disabilities to become capable, independent and live a more satisfactory life. In relation to that, Hasselbring & Glaser (2000) indicate that, descriptive video services (DVS), which provide narrative verbal descriptions of visual elements, have proven useful in helping students who are blind or have low vision to use educational programs in regular classrooms. In line with the above, the study done in Kenya by Wachiuri (2015) indicates that, assistive technology can be useful in two ways; to support learning and to avoid challenging tasks such as handwriting. In order to be effective, assistive technology needs to be embedded within quality instructions.

The use of computers and other devices as assistive technology has removed many barriers to students with visual impairments in education such as to complete homework, do research, take tests and read books along with their sighted classmates (AFB, 2014; Reuters et, al., 2015). For instance this assert that, with the aid of magnifying tools, students with low vision can often use the same handouts and textbooks as their sighted peers (Ring, 2008).

Assistive technology devices give students with visual impairment opportunities they have never had before. On another view Reeves (2017) insists that, in this time of enormous technological advancements, assistive technology for vision has become an integral part of many students' educational plans.

Assistive Technology for individuals who are visually impaired helps to increase their access to information and improve their overall academic performance. Through the use of various hardware and software such as Bluetooth keyboards, screen readers, screen magnifiers and refreshable braille help to increase access to the internet with voiceover controls and even read electronic documents with displays.

A study done by Mulira & Tusubira (2005) investigates the significance of the appropriate use of students' ICT curricular whereby skills can be imparted to students and enable them to be able to operate personal computer systems independently, to use software for preparing and presenting their work, to use internet effectively and efficiently, to access and use information from the www. In addition to that, there is a need of curriculum to consider the importance of access to assistive technology to university students with visual impairment to enable them access education more independently.

2.3 Challenges experienced by students with visual impairment in accessing assistive technology

Assistive technology have been developed to enable the students with visual impairment to access education and other activities effectively and independence still there are challenges facing them in accessing assistive technology. Johnstone, Altman, Timmons, and Thurlow (2009) reported that, students with visual impairments do not always have

the same opportunities to learn as their peers with normal vision. In addition, they illustrate more about challenges faced by students although there is assistive technology that, the challenge for students is that these assistive technologies are sometimes unreliable (e.g., not all formats work for internet-based text), take time to learn, and do not always accompany the student beyond the school walls (e.g., many students cannot bring AT devices home to assist with homework).

Researchers show that inadequacy of assistive technology in higher learning education hinder students with disabilities to access education effectively. Ayiah (2017) reviewed that students with visual impairment find it difficult to access relevant information for academic work, due to unavailability of assistive technologies in the library. In similar view, Laabidi, Jemni, Ayed, Brahim, and Jemaa (2013) commented that, these technologies do not seem sufficient for providing full support to people with disabilities. This has been supported by study done in Kenya by Wachiuri (2015), Koweru, et al., (2015) and Bruce et al. (2014) on the use of assistive technology which shows that assistive technology devices are too expensive and are not available in all schools in the country.

Researchers indicate the significance of SWVI to have knowledge and skills on how to access assistive technology in their academic area. Addison (2017) noted that in order students to be successful in a university setting, they must have basic knowledge of learning technologies. This affirmed by other researchers that Carlson (2005) that "effective use of AT depends on the availability of trained service providers" (p.21) in relation to that Chester (2012) noted that training may be needed not only for the student but for any family members and teachers who may assist the student.

Studies done in Tanzania by Nsimbila (2014) and Mnyanyi, Bakari, and Mbwete, (2012) indicate that, there is a big challenge of skill training on the use of assistive technology to students with VI in all levels of education. In addition, (URT, 2007) and AFB (2000) recorded the scarcity of trained personnel to manage the provision of assistive technology to students with visual impairment. Likewise, WHO (2015) recognizes training programmes to be established.

Training on how to use AT devices is essential to enable students with visual impairment to access their education effectively. Ahmad (2015) affirms that students need to be supported on how to use the technology to enable them access it successfully. The scholar added that, lack of,training to AT may be even worse than having no access to the technology at all.

Another scholar illustrated that, the goal of teachers of visually impaired students is to improve the student's use of assistive technology in the classroom in order to ensure greater access academic and personal activities (Reeves, 2017)

In line with the above, Mulloy, Gevarter, Hopkins,Sutherland and Ramdoss (2014) recorded that, many forms of AT for students with VI and blindness require specific skills for successful use. In similar view, Project IDEAL (2013) emphasizes the importance of training for visually impaired students for proper use of a number of adaptive devices, methods, and equipment that are collectively referred to as assistive technology, whereby some of this technology allows access to information presented on a computer while others are devices to be used independently.

Various literatures indicate the importance of training on assistive technology to students with visual impairment for effective use of various devices in accessing education. It has also been revealed that skilled personnel in area of assistive technology are crucial in providing necessary technical knowledge and skills to students with visual impairment on how to make proper use of various technologies.

Mason (2014) noted that, the use of assistive technology can facilitate a learning environment, where students are able to access their educational programs through low or high technology accommodations. Mulloy, Gevarter, Hopkins, Sutherland and Ramdoss (2014) encourage students to use assistive technology and emphasize professionals, parents, and caregivers to use evidence-based methods to teach and support skills for assistive technology use. Some scholars affirm that, assistive technology significantly underutilized by students who are visually impaired (Zou et al. 2011). The scholars then emphasize the training in the use of assistive technology to students with visual impairment.

A study done in Arlington VA by Smith, Kelly, and Kapperman (2011) noted that, students with visual impairments and additional disabilities must have access to instruction, in the use of appropriate assistive technology such as switches and communication boards tailored to their particular visual abilities. Smith, Kelly, and Kapperman (2011) added that, determination of access mode(s) must be guided by skilled specialists in the education of students with visual impairments who have comprehensive expertise in blindness, low vision in specific assistive technology and who can access individual learning characteristics.

Studies indicate that, legal framework and policies are very crucial to make assistive technology accessible to students with visual impairment in accessing their education at all levels. The study done India by Rout (n.d) indicates that, in many parts of the world, higher learning institutions declare to provide equal access and reasonable accommodations to students with disabilities although there are unfair policies and practices. The study done in the United Arab Emirates by Alhammadi (2014) indicates that, most universities do not have clear educational policy for students with disabilities. In line with the above study done in South Africa by Mosia & Phasha (2017) indicate that, countries such as the United States of America (USA) have well-known policies and legislation supporting the right to education for students with disabilities at all levels, however, implementing those policies remains a problem.

The study conducted in Kenya to investigate ICT policy to university students with visual impairment in Kenya showed that lack of the legal framework and policy to guide teaching of assistive technology make students with visual impairment to left behind (Oira, 2016).

2.4 Strategies for Increasing Access to Assistive Technology by SWVI.

Access to assistive technology is essential to students with visual impairment in their learning. Researchers recommended strategies to increase access to AT to students with visual impairment so as to enhance their learning. Alhammadi, (2014) recommended that, SWVI need to develop specific skills during their schooling to be prepared for higher education life. Furthermore, adaptive technology is very essential to students with visual impairment and it should be developed at low level of education before joining

universities. In line with study done in Tanzania by Lubago (2015) indicated the solution of increasing access to assistive technology was developing an ICT training curriculum for all school levels and a teacher-training course on assistive technology.

Awareness of assistive technology is another strategy which promotes access to assistive technology by SWVI. WHO (2015) recommended that many people with disabilities and their families have limited awareness of assistive products and services, this makes it difficult for children and their families to know what assistive technology are available or suitable and how they can be beneficial. In relation to that Ismihan & Uyanık (2003) also noted that teachers' awareness of visually impaired students is low. In similar views MOEST recommended there is lack of awareness among decision makers, development partners and private sector investors on the importance of ICT for education of students with visual impairment, as well as local and national development (URT, 2007).

Study done in Tanzania by Nsimbila (2014) also recommended the introduction of public awareness programs associated with special learning needs of students with visual impairments in all universities.

2.5 Summary

The literature review has highlighted the potential of assistive technology in general and how technology can bridge the gap in quality learning among students. In developed countries, technology has taken education to a higher level whereby quality learning and education is a requirement for all children and adults that is best observed in the United States of America and United Kingdom. In those countries assistive technology has been

employed in the education sector to address the needs of students with visual impairments. This indicates that those with disabilities are regarded as any other person in the education development agenda. However, the study seemed to focus on access to assistive technology by university students with visual impairment and therefore could not bring out conclusive findings of students with visual impairment.

The study bridged this gap by focusing on access to assistive technology by university students with visual impairment. Most of the studies reviewed were conducted in developed countries and few studies have been conducted in developing countries such as Kenya, Uganda and Tanzania. The minimal study that has been conducted in Tanzania shows that, students with visual impairments experienced inadequate knowledge of assistive technology, lack of trained personnel to enable them to access assistive technology effectively and insufficient use of assistive technology devices.

Considering the findings, majority of studies reviewed are from developed countries where technology advancement is at its optimum, the researcher was therefore motivated to conduct a study in a developing country due to the fact that, as other students in universities change with the advancement of technology, students with visual impairment in universities may be left behind therefore, denying them the basic right in life.

CHAPTER THREE

RESEARCH METHODOLGY

3.0 Introduction

This chapter intends to presents the research design, target population, sample and sampling procedures, sample size, research paradigm underpinning the study, data collection and location of the study. It further describes the aspects for data analysis procedure, issues of reliability and validity and finally ethical considerations.

3.1 Research Paradigm

This current study employed a constructivist paradigm. Social constructivists believe that individuals seek to understand the world in which they live and work by developing subjective varied and multiple meanings of their experiences. The researcher, therefore, looked at the complexity of participants' views of the situation being studied rather than narrowing meanings into a few categories or ideas (Creswell, 2014). Constructivism has three assumptions: (1) human beings construct meanings as they engage with the world they are interpreting, (2). Humans engage with their world and make sense of it based on their historical and social perspectives, and (3) the basic generation of meaning is always social, arising in and out of interaction with a human community.

A constructivist paradigm provides an appropriate inquiry context to respond to the main research questions of this current study. The four research questions that have been explored in this study are related to the level of provisions, the variations in the quality of

support offered to SWVI and challenges experienced by students with visual impairment in accessing assistive technology. Individuals interpret their subjective realities differently becomes a significant focus of the research study.

Since qualitative research is largely inductive, the researcher in this study utilized participants' views, and attitudes on access to assistive technology in facilitating learning. The researcher's observation and interpretation, in turn, was helped to reveal the reality and meaning of the views and attitudes of the primary users of assistive technology.

3.2 The Research Design

The study employed a case study research design. A case study is usually a study of a single case or a small number of cases (Starman, 2013). Kothari (2014) noted that the case study method is a very popular form of qualitative analysis and involves a careful and complete observation of a social unit, be that unit a person, a family, an institution, a cultural group or even the entire community. Baxter and Jack, (2008) noted that case study it enables the researcher to gather data from a variety of sources and to converge the data to illuminate the case. The choice of this design was driven as noted by Johnson and Christensen, 2016 that case study research is more varied than phenomenology, which focuses on individuals' experience of some phenomenon. This suited our study since the study collected qualitative data when a researcher can focuses on providing a detailed account of one or more cases. These were appropriate in this study since it sought to explore access to assistive devices by university students with visual impairment.

3.3 Area of the Study

The current study was carried out in Dar es Salaam region, Tanzania. This region has two public universities enrolling students with visual impairments, namely: University **A** from Kinondoni district and university **B** from Ubungo district. The University **B** is selected because it the oldest and the first university to starts enrolling students with visual impairment and has strong special education units rendering specialized service to students with visual impairment (Tungaraza, 2010). University **A** is the first pioneer in establishing an accessible computer laboratory for persons with disabilities (PWDs) country wide (Kija, 2017). TLB is the national Non - governmental Organization operated by the Blinds and visually impaired in Tanzania which is in Ilala district. This organisation offers some support to the SWVI and people with visual impairment such as training on access to assistive technology devices and provisions of some devices such as computer with screen readers. The region also has reliable public transport to enable the researcher move and reach participants timely.

The universities were ideal for the study since it provided the type of participants required by the study. It had students with visual impairment who helped the study to succeed. The universities provided an adequate sample for the study in the area of concern.

3.4 Population of the study

A population refers to the larger group from which the sample is taken. It also refers to an entire group of persons or elements that have at least one thing in common (Kombo & Tromp, 2006).

In this study, the universities population comprised students with varied levels of visual impairments. The students were admitted to the universities based on their advanced level performance, transcribers and an officer working with people with visual impairment.

3.5 Sample Size and Sampling Techniques

According to Kothari (2001) sample size refers as the number of items to be selected from the universe to constitute a sample. The size of the sample should neither be excessively large nor too small. It should be optimum in order to fulfill the requirements of efficiency, representativeness and reliability.

Table 1 Sample Size Frame

Group	Target population	Sample size
Transcriber	2	2
Officer	1	1
Students	16	10
Total	**19**	**13**

3.5.1 Students with Visual Impairment (SWVI)

The SWVI are the main and the most significant participants in this research. Students who are blind and students with low vision was part in this study. Seven of them were studying in university B, while three were from University A.

According to WHO (2007) blindness is defined as visual acuity of less than 3/60 a corresponding visual field loss to less than 10 degrees, in the better eye with the best

possible correction. Low vision is visual acuity less than 6/18 and equal to, or better than 3/60 in the better eye with best correction.

Table 1: Illustrates some of the characteristics of these student including participants: gender, their universities, year of study, types of vision impairments and the location and the date of their interviews.

Table 2: SWVI participants

Participants Number	Gender	Study year	Visual Impairment	University	Location and date of interview
1	Male	1st	Low Vision	B	B – SE Unit-29/3/2018
2	Male	1st	Low Vision	B	B - SE Unit-29/3/2018
3	Male	1st	Total blind	B	B - SE Unit-29/3/2018
4	Male	1st	Total blind	B	B - SE Unit-29/3/2018
5	Male	3rd	Total blind	B	B - SE Unit-29/3/2018
6	Female	1st	Total blind	B	B - SE Unit-29/3/2018
7	Male	1st	Total blind	B	B - SE Unit-29/3/2018
8	Female	3rd	Low Vision	A	A - SE Unit 23/4/2018
9	Male	4th	Total blind	A	A - SE Unit 27/4/2018
10	Female	4th	Total blind	A	Kibasila, SE Unit - 27/4/2018

The SWVI who took part in this study have different types of vision impairments, which allowed an investigator to investigate differences challenges which are faced by these students hence depending on the level of their vision loss. Seven students were males, and three were females.

3.5.2 Transcribers

The transcribers who participated in this study were two, one transcriber from university B and another transcriber from university A. The following table (Table 2) indicates the gender of the transcriber, university, locations and the dates of when interview was conducted to them.

Table 3: Transcriber

Participants number	Gender	University	Location and date of interview
1	Male	A	SE-A- 09/03/2018
2	Mąle	B	SE-B - 28/3/2018

The university transcriber provided information about the difficulties facing the students in university with visual impairment and challenges faced by them when they are providing reasonable accommodation to the SWVI in both universities. They also provided the adequacy of the resources available at their universities to accommodate the SWVI.

3.5.3 An officer From TLB

TLB is the national Non - governmental Organisation operated by the Blinds and visually impaired in Tanzania. This organisation offers some support to the SWVI such as training on access to assistive technology devices and provisions of some devices such as computer with screen readers.

3.6 Sampling Techniques

The current study contained university students with visual impairment, transcribers and officer from TLB, they were purposefully sampled. Purposive sampling according to Dudovskiy (2016) is a technique in which researcher relies on his or her own judgment when choosing members of population to participate in the study.

According to Earl (2014), purposive sampling is a type of non probability sampling in which the units to be observed are selected on the basis of the researcher's judgment about which ones will be the most useful or representative. The researcher in this context purposely selects units possessing the required characteristics who were university students with visual impairment, transcribers and officer from TLB. This technique allowed for the overview of the results obtains to other similar universities and students. The reasons for selecting the undergraduate SWVI only was that they had enough time and are titled to get reasonable accommodation from the university. To access assistive technology to them is potential hence they need skills for assistive technology in order to be efficiency, competent and independent in their study. Therefore, they had a strong foundation in developing careers adequately. Despite that fact, SWVI were not fully involved in the utilization of assistive technology due to lack of commitment of the university leaders and the ministry of education at large, negative attitude towards people with disabilities. Society also intentionally or un intentionally think that people with visual impairment cannot use assistive technology. However transcribers were selected because these are people who directly provide services to students with visual impairments. An officer from TLB was also contacted to get information about how they organize ICT training to their members.

3.6.1 Purposive Sampling

This method of purposive sampling was ideal for this current study because it picks a small group with similar characteristics to describe the entire spectrum of students with visual impairment. (Cozby & Bates, 2012) emphasis on to obtain a sample of people who meet some predetermined criterion. The researcher opted for purposive sampling because of its power to bring about in detail analysis of essential issues concern assistive technology to be accessed by students with visual impairment. In addition, all students participated is undergraduate because those who are visual impairment are few in number tenets.

3.7 Data collection methods

Data collection methods are instruments that are used to collect data from participants of the study. (Yaya, 2014) The instruments research in this study were semi structured interviews; focus group discussion, telephone interview and observation schedules. The choice of instruments was guided by the nature of data collected and objectives of the study.

3.7.1 Interview

In this current study, individual face-to-face interviews were carried out with student's participants from university A, Transcribers and officer from TLB. This type of interview was held to research participants with space to express themselves, and allowed the researcher to encourage them to disclose further details. Marshall (2016) argues that in

face-to-face interviewers are able to probe for more information in the event that they sense that the respondent has more information.

In this current study, semi-structured interviews were conducted with all the research participants. (Gill et, al., 2008) affirm that semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to diverge in order to pursue an idea or response in more detail. They made it possible for the researcher to obtain data required to meet the specific objectives of the study. They allow discovery or elaboration of information that is important to participants. Gill et, al., (2008). The semi structured interviews were designed for the all participants because they are flexible in questioning and responding.

3.7.2 Focus Group Discussions (FGDs)

A focus group is a group discussion base on a particular topic organised for research purposes. This discussion is guided, monitored and recorded by a researcher (sometimes called a moderator or facilitator) (Gill, 2008) in addition, focus groups are used to generate information on collective views, and the meanings that lie behind those views. They are also useful in generating a rich understanding of participants' experiences and beliefs.

One of the focus group discussions was conducted by students with visual impairment. This took about two hours. The researcher conducted one of the FGDs with SWVI at UVTB. The researcher prefers FGDs because it allows people to feed off others' comments, provide collective views, dominance by others; and inarticulate members may

be denied a voice (Mertler, 2012). The researcher were guide the FGDs, write notes and ensure that each participant is provided with the opportunity to speak and save time. However, group dynamics lead to non-participation by some members and share his or her perspective.

3.7.3 Observation

In order to get meaningful information the study used observation method to supplement interview and focus group discussion. The researcher was taking the role of non-participant's observer. An observational schedule was prepared in advance showing the important aspects to observe. The availability of assistive technology, types of assistive technology and present assistive technology in use were observed. The observation guides were also involving condition of the present assistive technology which are available and are in use and those which are not in use.

The observation schedule was filled by the researcher after session. Observation schedule was also used to investigate proficiency of the skills and level of the assistive technology utilization.

3.8 Piloting

Pilot testing means finding out if your survey, key informant interview guide or observation form will work in the "real world" by trying it out first on a few people (Center for evaluation and research, 2011). Piloting enabled the researcher to correct ambiguities detected in the instruments as affirmed by (Kasomo, 2006). A pilot study

was conducted with students of the same characteristics and setting as those intended for the study, but who were not part of the main study participants. All the instruments including the interview schedules, FGD guides and observation schedules were piloted with SWVI, Braille transcribers and an officer working with TLB. The purpose of the pilot study was to pretest the instruments intended to be used during the main study to ensure their compliance with the purpose for which they were designed, and to facilitate considerations for their validity. The findings of the pilot study were used to aid the full scale research processes.

3.9 Data collection procedures

Data were collected through semi-structured interviews. The interviews were conducted by the researcher early of the second semester of the university. The procedures of data collection were followed by the researcher used the interview questions to explore the participant's experience in access to assistive technology. All interviews were conducted in the respective area of the participants that means university A, university B and TLB. Each individual semi-structured interview was recorded using a digital voice recorder. The contact details of the all participants were gathered at university A and university B through Special Education Unit of these universities and TLB offices. Additionally, some SWVI volunteered to contact their colleagues with visual impairment at their university and asked them to take part in this research.

The researcher contacted all participants through the phone before interviewing them. This provides a clear idea to SWVI, Transcribers and an officer from TLB about the aim of the research, and enabled them to participate in this current study. FGD session was

conducted to students with visual impairment at university B campus. A voice recorder was used to record information from participants and observational schedule was assisted in recording information regarding to the objective of the study. Questions were asked in an interactive group setting where participants were free to talk with others. Focus group was comprised seven students. The observation schedule was focused on the availability of assistive technology and usage.

3.10 Data Analysis

The current study was employed thematic analysis to analyse the data. The collected data were subjected to inductive analysis. This is the process through which qualitative researchers synthesize and make meaning from the data starting with specific data and ending with categories, patterns and themes. Here the researcher were organized, described, and interpret findings. Organization of data involves the reduction of the massive amount of narrative data in the form of interview transcripts and focus group discussion notes. This is accomplished through grouping data that provide similar type of information (categorization). The researcher searched words or phrases that reflect specific events and that begin to repeat themselves throughout the collected data. After organizing the data, the researcher describe various pertinent aspects of the study including the settings, the individuals being studied, the purpose of activities examined and the viewpoint of participants. Finally, data was interpreted. Interpretation were involves explaining the findings, answering how and why questions, attaching significance to particular results and putting patterns into analytic framework (Mertler, 2012).

3.11 Logistical and Ethical Considerations

The researcher observed ethical considerations while conducting the study. Before going to collect data in the field, the researcher obtained a research clearance from the Vice Chancellor of the University of Dar es Salaam on behalf of Tanzania Commission for Science and Technology (COSTECH) which has authority to register and coordinate researches undertaken in the country. (Appendix 1) Thereafter, UDSM- Vice Chancellor introduced her to Regional Commissioner of Dar es Salaam region, Deputy Vice Chancellor Administration- UDSM, Vice Chancellor- OUT, Director General- TLB and Executive Director of three districts where the study was conducted to carry out research in selected districts as per the regulation. (Appendices 6, 7, 8, 9, 10, 11, 12) The study also obtained permission to conduct research from the Regional Commissioner of Dar es Salaam. (Appendices 13, 14, 15) Furthermore, all Deputy Vice chancellor Administration of both universities and TLB were informed through letters from District Executive Director. (Appendices16, 17). All universities and TLB have accepted and allowed her to conduct study in their institute and organization (Appendices 18, 19, 20, 21). The researcher informed all participants and asked for their consent. Participant confidentiality was also ensured by hiding their names, and instead, letters and numbers were used to identify them.

The researcher also assured the respondents that the information they provided would be used for academic purposes only respondents participated in the study on voluntary bases.

3.12 Summary

This chapter explicated the research paradigm, research approach and research design. It is also identified the target population, sample and sampling procedures. It further described the aspects for data analysis procedure, issues of reliability and validity and finally ethical considerations.

Constructivism research paradigm was adopted for this study because it aims to give insights rather than general results. To employ constructivism research paradigm, a case study approach was carried out to conduct the research. As a constructivism study, the questions formulated in this research were designed to generate rich understandings of human experiences. Therefore, semi-structured interviews and observation were implemented to collect the data within the case study settings. Document analysis generated further data to inform the research questions. These data are reported in the next four chapters of this research, which present the case studies of this research.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

4.0 Introduction

This chapter presents and discuss findings of the study were obtained during the study. The study sought to explore access to assistive technology by university students with visual impairment. Qualitative analysis method was used. The contents were presented within the framework of the objectives that the study sought to address. The chapter was arranged following the themes derived from the objectives: Assistive technology available for university students with visual impairments, students' opinions on the value of assistive technology, challenges experienced by students with visual impairment in accessing assistive technology and strategies for increasing access to assistive technology.

4.1 Assistive technology available for university students with visual impairments.

The study sought to investigate the assistive technology available for students with visual impairment.

4.1.1 Assistive technology available for students who are blind.

The study sought to determine assistive technology were available for students who are blind. Transcribers were asked to indicate the number of assistive devices available in their units and the number that was required. The findings were summarized in table 4 below:

e 4: Basic assistive technology devices for students who are blind

Universities	**A**		**B**	
Type of device	**Required**	**Available**	**Required**	**Available**
High Assistive Technology				
Computers installed with screen reading software	25	30	9	16
Braille Embossers	1	1	1	3
Braille note takers	25	0	9	19
Scanners	1	0	1	3
Mid Assistive Technology				
Digital voice recorders	25	0	9	5
Talking dictionaries	25	0	9	11
Low Assistive Technology				
Perkins Braillers	25	0	9	37
Slate and Stylus	25	0	9	3

Table 4 shows that the high tech assistive technology most available in both universities were computers installed with screen readers, with more than enough items available than required numbers. This implies that this item was sufficient in both universities, and the students did not have any challenge in accessing it. However, the Braille embossers were

just the required number in university A and slightly more than the required number in university B. This implies that students in university A were at risk of getting stranded if the embossers developed a mechanical problem; where as in university B there were some reserve embossers. The Braille note takers and scanners were completely missing in university A; and there were more than the required numbers in university B. One student from university A reported that:

> "In our university there are no materials in Braille, and it is difficult to obtain because we do not produce Braille print. Even many other devices are not available in our university. So, if it was not for this laptop with Non Visual Desktop Access I could not be able to read and do my university examinations".

Findings have also revealed that out of the 25 digital voice recorders and talking dictionaries required in university A; there was none available. Yet; these are items which each learner is required to use one of his/her own; and they are items which cannot be shared. This implies that the two services of voice recording and talking dictionaries were completely missing in the university.

In university B however; there were more than half of the required digital voice recorders; and more than the required talking dictionaries.

Findings shown in table 4 revealed that out of the 25 Perkins Braillers, slates and stylus required in university A; there was none available. Yet; these are also items which each learner is required to use one of his/her own; and they are items which cannot be shared. This implies that the use of the above items was completely lacking in university A. In

university B however; there were much more than the required Perkins Braillers; but less than the required slates and stylus.

Generally in university B; all basic assistive technology required for students who are blind were available although same items were less than the required numbers; as compared the situation in university A where almost all the items required were missing apart from computers installed with screen reading software and Braille embossers. This implies that the only basic assistive technology devices available for students in university A are two items of assistive technology; specifically computers with screen reading software and embossers.

The findings have revealed the devices which were available and those which were being accessed by SWVI. Findings showed that low, mid and high assistive technology devices generated great access to SWVI on how they can concur in their academic areas and their daily activities.

Findings revealed that assistive technology devices which were required in both universities were more available in universities B but limited in university A. This finding is in line with the finding by Boucher (2018) who observed that, several ATs are available in some institutions to support the blind and visually impaired in accessing information and communication technologies, but missing in other institutions. Examples of these devices include: televisions, computers, the internet, telephones and smart phones. Willings (2015) also noted that, assistive technology enables students who are blind and visually impaired to access and store information from libraries around the world and the Internet. So far the current study observed that through assistive technology devices for students who are blind enables them to collect information around

the world to overcome the incidence of the lack of Braille books and digital books which are not available in their universities. In support of this view Mwantimwa (2017) observed that ICT is being used as a tool for improving the quality of life by improving efficiency and enhancing effectiveness in different socio-economic sphere including in learning (p.2).

In line with views above, Addison (2017) also noted that in order for learners with disabilities to have transition from secondary education to university setting; they must have an array of learning technologies available. This aspect has been supported by Cook (2009) who stated that, the availability of assistive technologies can impact on participation, and can also, in increasing internal resources inventory for a person with a disability. In relation to that, Carlson (2005) noted that "... the availability and usefulness of AT devices, technologies and services were explored, as well as other factors believed to affect AT use and need to the society (p.29). The same reference to that, availability of a wide range of assistive technology makes it possible for people with visual impairment to operate computers and telecommunication equipment. In relation to that, Laabidi, Jemni, Ayed, Brahim and Jemaa (2013) affirm that, when technologies are available, affordable and accessible, they represent more than a transformation for people with disabilities. This is in contrast with the study done in Pakistan by Saleem & Sajjad (2016) who observed that there was no availability and access to assistive technology for students with blindness.

4.1.2 Assistive technology available for students with Low Vision

Transcribers were asked to indicate the number of low vision assistive technology devices available in their universities, and the number required. The findings were summarized in table 5:

Table 5: Basic Assistive Technology Devices for student with Low Vision

Universities	A		B	
Type of device	**Required**	**Available**	**Required**	**Available**
High Assistive technology				
Closed circuit television	17	0	16	2
Computers	17	5	16	7
Low Assistive technology				
Hand held magnifiers	17	60	16	104

The finding from table 5 shows that CCTVs were not available in university A, but in university B; some few were available and were much less than the required numbers. During FGD, a student from university B expressed the situation they were experiencing:

> "CCTVs are not enough. They are only two and students with low vision are sixteen, so I can take my book with me to the unit, in case I get chance I use it. If there is someone using it, I wait or I may not read at all.

The above was the situation; yet CCTVs are important devices for learners with low vision. One participant who is a student from university B commented that, "On my side I prefer more CCTVs because they are very important to us with low vision as they help us in reading and writing".

This implies that in institution A where there were no CCTVs, students were finding difficulties while reading and writing.

Findings also indicated that computers were insufficient in both universities. The number available was far less than the required numbers. This finding implies that the students did not make adequate use of computers as many of them shared the few available computers and this affected their performance. Institution A had serious challenges with high tech assistive technology. For example, CCTVs it completely lacking hence computers are only 5 which are available out of seventeen which were required. This implies that both universities had less CCTVs and computers than the required.

Findings further revealed that handheld magnifiers were more than the required numbers in both universities. During FGDs, students with low vision revealed that handheld magnifiers were assisting them in their studies. For instance; students from university B expressed the importance of handheld magnifiers; including helping them to do university examinations, tests and in their daily learning. This indicates that those items were sufficient in both universities, and it means that students with low vision did not have any challenge in accessing these low tech assistive technology devices.

Findings of the study found out that low assistive technology devices for student with low vision were sufficient in both universities. This finding is consistent with the statement by Tebo, (E.d) who noted that low-tech assistive devices such as portable tools are usually available in a range, and they allow students with some vision to access not only text, but other objects in their environment as well. Students with low vision from both universities were able to operate this low tech assistive technology in their daily learning activities because there were sufficient. According to for students with low vision,

handheld magnifiers are useful for viewing and manipulating objects, observing experiments, or viewing graphic information.

On other hand, low, mid and high tech assistive technology devices support the learning of students with low vision. Meanwhile there is a great need of increasing the number of assistive technology so as to support those students with low vision to learn smoothly.

4.2 Students' opinions on the value of assistive technology in supporting their learning.

The study sought to establish the students' opinions on the value of assistive technology in supporting their learning. The findings were summarized in table 6:

Table 6: Students' Opinions on the Value of Assistive Technology

Opinion	No. of respondense
Independence	8
Social interaction	9
Privacy	7
Confidence	5
Efficiency	4

Table 6 shows that all students' opinions on the value of assistive technology were positive. The students also reported during interviews and FGDs that their work was mostly facilitated by assistive devices. Findings revealed that access to assistive devices enhanced learning, social interaction, independence, privacy, confidence and efficiency. Some of the expressions made by students include;

> "Through assistive technology, I usually perform my duties without any limitation. For example; it helps while preparing my work because I am a teacher by profession. It also helps in making my notes, questions, examinations and other academic related work".

Assistive device such as computers enhance students' studying particularly reading independently as expressed below;

> "Computer helps me to perform my duties efficiently and I get time to read materials using my laptop installed with screen readers. I usually read most of the time because materials are easily available as compared to Braille materials. In our university, materials in Braille are difficult to obtain because they don't produce Braille print. So if it was not this laptop with NVDA, I could not be able to read and do my examinations".

Findings also revealed that students with low vision who accessed CCTVs gained confidence and independence in their learning. For example, during FGD session, a student expressed that:

> "The use of CCTV gives me confidence because instead of asking someone to take the book and read for me through CCTV, I can use them to take books with small letters and then I peruse through, and know which one helpful is".

Smart phones were also found to have great importance to the SWVI as they improved their learning, promoted social interaction, privacy and independence. During FGDs, students declared that smart phones made them study efficiently and properly. Through smart phones, students explained that assistive technology assisted them to find materials

on line. They observed that it was better for them to have many instruments which could be used in doing different activities. One of the participants from university B supported the use of smart phones. He pointed out that: "This device helps us to communicate, chart and talk to other people". Another student commented that smart phones gave them privacy, because they could perform any transaction themselves without help from any sighted person. One of the functions that can be done through the use of a smart phone is getting access to information at any given time. This was observed by one student with visual impairment who pointed out that:

> "Assistive technology such as smart phones gives the chance to survive independently through learning when finding materials from different sources on line; also it gives us the opportunity to cooperate with other students when we meet for discussions and personal activities".

The above finding implies that SWVI need various devices to enhance their learning. When the different types of devices are in place, students with visual impairment access their education without depending much on their sighted guides.

Generally, the findings of the study show that the students had a positive opinion on the use of assistive technology in their studies.

The current study found out that all students had a positive opinion on the use of assistive technology in their learning. According to them, they are important in the promotion of their confidence, efficiency, privacy, interactions and independence (Michaels & McDermott, 2003, Hasselbring & Glaser, 2000).Assistive technology has potential to be the "great equalizer" for persons with visual disability. Assistive technology equipment

has really responded positively in enhancing the efforts of the SWVI to perform their duties and access information in different sources. This is in agreement with research made by Willings, (2015, p.1) that, assistive technology helps student who are visually impaired (with and without additional disability) increase their access to the general curriculum and improve their academic performance. This is also in line with IDEA (2004), where information was expressed that, assistive technology is used to improve and maintain the functional capabilities of individuals with disabilities. In relation to that, UNICEF – WHO, (2015) noted that access to assistive technology is a precondition for achieving equal opportunities, enjoying human rights and living in dignity.

Another opinion that students revealed towards the value of assistive technology was that assistive technology increased the co-operation, interactions and charting among lectures and their colleagues. It also increased communicating through internet, searching different materials and contributes ideas during learning/teaching process. This is because assistive technology devices empowered SWVI to interact in various activities without depending much on being assisted. These results have been supported by Mason (2014) who revealed that the use of AT can facilitate conducive learning environment where students are able to access their educational program through low or high technology accommodations. The findings were also supported by Cavanaugh (2001) who noted that through the use of assistive technology devices, many students can decrease being isolated and become an important part of a regular classroom and restrictive environment.

Findings of this study also revealed that students participants realized the significance of AT in their learning by promoting their performance in different activities as well as in their academic performance. AT is very essential to SWVI because it enables them to

perform different things such as educational, activities of daily living, plus social and economic activities. Assistive devices makes it quicker and easier for SWVI to undertake activities that may be difficult to perform without AT. This is in line with the findings of a study by Rabello (2014); who revealed that visually impaired individuals need to be acquainted with the use of optical aids and devices to improve their performance in the use of technologies that might contribute to their social and school inclusion. This is also in line with the statement of Edyburn (2005) that assistive technologies are generally implemented to support students with visual impairment performing daily tasks more easily, interacting with others more effectively, and acquiring knowledge more consistently.

4.3 Challenges Experienced By Students with Visual Impairment in Accessing Assistive Technology

The study sought to establish challenges experienced by students with visual impairment in accessing assistive technology. Students were asked to elaborate the challenges they faced when accessing assistive technology. The findings were summarized in tables 7:

Table 7: Challenges faced by students with visual impairment in accessing Assistive Technology

Challenges	No. of respondents
Inadequate assistive technology devices	4
Limited training of SWVI	4
Lack of trained personnel	3
Inadequate funding	2
New changes in the use of equipment due to advanced science & technology	2
Lack of disability policy implementation	1

Table 7 indicates that the most reported challenges faced by students with visual impairment in accessing assistive technology were inadequate assistive technology devices and limited training of students with visual impairment. In the real situation, students get it hard because there are insufficient devices and lacks of knowledge on how use them. During interview and FGDs, students reported that they had few devices in that CCTVs were not enough compared to the number of students with low vision. During an interview, a participant from university A expressed that there were insufficient assistive technology devices in their institution. On other hand, participants reported that they faced difficulties while accessing assistive technology because they lacked knowledge on how to use assistive devices. During FGDs and interview, students also revealed that they lack training on how to access assistive technology devices. For instance, a student from institution B expressed that there was no training on access assistive technology devices,

for instance Braille note takers were not being used because they lacked knowledge on how to operate them. One of the participants from university B reported that:

> "The difficulty we face is lack of knowledge. This is because some of the students have been interested using some devices like Braille note takers but they lack knowledge of using them since we don't have training on how to use them".

This finding indicates that students faced difficulties on the use of assistive technology devices due to the fact that there is insufficient assistive devices and lack of knowledge on how to go about with them.

Lack of trained personnel was also reported to be a big challenge faced by students with visual impairment in accessing assistive technology devices. From the findings, a number of devices were not in use because no one had knowledge of accessing them as they were not trained. Data from participants during interview revealed that there was shortage of trainers for assistive technology. An officer from TLB reported that he had shortage of trainers to train students and staff on the use of assistive devices. The officer reported that:

> "Currently, those who can train people with visual impairment to use assistive technology devices were are few in general. I can say that we have ten qualified teachers, so ten compared to the number of students in different universities in place means that there is shortage of trainers".

In adequate funding was also reported to be a challenge faced by SWVI in accessing assistive technology. Transcribers from both universities reported about the low budgets

which hinder them from assisting students with visual impairment effectively. This hinders them from being provided with enough devices and also from arranging for trainings. Transcriber from university A expressed that:

> "Our university cannot afford to overcome the challenges faced by students with visual impairment because the budget is not enough. The budget is low and this determines the numbers of assistive devices which the university buys for the students".

Data has indicated that if there is enough funds in the budget, it could reduce the challenges faced by students due to the fact that funds are required for training purposes and to increase the number of equipment.

Another challenge was the new changes in the use of equipment due to advanced science and technology. Through this development, one student reported the fact that they live in an error of changing technology, some trainers of assistive technology devices are not conversant with some new devices. Thus; they cannot train SWVI how to use them. This implies that skills in the changes on advanced science and technology are essential to students with visual impairment to help them cope up with modern development.

Lastly, lacking disability policy implementation was found to be lacking to assist both students with visual impairment and other people with disabilities. This was reported by an officer from TLB that laws and policies concerning PWDs are not implemented enough to enable students with visual impairment to access assistive technology effectively. On other hand, disability policies were found to have an impact on assistive technology for people with disabilities (PWDs) and promoted their status generally. This

finding indicates that implementation of disability police is crucial in promoting the use of different assistive devices for PWDs if they are to do their work effectively. During an interview, an officer from TLB stated the policies which can increased the access to AT in general.

> "Currently we have various policies which promote the use of assistive technology. We have for example the policy of people with Disability (2004). The policy encourages the use of modern technology which will support people with disabilities to be independent".

This study has found out that the major challenges faced by students with visual impairment are inadequate assistive technology devices, limited training of SWVI, lack of trained personnel, inadequate funding and new changes in the use of equipment due to advanced science and technology. This finding relates with the finding of the study done in Tanzania by Nsimbila (2014) who observed that technical resources were not sufficient (p.8). This finding is also in agreement with the Tanzania's national ICT policy (URT, 2016, p.5) where it was noted that universities and other higher learning institutions do not have adequate ICT facilities to meet real demand. In line with the finding; Laabidi, Jemni, Ayed, Brahim and Jemaa (2013) also noted that …these technologies do not seem sufficient for providing full support to people with disabilities". However Smith, Kelly, and Kapperman (2011) indicated that cost and personnel often hinder the availability of assistive technologies for individuals with visual impairments.

Finding of the study indicates that SWVI have limited of training. This finding is in agreement with Addison, (2017, p.2) who indicates that, in order for students to be successful in a university setting they must have basic knowledge of learning

technologies. This in contrast to Simpson, McBride, Spencer, Lodermilk and Lynch, (2012) they noted the benefit of training on how to access assistive technology. Another study demonstrated that without the skills in the use of computer assistive technology, these students may find it difficult to access the computer and explore maximally, the world they live in. (Ampratwum, Offei and Ntoaduro, 2016). In relation to that Project IDEAL (2013) emphasizes the importance of training for visually impaired students for proper use of a number of adaptive devices, methods, and equipment that are collectively referred to as assistive technology.

This study also found out that lack of trained personnel in the use of AT is also a challenge. This finding is in agreement with MoEVT (URT, 2007, p.5) where it is recorded that there is scarcity of trained personnel to manage the provision of assistive technology for students with visual impairment. This finding also agrees with the study done in Kenya by Oira (2016) who observed that the challenge of teachers not being skilled is dealt with by in-service training of teachers on the use of such devices for quality teaching (p.68). In line with Silman et, al. (2017) they noted that the lack of training of trainers is seen as an obstacle to the use of technology.

Other challenges found were new changes in the use of equipment due to advanced science and technology and lack of disability policy implementation.

4.4 Strategies for increasing access to assistive technology by university students with visual impairment

The fourth objective was to find out the strategies for increasing access to assistive technology by university students with visual impairment. The findings revealed that participants focused on various ways for increasing access to assistive technology, as summarized in table 8:

Table 8: Strategies for increasing access to assistive technology by SWVI

Strategies	No. of respondents
ICT to be taught from primary school level	5
Need for awareness program	3
Increase in budget allocation for ICT	2
Lobbying for support from NGOs	2
Implementation of the ICT policy	1

The findings above show that training on how to access assistive technology was the most recommended strategy suggested by majority of the participants. This finding gives an indication that training on how to access assistive technology was very lacking, yet it is essential in enabling students with visual impairment to access their learning effectively. Data from students with visual impairment and other participants recommended that, the government through Ministry of Education Science and Technology (MoEST) should include ICT for visually impaired students in primary and secondary school curriculum. For example, one participant from university A suggested that applying an education system of using assistive technology from primary schools

will enable pupils to access it from the beginning in order to compete with other sighted pupils. Another student from university B also expressed that:

> "The government should make it possible for ICT to be taught in primary so that it is well understood by any person with disabilities in order for that problem to be handled right from the beginning".

Another strategy that was suggested for increasing access to assistive technology was rising to sensitize the public and stakeholders about the importance of assistive technology. This finding had an indication that community was not well aware about benefits of assistive technology to students with visual impairment. Data from participants during FGDs and interview revealed that awareness to creation lecturers and other students was very important in reducing the challenges faced by students with visual impairment. For example, a student from university B emphasized that: "There must be awareness to the lectures and our colleagues about the importance of assistive technology. For example, some lecturers were not aware that we use voice recorders, and they kept moving around while teaching; and this is distractive as one misses some voice. The some view was expressed by another student that other lectures do not want to be recorded; instead they question why they have to be recorded during lectures.

Another participant during interview expressed that,

> "There is need for sensitization to individuals from the grass root to National level, in order for individuals with funds to support students with visual impairment with ICT devices like smart phones, voice recorders and modems.

This is because many people think that people with visual impairment belong to government."

Another strategy that was suggested by participants was for government to increase the budget in both universities. This is due to the fact that many challenges are caused by low budget allocations for supporting students with disabilities. During interviews, transcribers revealed that both universities had gone through difficulties on how to provide good services to SWVI. For example, a transcriber from university A shortly suggested that: "I advise the government to provide enough funds to the university in order to buy all assistive technology devices". Another transcriber from university B suggested that government and the university should increase the budget in order to have sufficient funds to support the education of SWVI.

The findings above indicate that both universities had financial challenges which affected the education of students with visual impairment.

Data from table 8 also shows that another strategy that was recommended was lobbying for support from nongovernmental organisation, so as to promote access of assistive technology to students with visual impairment. A student from university A emphasized his views concerning support from nongovernmental organizations that, "I advise nongovernmental to empower students with disabilities in universities by providing assistive technology and training them on how to use them. This will enhance our performance in different activities".

Another emphasis made by a participant regarding NGOs' support towards the provision of assistive technology to students with visual impairment was to solicit for funds from different partners so as to generate sufficient funds for assistive technology.

The findings above imply that NGOs are important partners in promoting the education of students with disability.

Lastly, implementation of the ICT policy was also suggested as a strategy for increasing access to assistive technology by students with visual impairment. One participant emphasized that it is important for the ICT policy to be implemented to enhance access to assistive technology in all levels of education. Some of expressions made by participants include;

> "We need ministry of education science and technology to enhance those documents to be active especially information and communication technology policy for basic education (2007) and policy of people with disabilities (2010) which encourages the use of assistive technology in learning process.

The finding above indicates that policy about PWDs was not implemented enough to enable students with disabilities increase access to assistive technology.

The study has found out that the most recommended strategies for increasing access to AT were: ICT to be taught from primary school level, need for awareness program, increase in budget allocation for ICT, lobbying for support from NGOs and implementation of the ICT policy. This finding has been recommended by Alhammadi, (2014, p.28) who observed that, SWVI need to develop specific skills during their schooling to be prepared for higher education life. Furthermore, adaptive technology is

very essential to students with visual impairment and it should be developed at low level of education before joining universities. The study done in Tanzania by Lubago (2015) indicated the solution of increasing access to assistive technology was developing an ICT training curriculum for all school levels and a teacher-training course on assistive technology. This finding is not in line with MoEST goal which state it is our duty to prepare our children so that they can benefit from and contribute to our country's development in the information age. We must therefore take advantage of the full range of ICTs, from radio and mobile telephones to computers and the internet, in order to build the foundation for a well-educated and learning knowledge society (URT, 2007, p.1). This is also line with study done in Kenya by Oira (2016) which concluded there was no other organized training that had trickled down to primary and secondary schools.

This study has therefore confirmed that it is difficult for SWVI to join higher education with at the knowledge of accessing assistive technology unless the MoEST implements its goal of providing the ICT from primary level of education.

A finding of this study also found out that sensitization program to the community was recommended a strategy to increase access to assistive technology by university students. This is in line with study done in Tanzania by Nsimbila (2014) who recommended the introduction of public awareness programs associated with special learning needs of students with visual impairments in all universities. In contrast with ministry of education's recommendation, there is lack of awareness among decision makers, development partners and private sector investors on the importance of ICT for education of students with visual impairment, as well as local and national development (URT, 2007, p.28). Ismihan & Uyanık (2003) also noted that teachers' awareness of visually

impaired students is low (p.77). In relation to that WHO (2015) indicated that many people with disabilities and their families have limited awareness of assistive products and services, this makes it difficult for children and their families to know what assistive technology are available or suitable and how they can be beneficial.

The finding revealed that the government to increase the budget in order to promote access to assistive technology to SWVI. This is because both universities complain about low budget which hinder the effectiveness of access to assistive technology to SWVI. This fact supported by MoEVT that, insufficient financial resources to ensure the equitable and sustainable integration of ICT in education at all levels are challenge facing ICT policy in Tanzania, (URT, 2007, p.28)

This finding found out that other recommended strategies were found are lobbing for support from NGOs and implementation of the ICT policy.

4.5 Summary

This chapter presents and interprets the data that were obtained during the study. The study sought to explore access to assistive technology by university students with visual impairment. The contents were presented within the framework of the objectives that the study sought to address. The chapter was arranged following the themes derived from the objectives which are assistive technology that were available for university students with visual impairments, students' opinions on the value of assistive technology, challenges experienced by students with visual impairment in accessing assistive technology and strategies for increasing access to assistive technology.

The findings of the study were analysed and interpreted through tables. Tables were used to analyze data from the participants. All universities have sufficient high assistive technology accessed by students who are blind. But students from university A seem to have difficulty to access other assistive technology due to the lack of mid and low assistive technology in their university. Students with low vision in both universities seem to experience the same challenges in accessing high assistive technology such as; CCTV. However, this is insufficient in university B and in university A there are no CCTVs.

Students' opinions show that access to assistive technology in their learning has a great impact. Most of the students responded positively concerning access of assistive technology in their life in general. The SWVI faced different challenges in accessing assistive technology. Some of these challenges are similar to those barriers that were identified in the literature review chapter, such as; inadequate assistive technology, lack of knowledge and skills of accessing assistive technology devices, lack of trained personnel to train them on how to use the assistive technology devices and lack of implementation of ICT policy.

The participant's interview responses suggested that these students faced different types of challenges in accessing the assistive technology devices because they lacked skills from the lower level of their studies, lack of awareness to the society at large and the poor implementation of the policies namely; Basic Education ICT policy (2007), Disability law of (2010) and National ICT (2016).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter presents summary of the study. It also provides conclusions, recommendations and suggestions for the future research.

5.1: Summary

The purpose of the study was to explore access to assistive technology by university students with visual impairments. This study is attached with HAAT model which is described by Cook and Hussey (2008). Students with visual impairment in universities are not capable of using assistive technology devices due to the different challenges which they experience. The study had four objectives: First, to investigate the assistive technology devices available for university students with visual impairments in accessing education; Second, to determine students' opinions on the value of assistive technology in supporting their learning. The third objective was to find out the challenges experienced by students with visual impairment in accessing assistive technology and the last objective was to find out the strategies for increasing access to assistive technology by university students with visual impairment. The findings of the study were related studies in literature review. A qualitative approach was used. Purposive sampling procedures were applied to get the participants. The study included ten students, two Braille transcribers and an officer from TLB, making a total of thirteen participants. Two

research instruments were developed and used to collect data and they were which were semi structured interview and observational schedules. The overall finding of the current study was that assistive technology was generally not yet being accessed by all students with visual impairment in universities in Tanzania.

5.1.1 Assistive technology available for students with visual impairment

Objective one sought to establish the assistive technology devices available for university students with visual impairment. To achieve this objective, question 1 of section A in the semi structured interview required Braille transcribers to indicate the assistive technology devices available in their unity and the number required.

Assistive technology available for students who are blind

Findings of the study concluded that assistive technology devices which were required in both universities were more available in universities B but limited in university A.

Assistive technology available for students with low vision

Findings of the study found out that low assistive technology devices for student with low vision were sufficient in both universities.

5.1.2 Students' opinions on the value of assistive technology in supporting their learning

Objective two sought to establish the students' opinions on the value of assistive technology in supporting their learning. To achieve this objective, data was collected

through interview and FGDs. The study established that the students from both universities generally had positive opinions on the value of assistive technology in their learning. The current study found that students supported the use of assistive technology due to the fact that assistive technology helped them to increase confidence, efficiency and independence in their learning.

5.1.3 Challenges experienced by students with visual impairment in accessing assistive technology

Objective three sought to establish the challenges experienced by students with visual impairment in accessing assistive technology. Data were collected through interview and FGDs. Section D of the semi structured interview was designed to allow students to express themselves on challenges they faced while accessing assistive technology.

The study revealed the challenges facing students in accessing assistive technology to be; inadequate assistive technology devices, limited training of SWVI, lack of trained personnel, inadequate funding and new changes in the use of equipment due to advanced science and technology.

5.1.4 Strategies for increasing the access to assistive technology by students with visual impairment

Objective four sought to establish strategies for increasing access to assistive technology for student with visual impairment. To achieve this objective, data was collected through interview and FGDs. In section D of the semi structured interview, questions 15 and 16 were designed to get suggestions from participants on what to be done to ensure access to

assistive technology in higher education universities for learners with visual impairment. Participants suggested that government through MoEST to include; ICT to be taught from primary school level, need for awareness program, increase in budget allocation for ICT, lobbying for support from NGOs and implementation of the ICT policy.

5.2 Conclusion

Findings of the study concluded that assistive technology devices for students who are blind required in both universities were more available in universities B but limited in university A. Further, the study concluded that low assistive technology devices for student with low vision were sufficient in both universities.

Secondly, the study findings concluded that students' opinions on the use of assistive technology were positive. This is due to the fact that the uses of assistive devices enhanced their confidence, independence, promoted social interactions.

Thirdly, the study concluded that the challenges which were mostly experienced by SWVI were inadequate assistive technology devices, limited training of SWVI, and lack of trained personnel. Other challenges included lack of disability policy implementation, inadequate funding and new changes in the use of equipment due to advanced science and technology.

Lastly, the study concluded that the strategies most recommended were ICT to be taught from primary school level, need for awareness program and increase in budget allocation for ICT. Other strategies recommended are lobbying for support from NGOs and the need to implement the ICT policy.

5.3 Recommendations

Based on the conclusions made for the study, the following recommendations have been made:

The study concluded that assistive technology devices for students who are blind which were required in both universities were more available in universities B but limited in university A. Further, the study concluded that low assistive technology devices for students with low vision were sufficient in both universities. Therefore the study recommends that:

- Both universities should be equipped with assistive technology which can easily be accessed by all SWVI, hence encouraging confidence, efficiency and independence in learning.

Secondly, the study concluded that students' opinions on the use of assistive technology were positive. This is due to the fact that the uses of assistive devices enhanced their confidence, independence, promoted social interactions. Basing on this conclusion, the study made two recommendations:

- Universities, students, parents, guardians and all stakeholders of PWDs who managing students with visual impairment should be sensitized about the value related with assistive technology so that all of them to play part in implementing the access to assistive technology in education process.
- All advocates of PWDs and students with disabilities should put more pressure to the government through MoEST to enhance the access to AT in the universities.

Thirdly, the study concluded that the challenges which were mostly experienced by SWVI were: inadequate assistive technology devices, limited training of SWVI, lack of trained personnel, inadequate funding and new changes in the use of equipment due to advanced science and technology. Basing on the above conclusions, the study recommended the following;

- MoEST should increase the budget for ICT in order to stock universities with sufficient assistive technology devices.
- MoEST should equip transcribers and students with technology and skills in assistive technology to enable them to work independently than depending on others for assistance.

Lastly, the study concluded that the strategies mostly recommended for increasing ICT were: ICT to be taught from primary school level, need for awareness program, increase in budget allocation for ICT, lobbying for support from NGOs and implementation of the CT policy. Basing on this conclusion, the study recommended that:

- MoEST should sensitize the public about the need to have ICT as a priority.
- Ministry of Education Science and Technology should increase the budget of ICT.
- Universities should lobby in for funds from other stakeholders including; NGOs, disabilities associations and well-wishers.

5.3.1 Recommendation for Further Research

Low and High Assistive Devices

The study revealed that some devices were proved to enhance students learning hence to promote independence. They include: Braille note takers, talking dictionaries, talking books, large print materials, talking calculators and Digital Accessible Information System (Daisy). A study to investigate how effectively they could be applied to SWVI in universities would help SWVI to benefit from them since they were being used by SWVI in other developed countries.

Trained Personnel

The study revealed that the number of trained personnel who had specialized training in visual impairment were lacking in university B; and were not enough in the university A. A study to find out the impact of trained personnel who specialized in teaching visual impairment and are teaching the use of assistive devices in universities would help to train SWVI in universities.

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APPENDICES

Appendix 1: Semi structured interview for students with visual impairment

SECTION A: Assistive technology available for students with visual impairment

1. What types of assistive technology devices do you know?
2. Which types of assistive technology available in your institute?
3. Which of the assistive devices available are useful to you?
4. What benefits do you get when accessing those AT devices available in your institute?

SECTION B: Students opinions' on the value of assistive technology in supporting their learning.

5. What is your opinions about assistive technology which available in your university?
6. How do the available assistive technology devices improve your learning?
7. How has assistive technology helped you in your learning?
8. What is your view on how assistive technology can be used more effectively to access education?
9. What kinds of AT do you prefer most in your learning?
10. How do you think you will continue accessing them in your future academic works?

SECTION C: Challenges experienced by students with visual impairment in accessing assistive technology.

11. What challenges are you facing when accessing assistive devices?

12. How do you overcome these challenges?

SECTION D: Strategies for increasing the access to assistive technology

13. Suggest what to be done to increase the access to assistive technology?

Appendix 2: Semi structured interview for Braille transcriber

SECTION A: Assistive technology available for students with visual impairment

1. What are the types of assistive technology devices available in your unity?

No.	Items	Available	Required
1	Closed circuit Television (CCTV)		
2	Handheld magnifiers		
3	Braille Embosser		
4	Digital voice recorder		
5	Computer installed with screen reading software		
6	Braille note takers		
7	Talking dictionaries		
8	Perkins Braille		
17	Dictation devices and transcription		
18	Scanners		
20	Others		

2. Which types of assistive technological devices mentioned above are you familiar with?

3. Do you think assistive technological devices available are helpful to enable SWVI learn effectively?

4. How do you rate the availability of assistive technology devices in your unit?

SECTION B: Students opinions' on the value of assistive technology in supporting their learning.

5. In which ways do the available assistive technology devices improve the functions of students with visual impairment?

6. How do you rate academic progress/performance of SWVI when accessing assistive technology?

7. How assistive technology support SWVI in their academic activities?

8. What is your opinion about the value of assistive technology in acquisition of education to students with visual impairment?

SECTION C: Challenges experienced by students with visual impairment in accessing assistive technology.

9. What challenges associated with assistive technology do you face as a Braille transcriber?

SECTION D: Strategies for increasing the access to assistive technology

10. What should be done to increase the access to assistive technology for university students with visual impairment?

Appendix 3: Semi structured interview for representative from (TLB)

SECTION A: Assistive technology available for students with visual impairment

1. What types of assistive technology devices your organization provide to university students with VI in Tanzania?

2. Do you have proper plan to ensure availability of assistive devices to university students with visual impairment?

3. What services are provided by your organization to ensure utilization of assistive devices to students with visual impairment?

4. How is your organization promote the access of assistive technology to university students with visual impairment in accessing education?

SECTION B: Students opinions' on the value of assistive technology in supporting their learning.

5. How do you rate the value of training on proper access of specific assistive technology can contribute to the effective use of that particular technology?

6. What do you think on assistive technology access has resulted to a greater achievement of students with visual impairment in their learning?

7. What efforts your organization is made to advocate to the MoEST and other stakeholders about the importance of assistive technology to SWVI in Universities?

8. How do you think the access of assistive technology can improve the learning of students with visual impairment?

9. What efforts does your organization make to emphasize the access of assistive technology to SWVI in their learning?

SECTION C: Challenges experienced by students with visual impairment in accessing assistive technology.

10. What challenges are faced by students with visual impairment in accessing AT?

SECTION D: Strategies for increasing the access to assistive technology

11. What are the strategies for increasing the access to assistive technology?

12. What are the efforts your organization makes to solve challenges related with access to AT use to University SWVI?

Appendix 4: Observational Schedule

No.	Items	Available	In use	Not in use
1	Closed circuit Television (CCTV)			
2	Handheld magnifiers			
3	Braille Embosser			
4	Digital voice recorder			
5	Braille note taker			
6	Talking dictionaries			
7	Perkins Braille Machines			
8	Computer install with screen reading software			
9	Scanners			
10	Others			

Appendix 5: Research clearance application form

UNIVERSITY OF DAR ES SALAAM

Directorate of Research and Publication

STAFF RESEARCH CLEARANCE APPLICATION FORM

(This Application Should be completed by the Project Investigator)

1. **Research Project Registration Number:** 16/x/1135 e1/ GMSN/12
2. **Research Project Title:** Access to Assistive technology by University students with visual impairment
3. ***Personal Details of the Lead Researcher (Project Investigator)***
   Name: MERCY SAID HOZA
   Title: Professor/Associate Professor/Senior Lecturer/Lecturer/Assistant Lecturer/Tutorial Assistant
   Department ..... Academic Unit: .....
   Mobile Number: 0685 182979 Other Telephone Numbers: .....
   Email: maysaligeh0226@gmail.com
   (Please attach copy of your Staff ID and other researchers' Staff or Student IDs to be involved in the study)
4. **Financial Details:**
   Amount of Funds: 6, 410,000/=
   Source of Funds: Foreign [✓] Domestic [ ]
   Name of Funder/Funding Organization: UDSM- NORHED ENABLE PROJECT
5. **Proposed Dates of Research:**
   Date of Commencement 1/3/2018 Date of Completion 30/6/2018
   Research Duration: 3 (in months)
6. **Type of Research:**
   a. Commissioned Research
   b. Independent Study
   c. Postdoctoral
   d. PhD Study undertaken abroad
   e. Master Study undertaken abroad ✓
   f. Other (specify).....
7. **Other UDSM Researchers to be involved (if Applicable)**

S/N	Name	Department	College/School/ Institute	Mobile Number	Email
1.					
2.					
3.					
4.					
5.					

8. **Research Affiliates/Associates to be involved (if Applicable)**

S/N	Name	University	Country	Mobile Number	Email	Hosting Academic Unit
1.						
2.						
3.						
4.						

9. **Research Site/ Location** (you may use a separate sheet using this format)

S/N	Region	District Council/ Municipality	Ward	Village/Street	Assigned Researcher
1.	DSM	[illegible]	[illegible]	UDSM	
2.	DSM	KINONDONI	KINONDONI	BIAFRA	
3.	DSM	ILALA		CHUO	
4.					
5.					

10. **List of Organizations under which interviews will be conducted** (you may use a separate sheet using this format)

S/N	Title/Designation	Organization	Postal Address	Place	Telephone/Mobile Number	Email
1.	Transcriber	UDSM	35091	DSM	0754 531630	
2.	Students	UDSM	35091	DSM	0764 804023	
3.	Director	TLB	22408	DSM	0784 631815	
4.	Transcriber	OUT	23409	DSM	0759 960514	
5.	Students	OUT	23409	DSM		

SUPPORTING DOCUMENTS

i) Approved Research Project Document/Agreement [ ]
ii) Evidence of the Payment of Institutional Fee [✓]
iii) Certificate of Registration of the Research Project [ ]
iv) Copy of UDSM Staff or Student IDS [✓]
v) Copy of Approval Letter of Research Affiliate [✓]

DATE SUBMITTED: 25/2/2015 **SIGNATURE:** [signature]

For Official Use Only

AUTHORIZATION OF ISSUANCE OF RESEARCH PERMIT

1. **Comments by the Head of Department:**
   a) **Recommended** [✓] **b) Not Recommended** [ ]

   Remarks (if any): This is part of her Postgraduate Studies

   Name: Dr. CONSLATA CHUWA Signature: [signature] Date: 08/03/2018

2. **Recommendation by the Principal/Dean/Director of the College/School/Institute:**
   a) **Recommended** [✓] **b) Not Recommended** [ ]

   Remarks (if any): Research is part of Masters Study

   Name: JULIUS MBUNA Signature: [signature] Date: 08/3/2018

3. **Recommendation by the Director of Research and Publication:**
   a) **Recommended** [✓] **b) Not Recommended** [ ]

   Remarks (if any):

   Name: Dr Penelo Mafuru Signature: [signature] Date: 26/3/2018

NB: Research Affiliates/Associates should complete a separate form to get approval from University Management and CoSTECH prior starting their research activities in Tanzania.

Appendix 6: Request for research clearance – Ilala district

Ref. No: AB3/12(B) Date: 19th March 2018

Executive Director
Ilala Municipal Council
Dar es Salaam Region

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your municipality in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover **Ilala Municipality.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

QUOTATION OF REF. NO. IS ESSENTIAL

Appendix 7: Request for research clearance F

Executive Director
Ubungo Municipal Council
Dar es Salaam Region

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your municipality in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover **Ubungo Municipality.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

Appendix 8: Request for research clearance

Date: 16 March 2018

Executive Director
Kinondoni Municipal Council
Dar es Salaam Region

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your municipality in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover **Kinondoni Municipality.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

Appendix 9: Request for research clearance

Ref. No. AB3/12(B) Date: 19th March 2018

Vice Chancellor
Open University of Tanzania
Dar es Salaam

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your institution in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover the **Open University of Tanzania.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

QUOTATION OF REF. NO. IS ESSENTIAL

Appendix 10: Request for research clearance

Ref. No: AB3/12(B) [illegible] 19th March 2018

Regional Administrative Secretary
Dara es Salaam Region

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your region in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover **Dar es Salaam Region.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

[illegible]

Appendix 11: Request for research clearance

Ref. No: AB3/12(B) Date: 19 March 2018

Director General
Tanzania League of the Blind (TLB)
Dar es Salaam

RE: REQUEST FOR RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Ms. Mercy Said Hozza** who is a bonafide staff member of the University of Dar es Salaam and an MA student at Kyambogo University Kampala, Uganda. Ms. Hozza is required to undertake research work as part of her MA studies.

In accordance with government circular letter Ref. No. MPEC/R/10/1 dated 4th July 1980, the Vice Chancellor of the University of Dar es Salaam is empowered to issue research clearances to staff members and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology (COSTECH). I am pleased to inform you that I have granted research clearance to the above named researcher.

I therefore, kindly request you to grant her any help that may enable her achieve her research objectives. Specifically we request your permission for her to meet and talk to the leaders and other relevant stakeholders in your organisation in connection with her research.

The title of her research is **'Access to Assistive Technology by University Students with Visual Impairment'.**

The period of her research is from **March to May 2018** and the research will cover **Tanzania League of the Blind.**

Should there be any restrictions, you are kindly requested to advise us accordingly. In case you require further information, please do not hesitate to contact us through the Directorate of Research, Tel. +255 22 2410500-8 Ext. 2084 or +255 22 2410727 and E-mail: research@udsm.ac.tz.

Yours sincerely,

Prof. William A. L. Anangisye
VICE CHANCELLOR

QUOTATION OR REF. NO IS ESSENTIAL

Appendix 12: Research permit

THE UNITED REPUBLIC OF TANZANIA
President's Office
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

DAR ES SALAAM REGION

REGIONAL COMMISSIONER'S OFFICE
2 RACHID KAWAWA ROAD,
P.O. BOX 5420,
12850 DAR ES SALAAM

Ref. No. .....

21 APRIL 2015

Municipal Director/Town Secretary,
KINONDONI
P. O. Box .....
DAR ES SALAAM.

RE: RESEARCH PERMIT

Mr/Mrs/Ms MERCY SAID HOZZA is a student/Researcher from KYAMBOGO UNIVERSITY KAMPALA who has been permitted to undertake research on ACCESS TO ASSISTIVE TECHNOLOGY BY UNIVERSITY STUDENTS WITH VISUAL IMPAIRMENT

From MARCH 2015 to MAY 2015

I Kindly request your good assistance to enable her/his research.

For: REGIONAL ADMINISTRATION SECRETARY
DAR ES SALAAM

Copy: Municipal Director,
KINONDONI
DAR ES SALAAM.

Principal/Vice Chancellor
UNIVERSITY OF DAR ES SALAAM

Appendix 13: Research permit

THE UNITED REPUBLIC OF TANZANIA
President's Office
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

DAR ES SALAAM REGION

REGIONAL COMMISSIONER'S OFFICE
12880 DAR ES SALAAM

5/APRIL 2018

District Administrative Secretary,
UBUNGO,
P. O. Box,
DAR ES SALAAM.

RE: RESEARCH PERMIT

Mr/Mrs/Ms/Miss MERCY SAID HOZZA is a student/Research from KYAMBOGO UNIVERSITY KAMPALA(UG) has been permitted to undertake research on ACCESS TO ASSISTIVE TECHNOLOGY BY UNIVESITY SIUDENTS WITH VISUAL IMPAIRMENT

From MARCH 2018 to MAY 2018.

I Kindly request your good assistance to enable her/his research.

For; REGIONAL ADMINISTRATION SECRERTARY
DAR ES SALAAM

Copy: Municipal Director,
UBUNGO
DAR ES SALAAM.

Principal/Vice Chancellor
UNIVERSITY OF DAR ES SALAAM

Appendix 14: Research permit

5/APRIL

ILALA

RE: RESEARCH PERMIT

MERCY SAID HOZZA

KYAMBOGO UNIVERSITY KAMPALA(UG)

ACCESS TO ASSISTIVE TECHNOLOGY BY UNIVERSITY STUDENTS WITH VISUAL IMPAIRMENT

MARCH 2013 to MAY

REGIONAL ADMINISTRATION SECRETARY
DAR ES SALAAM

Copy: ILALA
DAR ES SALAAM

UNIVERSITY OF DAR ES SALAAM

Appendix 15: Research permit

THE UNITED REPUBLIC OF TANZANIA
PRESIDENT OFFICE
MINISTRY OF REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

KINONDONI DISTRICT
Telephone No: 2170169 / 2170183
To reply please quote:
Ref. No. AB. 320/378/01B

THE DISTRICT COMMISSIONER'S OFFICE,
1 MINAKI STREET,
P.O.BOX 9583,
11881 DAR ES SALAAM.

30th April, 2018

Vice Chancellor
Open University,
KINONDONI.

RE: RESEARCH PERMIT

Mercy Said Hozza is a Student/researcher from **Kyambogo University (KAMPALA).** She has been permitted to undertake field work research on **"Access to Assistive technology by University Students With Visual Impairment."** From March 2018 to May, 2018.

I kindly request your good assistance to enable her to complete her research.

Truphaina Maro
For: District Administrative Secretary
KINONDONI

Municipal Director,
DAR ES SALAAM.

Appendix 16: Introductory letter

UNIVERSITY OF DAR ES SALAAM
OFFICE OF THE DEPUTY VICE-CHANCELLOR
(ADMINISTRATION)
P.O. BOX 35091 - DAR ES SALAAM- TANZANIA

Tel: 022 2410500 - 8 Ext. 2003
022 2410394 - Direct Line
Fax: 022 2410718/2410078
Your Ref:

Telegram: University of Dar es Salaam
E-mail: dvc-pfa@admin.udsm.ac.tz
Website: www.udsm.ac.tz

Our Ref: AB3/12(B)

6th April, 2018

Dean,
School of Education
University of Dar es Salaam

RE: MS. MERCY SAID HOZZA

This is to introduce to you the above named person who is a bonafide staff member of Dar es Salaam University College of Education and M.A student of Kyambogo University Kampala, Uganda.

Ms. Hozza has been granted permission by the Vice Chancellor to conduct research titled, "***Access to Assistive Technology by University Students with Visual Impairment***" from March to May, 2018.

You are therefore kindly requested to assist her accordingly.

Yours sincerely,

P.P. Laswai
For: DEPUTY VICE-CHANCELLOR
(ADMINISTRATION)

cc: DVC (Ad) - on file
cc: DHRA - on file
cc: Ms. Mercy Said Hozza

Appendix 17: Introductory letter

HALMASHAURI YA MANISPAA YA ILALA

SIMU NA. 2121660
2128805
FAX NA. 2121485

OFISI YA MKURUGENZI
1 MTAA WA MISSION
S.L.P. 20950
11883-DAR ES SALAAM

Kumb. Na. IMC/AF.3/31

Tarehe: 21/4/2018

Halmahsauri ya Manispaa ya Ilala.

YAH: KUMTAMBULISHA : MERCY SAIDA ... [illegible]

Husika na mada tajwa hapo juu.

Halmashauri ya Manispaa ya Ilala imemruhusu Mwanafunzi toka KYAMBOGO UNIVERSITY (KAMPALA) kufanya (Project/Field/Research) juu ya [illegible]

katika ofisi yako. (Project/Field/Research) itaanza kuanzia tarehe 26/3/ 2018 hadi 5/5/ 2018

Tafadhari apewe ushirikiano

R. Mahe

Kny: MKURUGENZI WA HALMASHAURI MANISPAA YA ILALA.

Appendix 18: Introductory letter

School of Education

University of Dar es Salaam

Deans Office, 11th April, 2018

All Staff and Students

School of Education

RE: INTRODUCING Ms. Mercy Said Hozza

The purpose of this communication is to humbly introduce to you **Ms. Mercy Said** who is engaged in collecting data for a study titled ''**Access to Assistive by University Students with Visual Impairment**''

Ms. Hozza is from the University of Kyambogo, Kampala. She is currently conducting data collection as part of her M.A degree and has been permitted by UDSM Management to conduct her study in our school.

Please give her your valuable assistance that she requires.

Thank you very much.

Yours sincerely,

Dr. Kahangwa, G.

Ag. Director, CERPD