USE OF ASSISTIVE TECHNOLOGIES IN TEACHING AND LEARNING OF LEARNERS WITH VISUAL IMPAIRMENT IN PRIMARY SCHOOLS IN KASULU DISTRICT, TANZANIA

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DECLARATION

I **John Karusha Bahati** do hereby declare that this dissertation is entirely my own original work and that it has never been previously submitted or published at any institution of learning for a similar award. Inputs from other people's works were recognized accordingly. Therefore, any fault emanating from this work should be soley referred to me.

Signature……………………… **Date** ……………………………………….

APPROVAL

The preparation and completion of this dissertation was done following the research guideline laid down by Kyambogo University and is hereby submitted to the graduate board with our approval as supervisors;

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DEDICATION

To my family; notably my mother Evelina, my father John and their grand daughter Eveline, who is my only daughter, not forgeting my lovely wife Godriva for their encouragement and prayers that made me strong throughout.

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ADL: Activities of Daily Living
AT: Assistive Technology
ATs: Assistive technologies
BEST: Basic Education Statistics for Tanzania
CCTV: Closed Circuit Television
CRPD: Convention on the Right of Persons with Disabilities
DBT: Duxbury Braille Translator
DSAs: Daily School Activities
EASTIN: European Assistive Technologies Information Network
GATE: Global Cooperation on Assistive Technologies in Education
ICT: Information Communication Technology
IDA: International Disability Alliance
JAWS: Job Access with Speech
LwVI: Learners with Visual Impairment
MoEST: Ministry of Education Science and Technology
NGOs: Non-Governmental Organizations
TEHAMA: Teknolojia ya Habari na Mawasiliano
TLVI: Teachers of Learners with Visual Impairment
TVs: Televisions
UD: Universal Design
UDL: Universal Design for Learning
UK: United Kingdom
UN: United Nations
UNESCO: United Nations Science and Cultural Organization
UNICEF: United Nation International Children Emergence Fund
URT: United Republic of Tanzania
WHA: World Health Assembly
WHO: World Health Organization

ABSTRACT

This study examined the use of ATs in teaching and learning of LwVI in primary schools in Kasulu District, Tanzania. It was guided by three objectives namely; to establish the available ATs for teaching and learning of LwVI; to examine how ATs are used to facilitate the teaching and learning of LwVI, and investigate how ATs might be enhancing the learning of LwVI in primary schools. The study was guided by the Delone and Maclean (D&M) IS Success model as a comprehensive theoretical framework to examine how ATs are successfully used to facilitate the teaching and learning of LwVI. A case study design under a qualitative research approach was adopted and the data was collected using two methods namely; observation which was conducted to analyze the available ATs and other enabling infrastructures for use of ATs; then interviews, where semi-structured interviews were held with twelve participants in categories of teachers; the deputy head teacher; learners with visual impairments, and a District special Needs Education Officer. The data obtained was subjected to thematic analysis to generate meaning for inferences. The study reveals that primary schools have some ATs but many of them are not available and those that are available are not sufficient to cater for LwVI. On another side, the school is constrained with limited collection of low-tech ATs and extremely few high-tech ATs and that some of the available ATs are not operating due to breakdown and lack of repair. It also shows that the use of ATs is hindered by poor infrastructure. Though limited, teachers and LwVI were making use of ATs in different ways and the learning of LwVI was therefore to some extent enhanced. The study, therefore, concludes that the schools had very few ATs, the use of ATs in primary schools was limited due to existing challenges, and the learning of LwVI was slightly enhanced. Lastly, the study recommends that efforts be made by stakeholders including the MoEST in collaboration with the PO-RALG, TIE, NGOs should equip primary schools with ATs and put in place necessary enabling infrastructure, improve pre-service and in-service teacher training programs. The study further recommends proper budget allocation to cater for acquisition of ATs for primary schools in Tanzania if learning among LwVI is to be enhanced.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Every human being is entitled to education as a right that helps them to live a standard life. Different reasons including inaccessibility to most of the educational information have been denying children with visual impairment an opportunity to access equitable education. Therefore, this study's main target was to examine how Assistive Technologies (ATs) are being used to enhance LwVI access the education opportunities through teaching and learning processes in primary schools. This chapter present nine sections that introduce the study. It begins with the background of the study, followed by the statement of the problem, the purpose, objectives, research questions, scope, significance, and definitions of operational terms of the study. The last part of this chapter describes the theoretical framework and its relevance to the study.

1.2 Background to the Study.

Vision is a source of information believed to supply most of the choices of information a person depends on for normal living (Ferreira, et al., 2020). It is known to provide more than 80% of all the information available outside the world (Gorbunova & Voronov, 2018). This view implies that if vision is impaired, then a person's ability to live a normal life is challenged because the wide range of information accessibility is limited.

Visual impairment denotes loss or reduced visual performance, which even with correction by refractive remedies, surgery, or medication consequently affects a child's educational performance (Naipal & Rampersad, 2018). In this study, visual impairment means a condition in which a person's visual ability

is limited. It ranges from low vision (presence of some vision) to blindness (absence of sight).

Visual impairment is estimated as the leading disability in the world. It covers 3.2% of 15% of the world's total population who have different forms of disabilities. This number keeps increasing due to aging and the increase of dangerous diseases (World Health Organization [WHO], 2022). The Fact sheet data contemplate that around 2020 to 2030, at least 2.2 billion people will have a visual impairment. Likewise, in Tanzania the fact sheet under Seva International estimated 2.23% of the total population having different forms of visual impairment (Seva, 2022). These people live in a challenging situation due to inaccessibility and exclusion in different life aspects including in education (WHO, 2020).

Globally, researchers have reported visual impairment as a leading disability causing barriers to accessibility of equitable quality education due to limited accessibility to information; inappropriate resources; deprivation of abilities to perform Activities of Daily Living (ADL); and deficiency in learning basic skills such as reading, language, writing, reasoning and development skills (Ferreira et al., 2020; Kaulu, 2019; Bhowmik, 2017; and Wilfred, 2017). These researchers give an impression that visual impairment is a serious disability requiring serious measures including preventive and rehabilitative to enhance the life of the above-mentioned population.

The Universal Declaration of Human rights (UDHR), article 26 recognizes education as a right entitled to every human being including LwVI (United Nations [UN], 1948). To ensure this is a reality, the Convention on the Rights

of Persons with Disabilities (CRPD), article 24 interprets obligations for states to bridge the gap of accessibility needs of persons with disabilities (PwDs) and those without disabilities by enabling independent living and guarantee them with equal chances to engage in all activities including in education. Equally, it obligates States to make accessibility to information and technologies a priority need (United Nations [UN], 2006).

The above international frameworks have sharpened the world efforts both in developed and developing countries such as UK, Latin American, South Africa, Ghana, Uganda and Tanzania to mention but a few under inclusive education focus to create disability friendly education by adjusting and amending laws and legislations, designing infrastructures, improving teacher training, and developing flexible curriculums (UNESCO, 2020). Although all these are being done, data from the World Bank group on the study ***"The price of exclusion"***, report an estimate of a gap of 4 points in percentage of primary completion and enrollment between children with visual impairment and their counterparts that has remained constant over time across countries more especially in developing countries (Wodon et al., 2019)

This has led to the global attention on the Universal Design for Learning from the Universal design (UD) principle four (4) which requires any design to render essential information suitable for users regardless their conditions which in this study visual impairment is focused (International Disability Alliance [IDA], 2021). It recognizes the fact that assistive technologies are imperative and should not be ignored. This imply that, investments in the use of Assistive Technologies as one of the measures to create equitable access to

all educational opportunities among children with visual impairments enrolling in primary schools should be taken seriously.

Assistive Technology (AT): refers to any item, equipment or product, system, and services tailored towards supporting a person with disability to carry out functional activities that could otherwise be performed (WHO, 2022). In this study, the concept of AT is used to refer to any piece of item or equipment, software programmes, internet application, hardware products such as; computers, embossers, braille and product systems such as DBT, Job Access with Speech (JAWS) to mention but a few; that could increase participation, interaction, accessibility to information, maintain functional abilities and improve accessibility to all education opportunities for LwVI. Assistive Technology (AT) range from low-technological products/devices to high-technological products/devices (UNICEF-WHO, 2015). The low-tech AT include simple devices which are simple to make, use and to obtain and require little technology such as a white cane (Viner et al., 2020). The High-technological devices includes complex electronic communication system such as a computer and associated software programs which are expensive, hard to get, and require more skill in using them, they may include but not limited to computers, Closed Circuit Television (CCTV), voice recognition software and literacy (language, reading, writing and arithmetic) enabling software (Ahmad, 2015; Kirboyun, 2020). Assistive Technologies increase learning independence, choices of information and bridge the gap of inequalities thus, creating equitable opportunities for educational accessibility to all persons including LwVI.

Assistive Technology has long been in use to support people's lives and learning even before the advancement in technology. Early ATs for persons with visual impairment included the use of tree branches to mould crude canes for mobility. It is not until 13th century when handheld lenses and spectacles were used to support the life of persons with low vision in pursuing their daily living (Viner et al., 2020). The early 20th century witnessed a shift in AT innovation, both in hardware and software. For instance, Brailler which was first invented by Graham Bell, the first CCTV by Genensky, Optical Character Recognition by Hocek and the JAWS by Henter-Joyce; all were meant to ease accessibility to information and ensuring a high standard life for persons with visual impairment (Burch & Longmore, 2010)

Today technology has furnished people's thinking and practices in solving different challenges including those of education. Efforts are done within the CRPD model of accessibility to equitable education, where Article 4 (1) and 26 (3) urges states to ensure availability and use of new technologies in this case ATs for PwDs including those with visual impairment for maximal independence and participation (UN, 2006).

In line with the above, efforts are being made by countries under health care and social welfare provision systems to ensure the availability of ATs that are geared to ensure promotion of standardized education for persons with disabilities including LwVI by enabling equal accessibility (de Witte et al., 2018). For instance, in Europe innovation of the European Assistive Technology Information Network (EASTIN), the AbleData in USA, AskSARA of UK, Australian National equipment Database (NED) (D'Cunha

et al., 2022), and in Africa, especially the South African Shonaquip Social Enterprise (SSE) (Trafford et al., 2021).

The Global Education Monitoring (GEM) report, gives a revelation on this advancement and report that ATs have been the concern of governments worldwide and that they are provided and utilized in schools by different countries across the world both developed such as Estonia, Italy and the republic of Korea and in developing countries such as Nigeria and Kenya though in limited access (UNESCO, 2020). The report adds that ATs increase participation and engagement by PwDs including LwVI in activities.

Tanzania keeps the spirit of CRPD model of accessibility and intends to eliminate barriers of inaccessibility to education for PwDs. Evidence shows that ATs have been used in schools since independence around late 1960's and early 1970's where Radios and Televisions were used as main assistive tools (Hare, 2007). Since then, efforts have been to ensure accessibility of quality education through provisions and sensitization as the result the year 2002 witnessed the rise of awareness on benefits that could be harnessed if ICT in forms of AT was to be used in education. This influenced establishment of e-school in 2005 to enforce the first ICT policy issues adapted in 2003, where expansion was made to include the use of computer and internet that could enhance the achievement of education goals (Hare, 2007). In the same year, ICT was made one of the subjects in primary school curriculum and is taught as Teknolojia ya Habari na Mawasiliano (TEHAMA) (Nihuka & Peter, 2014). The aim was to equip learners including LwVI with computer literacy and enhance easy access and understanding of the curriculum.

Currently, the number of LwVI enrolled in primary schools is increasing. The Basic Education Statistics for Tanzania (BEST) reports a total number of 5, 945 LwVI in 2019 and 7, 126 LwVI in 2020 who were in primary schools. Out of these, only 5199 in 2019 and 3944 in 2020 were found to be in different levels of secondary education (BEST, 2019; 2020). Realistically, the enrollment is increasing but retention, performance and transition to further levels of education is still a permanent problem.

Relentlessly, more is done within the constitution of the United Republic of Tanzania, where Article 11 requires the government to ensure provisions for realization of people's rights of which among others, self-education to all people including PwDs is stated. To operationalize this, different policies were put in place including the launch of ICT policy for Basic Education of 2007, aimed at guiding the integration of ICT in education and realize the importance of ICT for quality and accessible education. Similarly, the National Policy on Disability (2004), section 1.2.11 requires people with disabilities (PWDs) to be supported with their functional abilities. Giving them ATs such as white cane, writing frames with stylus, sunglasses, braille for visual disability was a priority (URT, 2004). In reference to this, the Persons with disability Act (2010) section 50 (d) criminalizes denial of accessibility to any facility and all ICT related services to PwDs including those with visual impairment in both rural and urban areas (URT, 2010).

The current effort is made under the Education and Training Policy of 2014, where section 3.2.8 requires the use of technology in providing education (URT, 2014). The Ministry of Education Science and Technology (MoEST) ensures supply of all necessary materials including the teaching and learning

equipment and devices in line with the National strategy for inclusive education 2018-2021 requirements (URT, 2017). For instance; in 2021 the government through the Minister for education proclaimed that 3 billion were used to purchase laboratory tools and other ATs for learners with special needs (Tawala za Mikoa na Serikali za Mitaa [TAMISEMI], 2021). Probably that is why it is possible to find some of the ATs available in schools. This information however, does not specifically mention ATs for learners with visual impairments and their use in facilitating education. Nevertheless, this is a display of efforts to ensure equal opportunities to LwVI in schools.

The government collaborates with NGOs such as Kilimanjaro Blind Trust Africa, Tanzania Albino Society, Learn Community aid Foundations, Tusaidiane Disability Resource and Charity Center, to mention but a few, to ensure ATs are available in schools and almost all-inclusive schools and special schools have ATs. It is normal to find Perkins braille, embossers, slate and stylus, computers with installed software, white canes, sunglasses, and optical devices one or two of these available in a school. However, not much is known about how these ATs are used to facilitate the teaching and learning of LwVI in primary schools in Kasulu District, Tanzania. This study therefore, was undertaken to bridge this gap.

1.3 Statement of the Problem.

Assistive Technologies provide opportunities for children and adults with disabilities to maintain independence and full participation in community activities including in education (UNICEF, 2022). In Tanzania, ATs are provided by the government through MoEST in collaboration with NGOs and

other stakeholders (URT, 2017). Through different policies including the Education Training Policy, and the National Strategy for Inclusive Education, teachers are required to use ATs in order to cater for varying needs of learners including LwVI. In addition, learners are trained and motivated to use ATs through TEHAMA sessions which is one of the subjects in the primary school curriculum. Despite the above attempts by government through MoEST, NGOs and stakeholders to ensure adequacy of ATs for LwVI in primary schools, not much is known about the use of these ATs to facilitate the teaching and learning of LwVI in primary schools in Kasulu District, Tanzania. This study therefore, attempted to bridge that gap.

1.4 Purpose of the Study

The purpose of this study was to explore the use of ATs in teaching and learning of LwVI in primary schools in Kasulu District, Tanzania.

1.5 Research Objectives

This study was guided by the following objectives;

1. To establish the ATs available for teaching and learning of LwVI in primary schools in Kasulu District.
2. To examine how ATs are used to facilitate the teaching and learning of LwVI in primary schools in Kasulu District.
3. To investigate how ATs might be enhancing the learning of LwVI in primary schools in Kasulu District.

1.6 Research Questions

This study was guided by the following questions

1. What ATs are available for teaching and learning of LwVI in primary schools in Kasulu District?

2. How are the ATs being utilized to facilitate teaching and learning of LwVI in primary schools in Kasulu District?

3. How ATs might be enhancing the learning of LwVI in primary schools in Kasulu District?

1.7 Justification of the Study

The government of Tanzania has realized the growing number of children with visual impairment enrolling in different primary schools all over the country. To ensure education is equitably accessed by all, including LwVI, promotion of the use of ATs to facilitate teaching and learning of these learners has been the focus. There is limited information on how ATs are used to facilitate the education for LwVI in Tanzania. Likewise, no study has been conducted to investigate the use of ATs in teaching and learning of LwVI in primary schools in Kasulu District.

1.8 Scope of the Study

This section describes the content scope, geographical scope as well as time scope of the study.

1.8.1 Content Scope

The focus of this study was on the use of ATs for teaching and learning of LwVI in primary schools. It is particularly grounded on analyzing the available ATs for LwVI, how ATs are being utilized to facilitate teaching and learning as well as examining how ATs might be enhancing the learning of LwVI in primary schools.

1.8.2 Geographical Scope

The study was carried out in one inclusive primary school in Kasulu District in Kigoma region, Tanzania. The school was made a choice because of its nature to provide education to children with different needs including LwVI. Teachers and LwVI were expected highly to use and benefit from ATs for full engagement in different school academic and non-academic activities.

1.8.3 Time Scope

This study was undertaken and completed within one year from March 2022 to March 2023

1.9 The Significance of the Study

The researcher hopes that the findings may be beneficial in the following ways;

(i) Policy makers may use the information to design and amend the available ATs policies and programs to suit the needs of LwVI in primary school.

(ii) School managements may utilize the findings to see the essentiality of using ATs in order to increase efficiency in teaching and learning of LwVI in primary schools.

(iii) Teachers may gain awareness of the available ATs and those not available and be motivated to use them to facilitate teaching and learning of LwVI.

(iv) Be a motivation gear for stakeholders to improve the supply of ATs in varieties with the target to improve the learning of LwVI in primary schools.

(v) To contribute to the existing knowledge and be a data base for further researchers to take on.

1.10 Definition of Operational Terms.

Teaching: In this study, teaching denotes an interactive process between teachers and LwVI. Teachers facilitate learners' accessibility to curriculum content or activities both inside and outside through interaction to bring about learning among LwVI.

Learning: is used to denote all the processes including interaction between LwVI and their teachers; materials, activities, devices indoor and outdoor that enhance acquisition of skills to enrich the life of LwVI.

1.11 Theoretical Framework

This study was guided by the DeLone and McLean Information System Success (D&M IS Success) model of 2003 which is the validated model of Information System Success theory (IS Success) (DeLone & McLean, 2016). It is a comprehensive model which provides a procedural approach by which successful use of the system; in this case AT can be examined. The model is engrained on interdependent dimension of six constructs which are; system quality, information quality, service quality, the use, user satisfaction and the net impact. This study will put into utilization the following constructs;

The first is the System Quality; this is a measure of what makes the system to be worth and useful to clients. It considers desirable features such as availability, usability, ease-to-use, flexibility, reliability (DeLone & McLean, 2016). Most researchers who have used this model, associate this construct with the availability, ease to get and ease to access as well as user friendliness of the system (Lee-Post, 2009; Ojo, 2017).

The second is the use; this considers how the system is utilized in terms of quality, nature and correctness to yield the intended outcomes (DeLone & McLean, 2016). In other words the use measures the actual utilization, quality and appropriate usage of the system as ideal dimension under which benefits on client can be rated (Lee-Post, 2000; Freeze et al., 2010; Ojo, 2017).

The third is User Satisfaction; this examines the overall agreeable or disagreeable level of the system users to the usefulness of the system (DeLone & McLean, 2003). It is a general measure of the user' view and experience from using the system in performing their tasks (Freeze et al., 2010). It generally examines whether they perceive the system useful or not useful

Lastly, the Net impact; this is an important measure that describes positive and negative success of the system in utilization in terms of how it is yielding intended results. It is a vital aspect in which the system's contribution to the performance of users is determined. Aspects such as facilitating performance, empowering, time saving, easy accessibility to organizational information, reducing or eliminating limitations, ease of communication among stakeholders of the system are examined (DeLone & McLean, 2016; Ojo, 2017; Onn, 2011).

Relevance of the Model to this Study

The D&M IS success model presents a process framework for evaluating how ATs are made available and utilized by stakeholders (teachers) to facilitate teaching and learning of LwVI in primary schools, to explore how comprehensive utilization of AT might be enhancing the learning of LwVI as sought in objective three.

In line to the above, in their study on "Information Systems Success Measurement" DeLone and McLean (2016) insist that quality design, delivery, use and impact of Information Technology are key measures of system success in an organization which in this study is a school. This implies that the expected improved learning by LwVI which is assessed in ter ms of accessibility, increased interaction, participation in academic activities, confidence and learning independence, is a result of an integrated process from the design phase (ensuring the availability of all the ATs in schools). For example, CCTV, Braille machines, JAWS programmes, Computer with assistive software, embossers, assistive devices like glass, magnifiers and smartphones or tablets, to mention but a few. The utilization phase (measuring how ATs are now put into actual use to facilitate teaching and learning of LwVI) and lastly, the outcome on the learning of LwVI as the result of how ATs are being utilized.

The System Quality provides a base by which the availability of ATs to facilitate the teaching and learning of LwVI was examined as sought in the first objective. The sub-metrics; availability provided a framework of scrutinizing the available ATs for teaching and learning of LwVI and other facilities generally termed as enabling infrastructure for ATs use.

The use; this was an important aspect of this study. It brought out the main focus of the study under second objective, where the actual use of ATs was examined in relation to the nature of use (how ATs are being used). The User Satisfaction was an initial base by which perceived impacts of the system utilization was measured in relation to willingness and readiness of the teachers and LwVI in using the ATs as sought in the second objective.

Similarly, possible hindrances that might be undermining the use of ATs was scrutinized with the guide of this construct.

The central theme of the model is on successful use of the system which is evaluated at the end of the process (DeLone & McLean, 2016). The "Net impacts" describes the contribution of the system to the job performance of the user. This was a very important entity to this study. In line with objective three, this construct guided the study in examining how AT might be enhancing the learning of LwVI as far as communication, accessibility, participation, interaction, collaboration as well as learning independence is concerned.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the reviewed literature on the use of ATs to facilitate the teaching and learning of learners with visual impairment (LwVI). Literature sources such as Books, reports, journal articles, internet sources, and manuscripts from the perspective of developed and developing countries are discussed. The literature is arranged following objectives of the study which are: To establish the available ATs, investigate how ATs are utilized, and examine how AT might be enhancing the learning of LwVI in Kasulu District, Tanzania. Lastly it provides the summary to explain the key findings and gap in relation to the study.

2.2 Assistive Technologies available for Teaching and Learning of LwVI

The World Health Organization (WHO) is committed to ensuring access to ATs. Under the Global Disability Action Plan 2014-2021, emphasis is made to promote the availability of ATs for persons with disabilities including those with visual impairment (Tangcharoensathien et al., 2018). WHO promotes the following two initiatives: (1) the launch of Global Cooperation on Assistive Technology (GATE) in 2014 from which a list of sixteen ATs for visual impairment is provided; (2) the adaption of the World Health Assembly resolution (WHA17.8) to strengthen the partnership and urge partner countries to develop, implement and strengthen policies and programmes that could ensure ATs are available for accessibility of services for persons with disabilities including those with visual impairment in schools (WHO & UNICEF, 2022).

In a study conducted in Australia, Opie (2018) reports that the provision of ATs is imperative to ensure accessibility. Various ATs, including the Braille note, computer, monocular device, Clear Note, Mimio portable device, and bold pens were found available in schools and used for accessibility needs. On the other hand, participants presented difficulties in the use of AT including; unsuitable ATs which could not help them to access information on the board, failure to use Braille machines due to lack of knowledge. The author opines that the availability of ATs is not an end in itself but its applicability, adequacy, appropriateness, and reliable technical support matter a lot in the use of ATs in the teaching and learning by LwVI (Sullivan et al., 2021) Similarly, Wong and Cohen (2015) conducted a study in Singapore and found that high-tech ATs available and used in teaching and learning included; computers, braille, JAWS, CCTVs, ZoomText, and internet websites. On the contrary, they reported that barriers such as inadequacy of ATs hampered accessibility, hence creating a gap.

A similar study by Senjam et al. (2020) in Delhi-Indian schools for visual impairment assessed the availability of ATs in 22 schools and report that ATs for reading, writing, mathematics, science, mobility, and games were available in schools. That more than 90% of the schools had slates with stylus; only less than 90% of schools had Tylor frame, smartwatch, and long cane: 70-80 % were found to have braille reading books and large print cards for games, while 60%-70% of all the schools had braille typewriter, adapted papers and the braille chess. Lastly, 41 ATs of the list were reported to be available in only 60% of the schools. Equally, they report that ATs are not enough to cater the needs of LwVI in their learning. The study notes that the shortage of ATs

and their inappropriate continues to create limitations on the education of LwVI.

Similarly, Alimi et al. (2021) conducted a study in Nigeria to assess the availability and utilization of ATs for learners with special needs and observed that 52.1% of braille and braille embossers, 45.2% of the stylus, 74% of eyeglasses, 53.4% of optical aids, 57.5% of talking computers, 52.1 % of note takers and screen readers for only 52.1% were available and used in schools. The study further adds that all these available though not adequate, were being used in the teaching and learning process and thus motivated and increased performance of LwVI.

Likewise, a study by Assie (2021) in Ghana reports that ATs such as computers, braille, CCTV, and tape recorder were available and used in schools. The author adds that these tools play a great deal in their academic achievement and therefore they enjoyed using them every day. Retorta and Cristovao (2017) observed that in sometimes teachers use smartphones as ATs to enhance the learning of LwVI. In line with this, Wu et al. (2021) suggest that smartphones with their associated applications can be used by teachers and LwVI to enhance teaching and learning.

Similarly, in a study conducted in Tanzania, Wilfred (2017) observed that ATs devices such as Stylus, white canes, computers, and spectacles were available in less than 30% in schools. Also, tape recorders, thermoform, braille globes, talking computers, radio, embossers, block puzzles, braille alphabet puzzles, magnifiers, books on tape, talking watches, talking calculators, and hand-held scanners were available in less than 5% while 52.7% of Perkins Braille,

40.5% of Slates and 54.9% of abacus was available in schools in Dodoma, whereas in Dar Es Salaam the sampled schools, slates and stylus, as well as white canes, were found to be available in greater than 64.9% and 31.3% of Perkins brailler, 36.1% of spectacles and 38.6% of braille alphabet were available in schools. The study shows that ATs both low-tech and High-tech were not sufficiently available, and most of the infrastructure were non-existent.

The reviewed literature above provides an impression that ATs were available in schools though not sufficiently enough to cater for LwVI. Likewise, some of the available are not utilized for different reasons, including poor infrastructure and inadequate skills among users. Also, the literature indicates that smartphones are among the ATs available and used by teachers. Generally, the literature indicates that scarcity of ATs, enabling environment, skills amongst teachers and LwVI in using the ATs are gaps basically not addressed to a satisfying extent including in Tanzania. Thus, this gap needs to be filled up.

2.3 How ATs are used to facilitating Teaching and Learning of LwVI

Assistive technologies have gained pace as a pedagogical enabler that is playing a crucial role in teaching and learning of LwVI. They are used in different ways, specifically as tools to minimize barriers to learning that rise due to vision loss (Ahmad, 2015). This is evidenced by a study by Samanta (2017) who observed that teachers use ATs such as enlarged prints, braille, digital tape recorders, and computers as tools teaching aids including preparing lessons for the students with visual impairment. In their study,

Karakoç and Aslan (2022)an impression is made that teachers use ATs to make teaching process feasible for LwVI. This involves makinf lesson plans by preparing teaching and learning science content in a way that is suitable for LwVI.

Chanana et al. (2022) conducted a study to assess awareness of teachers on ATs and went further to appraise how ATs were used. They discovered that ATs both hardware and software are used in the assessment and evaluation of a student's academic progress. They further say that a laptop with installed screen reader is used by blind students to complete assignments and easily take their examinations decently. Similarly, the study by Avagyan (2019) indicates that ATs are used by LwVI to access different assessment practices as they provide alternative modes such as large prints, braille and audio presentation. Likewise Cadwallader and Tonin (2021) observed that ATs create a room for LwVI to undertake their assessment activities without needing assistance from another person. This means that LwVI use ATs to complete different academic tasks in learning.

Assistive technologies are being used by teachers as pedagogical equipment to teache different subjects including literacies and arithmetic (Viner et al., 2020). They add that both low-tech and high-tech ATs are vital to create conducive environment from which every learner including those LwVI can easily understand the concepts presented by the teachers. Wong and Cohen (2015) adds that teachers use ATs such as computers and its associated application to enlarge text for reading by LwVI, teach literacy skills (reading

and writing) by writing, while letting LwVI follow through the computer-enhanced keyboard.

Alshahrani (2020) and Svensson et al. (2021) observed that LwVI and teachers use ATs such as the internet to search, organize and present information on topics they are not aware of by using telephones, and computers. They add that ATs are crucial tools that are used by LwVI to read text documents without needing any help from a second party. Likewise, Edgar Pacheco et al. (2017) observes that teachers use ATs to access information by downloading from online platforms, recording using digital recorders and make presentations for LwVI to access them. Similary, Edgar Pacheo and colleagues adds that learners use ATs such as CCTVs to read different content materials.

Drigas and Kostas, (2014) align with Wong and Cohen (2015) when they noted that LwVI use the voice recognition software to interact with the computer when trying to do their school works, and note takers are used to convert information in braille format into audio text that would be reviewed in the future through listening to it. Furthermore, (Chikonzo et al. (2021) and Chanana et al. (2022) reported that LwVI were using ATs such as Screen readers enlarged books, printers, embossers, digitalized magnifiers, personal computers, digital voice recorders to perform different academic activities including reading, writing, studying, note-taking and communicating with teachers and colleges. In line with this, Senjam (2019) point out that various ATs can be used by students with visual impairment in reading and writing. These may include but not limited to Typoscope, braille computer keyboard, braille electronic and others.

Kisanga and Kisanga (2020) conducted a study in which they pointed out that students use ATs to navigate the school environment when trying to reach out for learning information. They specifically mention a white cane as an only ATs that was available and used by learners. In line with this, Hakobyan et al. (2013) enlighten to the fact that there are many ATs including those that are of high-tech which learners can use for orientation and mobility. Contrary to Kisanga and Kisanga (2020), Hakobyan et al. (2013) provide an impression that schools have not yet adapted new innovated ATs to enhance LwVI which they should do.

Odeke-Nato (2021) provides an insight that different ATs are used in different ways in teaching and learning of LwVI. Odeke-Nato further observes that telescopes are used to enlarge images for students with visual impairment, while the pocket viewer produces a clear text by holding it over the text. Odeke-Nato further describes that a refreshable braille display can be used to display braille text over a computer desktop, and Text-to-speech converter software and DAISY are used to input audio format for reading of LwVI. Although, Odeke-Nato (2021) suggests that proper use of ATs depends on appropriate ATs and is controlled by a skilled person. The effectiveness of ATs requires expertise and competencies in selecting and using them in relation to learners' educational needs. Thus, training is a requisite for teachers and LwVI themselves on how ATs should be used.

On another side, lack of training and lack of skills among teachers and LwVI are among the reasons to why most of the ATs were not effectively used by both teachers and LwVI (Al-Zboon, 2020; Kirboyun, 2020; and Chukwuemeka & Samaila, 2020). They also point out that scarcity or

inadequate ATs undermine the use of ATs something that may affect accessibility needs by learners with disabilities including those with visual impairments. Al-Zboon (2020) specifically added that breakdown and damages of ATs may be the reason to why learners are lacking important ATs to use. Furthermore, Eligi and Mwantimwa (2017) reports challenges such as unstable electricity to be the barrier in using ATs in most of educational institutions. Also, Chukwuemeka and Samaila (2020) point out that inadequate electricity supply is one among the many reason that can lead to underutilization of ATs in schools, and therefore need to be mitigated.

Generally, these literatures have expressed how ATs are differently used by both LwVI and teachers. Many scholars explain that ATs are used to produce, manipulate, store, convert, and process teaching and learning materials in teaching and evaluating the learner's progress. Specifically, LwVI use ATs to read, write, navigate and access different learning information. They also recognize that their use is limited due to different challenges including inadequate skills, inaccessibility to some of the ATs, unstable electricity, and other poor infrastructure. Therefore, all these need to be resolved for appropriate use of ATs by LwVI.

2.4 How Assistive Technologies might be enhancing the Learning of LwVI

Students with visual impairment have a condition that degrades the standard of their academic life (Samanta, 2017). Their ability to participate, collaborate, access information and perform independently and with confidence is limited. Thus, the use of ATs is paramount to render a successful academic life to LwVI and improve their academic performance (Ahmed, 2018). Many

scholars have advocated for the use of ATs to LwVI due to their significance as follows;

Eligi and Mwantimwa (2017) conducted a study in Tanzania to assess the usage of ICTs. In the study, they found that most of the participants had opined that ATs enhance learning by minimizing time students with visual impairment spent in performing different academic and non-academic activities because it eases the tedious work that could not be performed within short time. The findings from a study by Demirok et al. (2019) support this and reports that ATs facilitate instructional delivery and saves time for learners to learn.

In studies conducted by McNicholl et al. (2019) and Satsangi et al. (2019) it is highlighted that ATs create conducive environment in which learners with disabilities including those with both low vision and blindness can perform their activities independently without relaying to the help provided by others. Montenegro-rueda (2022) in a review study, reports that ATs are potential because they help learners with disabilities including those with visual impairment to develop independence working abilities. On another side, Montenegro-rueda reports that the most notable challenge is that there are no enough appropriate ATs that can efficiently enhance independence. On the other hand, ATs are mechanisms towards learners' confidence and self-consciousness (Shinohara & Wobbrock, 2016). They explain that though ATs can lead to fear especially those which are wearable, they are vital to for LwVI to develop confidence and enhance social interaction. In line with this, Demirok et al. (2019) point out that ATs are the source of self-reliance and

identity for learners with disabilities including those with visual impairment. Thus, LwVI in schools gain assurance to do whatever they want as much as learning is concerned independently and with confidence.

Studies by Satterfield (2016) and Viner et al. (2020) show that when ATs are appropriate, they can facilitate participation of children with special needs, including LwVI in different school activities and enhance performance. According to Ahmed (2018), ATs are important tools that create a conducive environment for learning. Likewise, in the analysis of ATs for inclusion of students with disabilities, Kisanga et al. (2018) and McNicholl et al. (2020) observe the same that ATs remove barriers that hinder LwVI to participate and create pathways in which they can engage in inclusive classroom activities such as group deliberations. In another study, McNicholl et al. (2020) pointed out that because ATs create conducive learning environment, they help LwVI obtain and sustain good grades. Thus ATs are gist towards academic performance of LwVI. Thus, access to and effective use of AT is very crucial for LwVI in today's focus on inclusive education, and opposite to this equates to denying them the right to education.

Nordström et al. (2018) undertook a study as part of the Swedish programmes which assessed the use of Text-to-speech (TTS) and Speech-to-text (STT) software. In this study, it was found out that AT with reference to TTS and STT increase student's motivation to interact with text as well as promote independence in learning. This is because AT provides them with alternative ways to read and produce text, ways to follow instructions in a regular classroom, and ways to listen to books without intermediate personal

assistance. Similarly, Montenegro-rueda (2022) and Arpacık (2018) reported that ATs are salient tools that increases learner's motivation and raises attention to involve themselves in different academic activities. All these studies provide an impression that ATs should be considered for effective learning of LwVI.

Assistive technologies are also the gist towards conducive learning environment for learners with visual impairments. This is because ATs enhances LwVI access most of the curriculum information and as such helps these learners learn just like their counterpart students (Nordström et al., 2018; Koehler & Wild, 2019; Kirboyun, 2020). In addition to this Nees and Berry (2013) articulate that AT augment LwVI abilities both in reading and writing through different computer technological software programmes and audio ATs. Thus, LwVI are able to access different learning material and equally access all the learning process.

On another hand, Kisanga & Kisanga (2020); Hakobyan et al. (2013), and Fasciglione (2017) line with the article 20 of the CRPD model that requires orientation and mobility to be provided to persons with disabilities as their right. They equally describe that ATs provide autonomy, safety and liberty to interact with their environment which is very important for learner's learning, particularly LwVI.

Lastly, McNicholl et al. (2020) observes that ATs are crucial in a way that they enhance wide variety of learners with disabilities including LwVI to develop abilities to express their thoughts. On another side, the authors explain that there is a different in the benefit of ATs between those whose ATs needs were fulfilled and those that ATs needs were not fulfilled. That for learners to

develop high confidence to participate in academics, they must have that ability to engage in classroom communication in which self-expression enhanced through the use ATs is vital.

Summary and Gaps

Capturing from the reviewed literature, it is clear that ATs are both vital and reasonable accommodations every education institution is taking seriously. The discussion shows that ATs for LwVI are available and are being used both by teachers and LwVI in some schools with the efforts by government and NGOs under institutions concerned. However, they are not in a quantity and quality required to cater for the teaching and learning of LwVI. On the other hand, inadequate skills, poor or absence of infrastructure, unsuitability and others related to poor budget allocation undermine the utilization of ATs for LwVI. The discussion in this literature review indicates that many studies carried out on ATs were highly focused at higher levels of education. Additionally, some of them are focused on the efforts that are being put in place to ensure ATs are available in schools. However, there is a dearth of studies on the use of ATs in facilitating teaching and learning of LwVI in primary schools in Tanzania. Given such a situation, the current study so it important to attempt to fill that gap.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents a description of procedures that was considered in carrying out the study on the use of ATs in teaching and learning of LwVI in primary schools. It includes the research approach, design of the study, study location, target population, sample and sampling process, data collection methods, pilot of the study, data collection procedures, data analysis, and ethical issues to be considered in carrying out the study. Lastly, the limitations and that was encountered during carrying out this study are also presented here in this chapter.

3.2 Research Approach

Research approaches refers to strategies and arrangement that guide a study from broad postulations to the last phase of data interpretations. There are different research approaches including qualitative, quantitative and mixed approaches (Creswell & Creswell, 2018). This study was carried out using the qualitative research approach which refers to an inquiry that allows a researcher to explore and better understand the complexity of social phenomena based on the mind and action in relation to environmental context of the participants (Mohanjan, 2018). In this study, a qualitative research approach was the best choice for the researcher as it provided him with a holistic interpretation of the detailed processes referring to the use of ATs in teaching and learning of LwVI. It was also appropriate because the focus of the study required detailed information obtained from the limited number of

participants used by the researcher and from real-life and day-to-day practices on using ATs in primary schools.

3.3 Research Design

A research design is a structural plan of a proposed study that link all the major components of the research work aiming to address the central research problem at hand (Bostley, 2019). In qualitative research it may include a case study, action research, ethnographic studies, grounded theory and others. In this study, a case study was used to explore the use of ATs in teaching and learning of LwVI in a selected primary school. A case study refers to an inquiry in which a researcher intensively explores a contemporary phenomenon within actual life setting (Yin, 2014). A case study design was ideal because it helped the researcher to obtain detailed information on live experiences of teachers in using ATs in teaching and LwVI in their learning and how ATs was enhancing learning in the natural setting, thus the primary school in Kasulu district, Tanzania.

3.4 Area of Study

This study was conducted in one Primary school situated in Kasulu District in Kigoma Region, Tanzania. Kasulu is approximately 800 km North West of Dodoma capital city of Tanzania. It is bordered to the north by Burundi country, east by Kibondo, south by Uvinza, west by Kigoma, and to the northwest by Buhigwe Districts. It is the second largest town in Kigoma Region covering an area of 5324 km^2 with a total population estimated to 500, 000 (URT; Kasulu DC, 2019). Kasulu District provide equal accessibility to primary education among children including those with disabilities under the

Special Needs Education Unit (SNEU). There are two primary schools dedicated to accommodate children with disabilities including LwVI. This particular school was made a case for this study because it accommodates learners with multidimensional needs and where LwVI outnumber other categories in the school and in the district. The school follows the requirements of Educational Training Policy (ETP) 2014 on the need to use technology in delivering education.

3.5 Target Population of the Study

A population is a group of individuals from where a sample is drawn. Casteel and Bridier (2021) argues that the target population represents a specific, conceptually bound group of potential participants from which the results can be generalized. For the purpose of this study, the target population was five (5) teachers who were teaching LwVI and twenty-six (26) LwVI from lower, middle and upper classes that provide information on the use of ATs in the teaching and learning. The study also targeted two (2) administrators; a head teacher and a District Special Needs Education Officer chosen by considering the role in handling all issues related to special educational needs including ensuring availability of ATs and monitoring implementations of all the policies, guidelines and directives related to the use of ATs in the school.

3.6 Sample Size

A sample refers to a subset of a population which represents all units in a large population. Bhardwaj (2019) argues that a sample is a group of individuals, objects or items that are drawn from a large population for investigation. Casteel & Bridier (2021) add that a sample size may simply refer to a specific

selected number of participants required to completely address the research questions in a particular setting. This means that a sample size depends on the requirement of the research study in relation to the research purpose. In this study, a sample of five (5) teachers, one (1) deputy head teacher, five (5) LwVI and one (1) District Special Needs Education officer totaling to twelve (12) participants were selected and used to provide information on the use of ATs.

3.7 Sampling Technique

Sampling refers to a procedural process of obtaining a specific number of members for a sample from a large population in a defined research purpose (Bhardwaj, 2019). Sampling technique therefore, refers to an approach used by the researcher to recruit the members of the sample, considering the size required (Casteel & Bridier, 2021). The sampling in this study was done using purposive and convenience sampling technique to obtain a sample representing the population of teachers, LwVI and the District Special Needs Education officer. Purposive sampling is a non-probability sampling that involves selecting the members of a sample basing on the purpose of the study (Bhardwaj, 2019). The purposeful sampling was ideal in this study because it provided the researcher with opportunity to select members of a sample basing on specific quality in relation to the research problem (Casteel & Bridier, 2021). On another side, convenience sampling refers to a strategy by which a researcher obtaine a sample basing on who is accessible for the study (Bryman, 2016).

In line with this, the sample for this study was purposefully selected basing on the following criteria; LwVI from upper classes because they are the prime users of ATs and they have been using ATs in their learning than those in lower classes. Teachers who have been teaching LwVI for more than two years were selected; gender was also used as one of the criteria. Lastly, the Administrators (Deputy Head Teacher and District Special Needs Education Officer) were chosen due to the important role in handling issues related to special educational needs including ensuring ATs are available as well as monitoring implementations of all the policies, guidelines related to the use of ATs in teaching and learning of learners with disabilities including LwVI in primary school.

3.8 Methods of Data Collection

Data collection methods presents approaches and techniques of how data is collected in relation to research objectives (Johnson & Christensen, 2017). There are several methods used in qualitative approach including focus group discussion, interviews, observation and analysis of already existing data/documentary analysis (Yin, 2014). Based on the nature of this study, interviews and observation was used to collect qualitative data and/or direct views from the participants.

3.8.1 Interviews

An interview is a data collection technique in which a researcher obtains data by talking in person or through phone with participants (Johnson & Christensen, 2017). They add that an interview is best because it gives a second chance for participants to clarify their responses. Interviews may be; structured interviews, which do not allow flexibility of responses; semi-

structured interviews, which allow some form of flexibility through probing questions; and unstructured interviews, which are conducted informally. This study made use of a semi-structured interview to obtain detailed data on the use of ATs in teaching and learning of LwVI. Semi-structured interview was best because it offered the researcher with in-depth information through dialogic exchange where the researcher was able to actively construct knowledge in partnership with the participants who constructed answers (Husband, 2020). The Sem-structured interview guide was used for the District Special Needs officer, teachers and LwVI to obtain information, first to analyze the available ATs and then how they were being used in teaching and learning of LwVI. Then on the third objective on how ATs are benefiting the learning of LWVI in primary school.

3.8.2 Observation

Observation is one of the important methods of data collection in qualitative research approach which involves watching and noting the participant's behavior in their natural (setting and situation) or structured (in laboratory) location (Johnson & Christensen, 2017). This study preferably used a qualitative observation which is done in natural setting rather than the quantitative observation (structured) which is done in structured environment. It added values on the information collected through the interviews on the available ATs and other enabling infrastructure in the school. The researcher used a non-participant observation in a way that, as an observer he visited and observed the available ATs, available enabling infrastructures for use of ATs in a school and how the ATs are used in teaching and learning of LwVI in a

school as a social setting without getting involved in any activities (Bryman, 2016).

3.9 Piloting the Study

This is sometimes known as a feasibility study (Fraser et al., 2018). It refers to a small-scale study which is conducted by the researcher as an external study independent of the large-scale study or internally as part of the large-scale study procedure (In, 2017). A pilot study tests the credibility of the methods, research tools, population and sample. In other words, a pilot study helps a researcher to decide on how to make improvement of the procedures and tools in the full-scale study when disproportions are discovered. The pilot study was carried out in a similar primary school with the similar condition to study. The school is located in Kibondo District, Kigoma region, Tanzania. Specifically, LwVI were picked to tryout the tools for data collection for identification of possible disparities. The interview guide and the observation guide were pre-tested and indicated that there was no enough ATs, teachers and LwVI were using ATs in different ways but were limited by scarcity and poor infrastructure, and to some extent LwVI were benefiting from using ATs. Few disparities on the observation guide were discovered; for instance, enlarged text books, radios, sunglasses, raised maps, printers, photocopy machines, speakers were included in the guide. Similarly, some slight changes on semi-structure interview guides were made to ensure they are suitable for reliable data for the large-scale study.

3.10 Data Collection Procedures

Approval of the proposal was sought from the supervisors and the Department of Special Needs Studies under the Directorate of Research and Graduate Training, Kyambogo University. Secondly, an introductory letter for data collection was requested from the Head of Department and taken to the Regional Education Officer (REO), Kigoma region, Tanzania who also offered a letter to be taken to the District Commissioner's office. The District Commissioner's office offered a letter to be taken to Kasulu Town Council Director who also wrote to the Head teacher in a selected primary school. Lastly, the head teacher permitted the researcher to meet and interact with potential participants for rapport establishment. Each participant was then given a consent form which explained the expectations of the research, and they all consented. The researcher conducted a non-participant observation before by using an observation guide to analyze the available Assistive technologies, their functionality and enabling infrastructure in the school. Interviews were then organized basing on the date and time agreed with the participants and carried out personally by the researcher. Meanwhile, the researcher asked for permission from participants to record the conversation during the interviews using a digital-audio recorder. While recording, the researcher was careful to take notes to ensure no information was left out.

3.11 Data Analysis

Data obtained from the field are fieldnotes or records, simply known as crude data which does not make any sense in relation to the problem at hand and therefore, requires analysis (Tracy, 2013; Id et al., 2022). In qualitative

research it involves the process of sorting out crude data to dunvail meaningful and/or useful information and transform modelled information to guide inferences (Tracy, 2013). That is why data analysis was very important in this study. The data collected in this study was first transcribed from Kiswahili to English language and then coded with; 1. The open coding in which the researcher sorted out different concepts and ideas related to the use of ATs; 2. The axial coding in which the researcher identified the core concepts as related to objectives; 3. The selective coding which helped the researcher to identify the central ideas from the transcript basing on each objective. After coding was done, the data was then subjected to "Thematic" analysis method. In line with this study, themes and sub-themes were identified by extracting recurring issues, similarities and differences as rated to each research objective to ensure comprehensible logic about the data. Lastly, verbal accounts from interviews were presented as recorded from participants to enhance the originality of findings (Tracy, 2013; Bryman, 2016).

3.12 Credibility and trustworthiness of the study

Credibility refers to how research findings are believable and trustworthy due to how they correspond to the truth as sought by the researcher in verification with end users while trustworthiness is a state by which research readers become assured with the truth generated by findings due to its honesty (Stahl & King, 2020). In other words, credibility enhances trustworthiness. In this study, credibility and trustworthiness were used to make sure findings are accurate, to avoid bias and establish the quality inferences to other context and population. To ensure all these, the following were done: 1. The researcher prepared the data collection instrument which was then discussed and

approved by supervisors, and tried out through a pilot study: 2. The researcher used triangulation of data sources. This was done by using multiple data sources from observation and interviews to increase an understanding of the research topic and minimize potential bias in findings: 3. The data was collected from different categories of participants including; teachers, deputy head teacher, students and Special Needs Education Officer with the aim to increase a wide range of inferences and minimize bias in findings: 4. The research was conducted in a natural setting and verbatim experiences from the participants was gathered, presented, analyzed and discussed with utmost honesty to avoid any kind of deception (Bryman, 2016).

3.13 Ethical considerations

The research process involves people and is mostly about people. If the process is not carefully handled, it may expose participants and the researcher to vulnerability and leave its validity and trustworthiness compromised (Vicars et al., 2015). Due process that includes consideration of ethical principles is therefore required. Ethics present standards of conduct that differentiate what is proper and improper (Ubi et al., 2020). This means considering all acceptable conduct while avoiding inacceptable actions in the process to undertake research. Vicars et al. (2015) mention some aspects of conduct as; informed consent, avoiding deception, privacy and confidentiality, cross-cultural representation. This study was bound to consider ethical principles in order to enhance authenticity, credibility and trustworthiness. First, the researcher followed all the data collection procedures including obtaining research clearance and permissions from authorities before data collection. Then, before data collection, participants were informed about the

study, how data was to be collected, recorded and used in the future. Each one of them was given a consent form to sign, and decide whether to participate or not. Then, special emphasis was put on anonymity and confidentiality; the researcher used codes for participant's names and school and keeping their identity confidential for their safety. Lastly, in the process of data analysis and report writing, ideas used in this study are the researcher's own words, where other people's ideas have been used, acknowledgement has been made.

3.14 Limitations

In conducting this study, there were some of the limitations encountered. These includes the following;

Time constraints were one of the limitations. Considering that data collections was done at time when schools were preparing to close for Christmas holidays, many offices from the regional, District commissioner's, Director and the school were too busy. However, they were cooperative because they had to divide their time to participate in the study. Again, the head teacher was not available at the moment when data was being collected; this caused worries of missing some information by the researcher. However, the deputy head teacher accepted to participate and provided information equally to those that could be provided by the head teacher.

The study was conducted in one District and restricted in one primary school, involving few teachers, few LwVI and one District special needs education officer in the whole region and country. This brought fear of whether the findings could be generalized for other schools in the region. To mitigate this, the researcher ensured that the school is worth presenting other schools, then

selected a senior school which is hosting many LwVI than any school in the region, the researcher also conducted a pilot study in a similar school from another District, triangulation of method and participants was done to acquire different categories of information.

CHAPTER FOUR: PRESENTATION, INTERPRETATION, AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter covers presentation, interpretation and discussion of the study findings which sought to examine the use of ATs in teaching and learning of LwVI in Primary schools in Kasulu District, Tanzania. Data is presented following the research objectives which are to establish the available ATs for teaching and learning of LwVI; examine how ATs are used in teaching and learning of LwVI; and investigate how the use of ATs are enhancing the learning of LwVI in primary schools. In line with the mentioned objectives, the findings are presented and discussed basing on the main themes and sub-themes as they appear from the verbatim analyzed narration of each participant. The verbatim narration of the participants as obtained from the field are presented to maintain originality of the findings but the names of participants and the name of the school was not mentioned. Instead, they were assigned codes to ensure anonymity and confidentiality. The codes specifically assigned were; LwVI, to signify learners with visual impairment, TLVI, to signify teachers of learners with visual impairment, AD 1, to signify administrator one and AD 2 to symbolize administrator two, and the school was coded as X.

4.2 Description of the Study Participants

This section describes the participants who participated in the study. The researcher collected and presented the information of the participants of the study in categories as in the table below;

Table 1: Description of the Study Participants

SN	Category	Gender		Sub-Total
		Male	Female	
1	Learners with visual impairment (LwVI)	3	2	5
2	Teachers of LwVI (TLVI)	4	1	5
3	Deputy Head Teacher (AD 2)	1	0	1
4	District Special education officer (AD 1)	1	0	1
	Grand Total	**9**	**3**	**12**

Source; primary data (2022)

Table 1 above illustrates the twelve (12) study participants in three categories. These included; Five (5) Learners with visual impairments including three (LwVI 1, LwVI 2, LwVI 5) who were male, 2 Blind and 1 with low vision, and Two (LwVI 3, LwVI 4) who were females, 1 Blind and 1 with low vision; Five (5) teachers who were all teaching LwVI in the school including four (TLVI 1, TLVI 2, TLVI 4, TLVI 5) who were males, and one (TLVI 3) who was a female participant; Two administrators including one Deputy Head Teacher (AD 2) who was a male and provided data on behalf of the Head Teacher, and one District Special Education Officer (AD 1) who was also a male participant.

4.3 Assistive Technologies available for Teaching and Learning of LwVI in Primary School X

In this section, the study aimed at analyzing the different ATs available for LwVI in the school. This theme was vital to the study because the use of ATs to facilitate teaching and learning is determined by the available ATs in terms of quantity and quality as compared to the learners in the school. This data was a good lead for the researcher to first establish all the ATs available, and then establish their categories as well as the different enabling infrastructures available to aid the use of ATs. To obtain this information, the researcher

carried out observation using observation checklist. A comparison was made with the list provided by the head teacher and information obtained from participants through interview. The list of all the ATs available is shown in the table below;

Table 2: ATs Available for Teaching and Learning of LwVI in primary school X

SN	Item expected	User category	Available	Status of sufficiency compared to number of LwVI (36)	
				Enough	**Not enough**
1	Manual Perkins braille	Blind	23		✓
2	Electric Perkins braille	Blind	4		✓
3	A4 frames/slates	Blind	30		✓
4	Stylus	Blind	30		✓
5	White cane	Blind & Low vision	20		✓
6	Abacus	Blind & Low vision	7		✓
7	Card stock papers	Blind	5 boxes		✓
8	Monocular lenses	Low vision	7		✓
9	Raised maps	Blind & Low vision	3		✓
10	Enlarged books	Low vision	21		✓
11	Radios	Blind & Low vision	1		✓
12	Sun glasses	Low vision	1		✓
13	Closed circuit Televisions	Low vision	2		✓
14	Embossers	Blind	2		✓
15	Duxbury Braille Translator (DBT)	Blind	2		✓
16	Braille duplicators/ Thermoform	Blind	1		✓
17	Printers	Low vision	2		✓
18	Photocopy machine	Low vision	1		✓
19	Desktop computer	Blind & Low vision	2		✓

Source: Primary source, 2022

Table 2 above shows the ATs available in school X. The data provide insight to the fact that some of the ATs necessary for teaching and learning of LwVI, both learners with low vision (LwLV) and those who are blind are available. However, the available are not sufficient enough to cater for teaching and

learning for both LwLV and those who are blind. This means, teachers were limited on how they deliver the curriculum content for learners. As a result, LwVI (LwLV and those who are blind) may be limited from accessing some of the opportunities in learning. In one side, the findings above align with the D&M IS Success model which require that for Information system to be in use, provisions should be available (DeLone & McLean, 2016). This way, some of the available ATs may be used to enhance teaching and learning. On another side, the findings are contrary to the D&M IS Success model which states that for a system to yield positive outcome it should possess some qualities. This way the ATs are not enough to facilitate teaching and learning of LwVI, something which may negatively affect their performance.

The findings above also concur with Opie (2018) who observed that some of the ATs were available in school and LwVI were using them to access the curriculum content. However, Opie's observation enlightens that lack of varieties of ATs from which learners would select which one to use basing on their needs pose challenges towards accessibility in education. In relation to this, Senjam et al. (2020) observes that ATs dedicated for reading, writing, mathematics, mobility, communication and Daily Living including Perkins braille, A4 frames, refreshable display, CCTVs, computers, talking watches and calculators, typoscopes, phones with their associated apps to mention but a few are available in schools to cater for both LwLV and those who are blind. However, in the same study, Senjem and collegues report that schools do not have some of the ATs sufficient enough to cater for the needs of LwVI something which pose barriers towards accessibility to some of the educational opportunities. In relation to the above the World Health

Organization (WHO, 2016) under GATE list of ATs, provides a list of sixteen ATs for visual impairment from which an authority may consider to ensure ATs are available for accessibility needs in education. This serve as an alarm that calls for joint efforts by authorities to ensure that ATs are adequately available to enhance the teaching and learning of LwVI, both LwLV and those who are blind which may influence their performance.

4.3.1 Categories of Assistive Technologies

In this section the researcher' attempt's was to analyze all the ATs available in two categories which are; Low-tech ATs and High-tech ATs. This was important because with the current advanced world in technology, there is an argument that low-tech ATs are outdated and can no longer be of help to LwVI and that high-tech ATs should be considered instead (Kirboyun, 2020). Others report that though high-tech ATs are best to enhance the learning for both LwLV and those who are blind, Low-tech ATs are important because they are easy to access and use (Chukwuemeka & Samaila, 2020). However, findings from previous researchers show that what suit one may not suit another, so it is important to have all the categories where learners including those with visual impairment (low vision and blind) may choose to use what is suitable for them (Conderman, 2015; Jadhav et al., 2020). These categories are presented hereunder;

Low-Tech Assistive Technologies

Under this section, the researcher's attempt was to establish different low-tech ATs that were available in the school based on the expected, available, and those which are functioning,

Table 3: Low-tech ATs Available for LwVI in Primary School X

SN	Item expected	Users category	Available	No. of Operational	Function
1	Manual Perkins braille	Blind	23	15	Writing
2	Electric Perkins braille	Blind	4	1	Writing
3	A4 frames/slates	Blind	30	30	Writing
5	Stylus	Blind	30	30	Writing
6	Braille globe	Blind	0	0	Teaching
7	Electronic globe	Blind	0	0	Teaching
8	Electronic magnifiers	Low vision	0	0	Reading
9	White cane	Blind	20	20	Mobility
10	Abacus	Blind	7	7	Counting
11	Audio recorder	Blind & low vision	0	0	Recording
12	Victor readers	Blind & lowvision	0	0	Recording
13	Table lamps	Low vision	0	0	Reading
14	Card stock papers	Blind	5 boxes	All	Writing
15	Talking watches	Blind	0	0	Timing
16	Ear/Head phones	Blind	0	0	Listening/ read
17	Monocular lenses	Low vision	7	7	Reading
18	Binocular lenses	Low vision	0	0	Reading
19	Raised maps	Blind	3	3	Teaching
20	Enlarged books	Low vision	21	21	Reading
21	Radios	Blind & low vision	1	1	Entertain ment
22	Counting blocks	Blind & low vision	0	0	Counting
23	Lensed Spectacles	Low vision	0	0	Reading &O.M
24	Sun glasses	Low vision	0	0	Reading &O.M

Source; Primary Data (2022)

Table 3 above shows data from the list provided by head teacher and the observation carried out by the researcher and interviews with participants. From the table, nine (9) categories of ATs which are; Perkins braille, A4 frames/slates and their stylus, white canes, abacus, cardstock papers, a radio, magnifying lenses, enlarged books and raised maps were the only available ATs in the school. The data indicates that the school has very limited collection of low-tech ATs available for teaching and learning of both LwLV and blind learners, and thus many of them are non-existent. Furthermore, some

of those that are available were not in use due to different faults and lack of timely repair and maintenance.

When participants were asked whether they were aware of the existence of different low-tech ATs, participants (AD1, AD2, TLVI 1, TLVI 2, TLVI 3, TLVI 4, TLVI 5, LwVI 2, LwVI 3, LwVI 4, and LwVI 5) stated that some of the low-tech ATs are available. One of the participants said:

> Ehee, tuna vifaa vya kuandikia, kusomea na kumove (kutembea). Kuandikia tuna vibao, lakini pia ukitaja A4 frame hapa lazima utaje stylus. Lakini kuna mashine ambazo tunazitumia (Perkins braille), lakini pia tunavinavyotumika sehemu zote, mfano lenzi ambazo ni za kushika mkononi. Kwa kifupi, niseme tu kwamba vifaa vipo japo siyo kivile (AD 2)

> *[Ehee, we have ATs for writing, reading and for moving. In writing we have slates not forgetting stylus. We also have machines which are being used, but also, we have those that are multipurpose, example handheld lenses. In short, I would say that these devices are available though not adequate]*

Another one had this to say:

> Mimi nadhani tulizo nazo ni za kawaida, tuna hizo A4 frame zipo zinatumika. Lakini pia tuna hizi Abacus zipo tunazitumia, tuna slates pamoja na mandishi ya kimacho. Nafikiri pia tuna white cane ambazo tunazitumia pia (TLVI 2*)*

> *[I think we have the ordinary ones. We have A4 frames being used. We also have these Abacus; we have slates and the visual text. I think, we also have the white cane which are also being used]*

In connection to the above, it was noticed that some of the participants had little awareness on the availability of all the low-tech ATs in the school. This is because few of them could mention more than three ATs. This is observed through participants (LwVI 3, TLVI 3), one of them said: "*Tuna lenzi, miwani*

ya jua. Tayari ni kama hivyo tuu (LwVI 3) [We have lenses, sun glasses. Yeah, only those]

Another participant said*: "Aaah…hapa, nadhani tuna Perkins Braille na vibao tuu, ndo naona vipo basi, labda na whitecane" (TLVI 3) [Aaah…here, we have Perkins braille and slates only, may be a white cane too]*

The statements above show that though there were some ATs being utilized by teachers and LwVI in the school, some of the learners and teachers rarely utilized ATs available in school. Participants could only mention a Perkins brailler, an A4 frame, and white cane while unable to mention others such as; abacus, enlarged books, cardstock papers, a radio, and raised maps. This suggests that even the available ATs are not utilized as expected, something that may pose challenges for LwVI to access information, and fail to perform different academic activities.

These findings are contrary to the D&M IS Success model which suggests that for any system to function given positive impacts, the provisions should be available and easy to access (DeLone & McLean, 2016). Senjam et al. (2020) also explain that 70% up to 90% of the schools were attributed to have slates with styluses, braille typewriters, braille reading books and enlarged prints, long cane (white cane). Other adapted Low-tech ATs such as Tylor frame, smart watches were found to be available in small quantity or non-existed in the schools. They add that ATs more especially Low-tech ATs were not enough and this may continuously be creating limitations to educational accessibility to LwVI, both those with low vision and those who are blind.

Similarly, Wilfred (2017) observed that in most of the schools there were slates with styluses, Perkins braille, white canes in greater than 30%-64% while others such as tape recorders, braille globes, radios and other adapted were available in less than 5%. The author reports that most of the low-tech were extremely few in primary schools. This may cause an alarming situation to the academic performance of LwVI who are enrolled in primary schools. There is therefore, a high possibility of continuous lagging behind of LwVI in education based on the fact that accessibility to most of the learning opportunities is limited.

High-Tech Assistive Technology

Under this sub-theme, the researcher presents different high-tech ATs available and used in the school. To obtain data for this theme, the researcher carried out a case observation with the help of observation guide and interviews. The data is presented in a table with three sections; Expected, available for LwVI, both those with low vision and those who are blind, and their status of operational as in the table below;

Table 4: High-tech Assistive Technology available for LwVI in school X

SN	Expected Assistive Technologies	User category	No. of available	No. of operational
1	Computers with screen readers	Blind &low vision	0	
2	Computers with screen magnifiers	Low vision	0	
3	Closed circuit Televisions	Low vision	2	0
4	Digital recorders	Blind &low vision	0	
5	Smart boards	Low vision	0	
6	Embossers	Blind	2	0
7	Duxbury Braille Translator (DBT)	Blind	2	0
8	Scanners	Blind	0	
9	OCRs and OCR software	Blind &low vision	0	
10	Projectors	Low vision	0	
11	Digital books/DAISY	Blind	0	
12	Braille duplicators/ Thermoform	blind	1	0
13	Printers	Low vision	2	1
14	Android phones	Blind &low vision	0	
15	Photocopy machine	Low vision	1	1
16	Desktop computer	Blind &low vision	2	2

Source: Primary Data (2022)

Table 7 above shows that the school has only seven (7) categories of high-tech ATs for both LwLV and those who are blind and these were embossers, Duxbury Braille Translators, Desktop computers, Closed Circuit Televisions, Braille duplicator (thermoform), Printers and Photocopy machine. The data reveals that none of the two embossers, a thermoform, DBTs, CCTVs are

functioning. Only one printer out of the two is in use, one available photocopy machine, and the two Desktop computers are operational.

The data therefore shows that the school has a limited number of high-tech ATs. Many of the high-tech ATs are unavailable and some of those that are available in the school are not operational due to faults such as; breakdown and limited skills to operate them.

When participants were asked whether they were aware of the existing High-tech ATs, most of them (TLVI 1, TLVI 5, LwVI 2, AD 2, TLVI 2, TLVI 3, TLVI 4, LwVI 1, LwVI 3, and LwVI 5) mentioned an embosser, computers, photocopier, printers, CCTVs to be available in the school. One of the participants said:

> Teknolojia tulizo nazo, naweza nikasema kuna embosser, na embosser haiendi peke yake inaenda na kompyuta, kwahiyo pia kompyuta tunazo, lakini pia tuna CCTV special kwa wanafunzi wenye low vision (uoni hafifu) (TLVI 1)
>
> *[The technologies we have, I can say there is an embosser, and the embosser does not go alone, it goes with the computer, so we also have computers, but we also have special CCTV for learners with low vision]*

Another participant said:

> Teknolojia za juu tuna kama mashine ya embosser, lakini pia tuna teknolojia kama thermoform ambazo pia tunatumia kuzalisha maandishi ya nundu, tuna teknolojia kama compyuta za mezani ambazo zinatusaidia kwa sasa, japo kwa idadi yake hazitoshi na hizi hazina programu (TLVI 5)
>
> *[We have high-tech technologies such as an embosser, but we also have technologies such as thermoform that we also use to duplicate braille text, we have technologies such as desktop computers that help us at the moment, although they are not sufficient in number and these do not have programs]*

The data above provide insight to the fact that LwVI, both low vision and blind learners in primary schools have limited access to the quality and equitable education they deserve. This is due to the fact that most of the high-tech ATs that could enhance easy access to learning are unavailable in school while the few that are available are not operational. Moreover, the findings provide an impression that teachers and LwVI, both those with low vision and blind in the school are not using high-tech ATs. Instead, they are dependent on low-tech and unsophisticated ATs such as Perkins braille, slates and stylus, white canes which limit teaching and learning. This finding is contrary to the D&M IS Success model which suggest that for the system to function successfully, it should bear the "quality" that means all the provisions, in this case high-tech ATs should adequately be available to enhance learning, which is contrary to what is found in the school.

The findings are also consistent with Wong and Cohen, (2015) who observed that high-tech ATs accessed in schools included computers, embossers, JAWS, CCTVs, and ZoomText. Similarly, Alimi et al. (2021) in their study report that 52.5% of talking computers, 52.1% of embossers and 52.1% of screen readers and note takers were available and used in schools to enhance teaching and learning of LwVI. These reports suggest that there is a pool of high-tech ATs that can be put in place for teachers and LwVI to use. Likewise, Drigas and Ioannis (2017) and Assie (2021) have identified computer, CCTV, tape recorders, Voice synthesizers, and braille converter software to be important for LwVI to access information, interact and engage in lessons. A lot should therefore be done in the school to ensure current and sophisticated high-tech ATs availability. This way, dependency on braille and slates will be

reduced and LwVI, both LwLV and those who are blind in primary schools may access all opportunities comparable to their counterpart sighted learners.

Additionally, another issue from the findings is on the maintenance and repair of the available ATs. The data reveals that most of the high-tech ATs once damaged are not repaired. This may consistently affect the teaching and learning of LwVI. Opie (2018) explains that even though numerous ATs were available, they were not all utilized due to unsuitability and lack of support teams. Effort to repair the available and ensuring availability of specialists is therefore paramount if ATs are to be adequately available to enhance the teaching and learning of LwVI in primary schools.

It also emerged that inadequacy high-tech ATs in school made teachers to use their smartphones to ensure accessibility in their lessons. This is revealed from one participant who said: *"Ni za, mmh, hazipo. Hapa inatulazimu kama una material kupitia simu ya smart unawawekea wanafaidi kupitia audio" (TLVI 4) [They are for, um, they are unreliable. Here if you have the materials over the smart phone, you give them and they benefit through audio]*

The narrations above suggest that smart phones are among the high-tech ATs that can be used for teaching and learning of LwVI. Teachers use of personal smart phones helps to ensure that their lessons are accessible to all learners including those with visual impairment.

The results indicate that although we are in a digital technological advancement, the school has not yet accessed most of the high-tech/digital assistive technologies that could enhance the teaching and learning of LwVI in schools. In such a situation, mobile devices including Android smartphones

are appreciated by teachers in primary schools as easily accessible ATs that can be used to help LwVI access education opportunities. These findings corroborate with Retorta and Cristovao (2017) who found out that teachers were using smartphones as an assistive technology to easily teach English to LwVI. In line with this, Wu et al. (2021) affirm that smartphones with assistive application are useful in teaching writing to LwVI. Therefore, authorities should consider adapting smartphones with their applications since they are less expensive compared to many high-tech/digital technologies available in the market.

4.3.2 Availability of Enabling Infrastructure for use of ATs

In this sub-section, the researcher sought to establish the status of infrastructure available in the school to enable the use of ATs by teachers and LwVI. The concern was whether there is enabling infrastructure for use of ATs and their condition. Data for this aspect was collected through observation and interviews. The results are as follows;

Table 5: Enabling infrastructure for use of ATs in school X

SN	Item expected	**Available**	**Status**
1	Computer laboratory	none	-
2	Resource room	none	-
3	Electricity	available	Unstable
4	Shelves in classrooms	none	-
5	Internet connectivity	none	-
6	Tables in classrooms	none	-

Source; primary Data (2022)

Table 5 above shows that the school has electricity connectivity which is unstable. The school does not have computer laboratory, resource rooms, shelves and big tables in classrooms. The data also reveals that the few

available ATs were kept in offices due to lack of a resource room. For instance, photocopier, printer and a desktop computer for producing enlarged texts for LwVI was operating from the head teacher's office. Other ATs including the non-functioning CCTVs was kept in the Unit office. This may deny LwVI an opportunity to access and use the available ATs, something which may also limit LwVI from accessing necessary information for learning.

The data above was supported by participant's responses, whose when asked whether there was enabling infrastructure for ATs utilization in the school, they (TLVI 1, TLVI 2, AD 2, AD 1, TLVI 3, TLVI 4, TLVI 5, and LwVI 3) reported that the school has very poor infrastructure, except for the availability of electricity. One of the participants said:

> Hapa tuna umeme ambao ndio unatuwezesha kutumia hivi vifaa, Maktaba au Chumba maalum, mmm hatuna. Meza zinazotumika ni zile za mfumo wa madawati ambazo siyo nzuri kwa matumizi ya Perkins, kabati hakuna. Hii ni ofisi na kila kitu kiko humu (TLVI 1)
>
> *[Here we have electricity which enables us to use these devices. Mm…library or resource room, we don't have. The tables used are those of the desk structure which are not good for Perkins use, there is no cupboard. This is an office and everything is in here]*

Another participant said:

> Mmh…Meza kubwa hazipo hii ni kwasababu madarasa ni mafinyu na wanafunzi ni wengi. Makabati hakuna kwa hiyo wanatembea na vifaa vyao. Kuhusu mtandao, Hapana hapa huwa tunatumia simu binafsi na umeme tunao, ingawa umeme wetu ni wa shida (TLVI 2)
>
> *[Mm…there are no big tables, this is because the classrooms are overcrowded with many students. There are no lockers so they walk with their equipment. Regarding the*

internet, no, here we always use personal phones and we have the electricity although not stable]

Similarly, another one said:

Aaa, umeme upo lakini kwa sasahivi unakatikakatika sana. Kuhusu maktaba na chumba maalumu hatuna, hata maabara ya kompyuta hatuna. Tuna sehemu ya kutunzia tu ambayo ni ofisi ya mkuu wa kitengo. Hivyo ni shida (AD 2)

[Aaah, there is electricity, though erratic at the moment. We don't have a library and a special room, and not even a computer lab. We only have a storage area which is the head unit's office. So, it's a problem]

The findings suggest that the use of ATs in primary schools is still a challenge due to lack, limited or poor infrastructure. This is because the use of ATs depends on the enabling environment. For instance, there is no way ATs such as computers, CCTVs, embossers and thermoforms can be used without stable power connectivity. Similarly, it is hard to use a Perkins Brailler if there is no resource room and suitable tables. Some ATs especially high-tech ATs require internet connectivity, which is not available in the school. This may continue to limit the use of ATs in teaching and learning of LwVI which may cause poor performance. The D&M IS Success model suggests that quality provisions, electricity, libraries, resources rooms, and computer labs should be the basis for use of ATs (DeLone & McLean, 2016). Little has been done to ensure availability of quality infrastructure that could enhance the use of ATs.

The findings are also consistent with Wilfred (2017) who points out that poor infrastructure including unreliable electricity provisions and lack of enough space in classrooms are among the barriers towards the use of ATs in schools. Likewise, Odeke-Nato (2021) observe that inadequate infrastructures including poor internet connectivity limit the use of ICT (ATs) tools. These findings suggest that even though some ATs are available, some are not used

due to non-existing quality infrastructure. The finding is also contrary to Odeke-Nato who observes that in Uganda most schools had special rooms where ICT tools were kept and students had chances to use them without distraction. Learning from this, LwVI in this school may be denied opportunity to study in a space where they can access all provisions. This calls for much efforts to ensure availability of enabling infrastructure that can facilitate the use of ATs in primary schools.

4.4 How ATs are used to facilitate teaching and learning of LwVI

Objective two was meant to examine how the ATs are used to facilitate the teaching and learning process. The data is analyzed and discussed basing on the emerging sub-themes which are; how teachers use ATs for teaching and how LwVI utilize ATs in learning. They are as follows;

4.4.1 How Teachers use ATs in Teaching LwVI

Assistive technology was found to be imperative educational resources and tools for teachers to facilitate the learning of LwVI in primary schools. To obtain this data, a question was posed for participants to state different ways teachers make use of ATs to enhance the learning of LwVI.

When asked, participants (LwVI 3, TLVI 3, TLVI 4, TLVI 4, TLVI 5, AD 2, and TLVI 1) stated that teachers use ATs to prepare the lessons. They specifically pointed out that teachers prepare suitable learning materials and/or resources to use in teaching with the help of ATs. One of the participants said: "*Walimu huzitumia kutuandalia somo kwa kutukuzia maandishi kwa kompyuta na kutoa photocopy kwa kutumia kifaa hiki kifaa…. aaaa sikijui jina (printer)*" *(LwVI 3) [Teachers use them to prepare our lessons by enlarge text for us*

through computers and then produce copies through this equipment…. Aaa, I

don't know its name (referring to a printer)].

Another participant said:

> Mmmh...Mimi kwakweli ninatumia Perkins na A4frames kuandaa somo. Embosser wanatumia wenzangu kutolea nukuu za wanafunzi, na printer nayo huwa ninatumia kuzalishia nakala zilizokuzwa ili niwape wanfunzi wangu wenye uoni hafifu waweze kusoma nao (TLVI 3).
>
> *[Mmm…I actually use Perkins and A4 frames to prepare the lesson. My colleagues use an embosser to make notes for the students and the printer. I use it to produce enlarged copies for my learners with low vision to read]*

Another participant said;

> Eee..., Tunatumia kuaandaa somo. Kwa mfano tunatumia kukuza maandishi na kuwapatia wakaweza kusoma vizuri. Kwa upande wa kompyuta tunaitumia kwa namna ambayo tuna andika maandishi, tunayakuza halafu tukaenda kuyaprinti na kuwapatia wakasoma yakiwa kwenye ukubwa wake (TLVI 5).
>
> *[Yeah…we use it to prepare the lessons for example; we use it to enlarge the text so that they can read it well. On the side of the computer, we use it in such a way that we write text on the computer, enlarge it and then go to print it and give to them so that they can read in big size]*

The results above indicate that teachers make use ATs to enhance their instruction by preparing notes for LwVI to learn from. It shows that, Perkins braille, computers, printers and embossers were the only ATs teachers use to typewrite, enlarge text, print and produce copies of materials accessible for LwVI.

The data above suggest that ATs are being used by teachers to lessen the struggles they face while trying to cater for the needs of LwVI, especially in today's focus where LwVI are required to be accommodated in inclusive

learning. From the data, ATs are tools that teachers utilize to make curriculum content accessible. They use ATs to prepare their lesson by making all the necessary learning material in a format where LwVI can participate in the learning. Moreover, the findings suggest that the school is in the crisis of inadequate ATs especially the high-tech such as victor readers, CCTVs, Clear readers, computers with installed software which teachers could efficiently use to prepare their lessons without relying on low tech-tech ATs which may be tedious and hence may demotivate teachers in helping LwVI. The findings are in line with D&M IS Success model regarding the "The use" aspect which explains that expected outcomes depend on how the system is utilized in terms of appropriateness (DeLone & McLean, 2016). In this case, the findings suggests that although there is scarcity of appropriate ATs, teachers make an attempt to use ATs to create conducive learning environment for LwVI in primary schools.

The findings are also in line with Samanta (2017) who observes that ATs such as enlarged prints, braille writings, digital tape recorders, and computers are tools used by teachers as teaching aid when preparing lessons for the students with visual impairment. The findings is consistent with Karakoç et al. (2022) who suggest that technology should be used by teachers, especially science teachers to organize content materials to make accessible lesson for LwVI. In this way, ATs lessen teachers' tedious work of preparing tactile materials such as braille, hence improving the teaching process. Regarding this importance, Ahmed (2018) observes that teachers have the responsibility to use ATs if they want to minimize the barriers for LwVI to learn. This does not only serve for

teachers, but also for authorities to ensure access of ATs to primary schools which will improve teaching and learning among LwVI.

Other participants (LwVI 2, LwVI 4) mentioned that teachers use ATs to assess learners' educational progress. They pointed out that teachers do typewrite and produce exams for LwVI. One of the participants said: "*Walimu wanazitumia inapofikia mida ya kuchapisha mitihani, wanachapisha halafu ndo tunajisomea sisi wenyewe*" (LwVI 2) [*Teachers use them (ATs) when it is time for making examinations, they produce them so that we can read by ourselves*]

Another said: "*Walimu wanazitumia kutuchapia kazi kwenye mitihani. Wanatuchapia masomo mbalimbali yote*" (LwVI 4) [*Teachers use them to type out exams. They type for us all subjects*]

The results show that teachers do use ATs when it comes to assessing learners' educational progress. It indicates that teachers use different ATs including Perkins braille, computers to type/write, and produce exams for LwVI.

The data above affirms that teachers in primary schools are aware that ATs create grounds where assessment as a key aspect in teaching and learning is accessible to all. Therefore, teachers make use of ATs to assess LwVI by typing and producing brailed exams as well as enlarged printed papers so that learners can equally access them like others. Although teachers are trying to cater for the needs of LwVI, they are hampered by lack of digitalized ATs. For instance, teachers do not use computer-based assessment, there are no digital recorders, Victor readers and CCTVs that would allow them to administer

their assessment in method that is simplified for LwVI. Instead, they rely on braille and enlarged prints which are not efficient and effective.

The above findings align with D&M IS Success model which states that for a system to be utilized, it should be satisfying to the users (DeLone & McLean, 2016). Teachers may find ATs hard to use due to the tedious work in producing braille papers using Perkins and A4 frames. This therefore, may lead under utilization of ATs and may lower the learners' performance. Similarly, Avagyan (2019) noted that educators use ATs in assessment of learners to improve performance. Basing on the findings, teachers use brailed texts and enlarged prints to enable LwVI be assessed. Contrary to the findings, Avagyan shows that more digitalized ATs were being used by teachers something which is still not done in school X. Likewise, Cadwallader and Tonin (2021) suggest that ATs play a great role to create conducive environment that allows students to access assessment without requiring any assistance, thus improving their performance. This information suggests that authorities should consider facilitating teachers to use ATs in assessment by making ATs available in schools where scarcity is experienced.

Other participants (LwVI 5, TLVI 5) stated that teachers do use ATs as a pedagogical tool to teach learners different subject concepts. They contend that reading, writing, counting and environmental familiarity are some of the concepts taught while using ATs. One of the participants said: "*Walimu wanazitumia (kumaanisha Teknolojia saidizi) kutufundisha, kwa mfano kuandika, kusoma na kuhesabu*" (LwVI 5) [*Teachers use them (referring to assistive technology) to teach us, for example writing, reading and counting*]

Another participant said:

> White cane tunawafundishia wanafunzi kuwa familiar na mazingira ko tunawapa zile fimbo, unamsimamia kwa nyuma au kwa mbele halafu anaanza kuzunguka na ile fimbo nyeupe. Vifaa kama abacus inatusaidia kuwafundisha kuhesabu (TLVI 5)

> *[We use the white cane for example, to teach the learners to be familiar with the environment. We give them the cane, then control him/her from behind or in front and then he/she start moving around with the cane all alone. Other tools like an abacus help us teach them to count]*

The above narratives indicate that teachers use ATs as instructional tools through which they teach LwVI the basic three standard areas of academic life, namely; literacy, arithmetic, as well as Orientation and Mobility concepts.

The results above suggest that ATs are salient tools that are being used by teachers to make their instruction ease and accessible to LwVI. It implies that teachers in primary schools make use of ATs to help LwVI grab different concepts in subject areas including the 3Rs (read, writing, and Arithmetic) which are the basis of every learning. The results also show that teachers were able to teach learners how to safely move around and interact with the school environment which is important for effective learning. However, the worry is that teachers relied on low-tech ATs that could not ease their teaching process. For instance, there is no computer with software such as JAWS and NVDA, no CCTVS with OCRs, no Digital tape recorders which teachers can use to make the teaching of these concepts ease and memorable to LwVI. This calls for intervention of the government to ensure availability of varieties of high-tech ATs in primary schools.

The above findings are in line with Viner et al. (2020) who observe that teachers use ATs to create an enabling ambience where learners including those with visual impairment easily blend to concepts in relation to content areas. That teachers can make choices out of the pool of low-tech and high-tech ATs to help LwVI learn, reading, writing and arithmetic concepts. In relation to the findings, Viner and colleagues also point out that low-tech ATs may not be helpful in this era of technological advancement. Instead, teachers can make us e of the high-tech ATs such as Digital Personal Learning, Math Pad, Digital calculators, and smartphones to teach these concepts, something which is not done in most primary schools. Therefore, authorities should ensure availability of ATs from which teachers can make choice to create a welcoming learning environment for LwVI in primary schools.

Other participants' (TLVI 4, TLVI 5) responses indicated that teachers use ATs to download, record and make presentations of instructional information in classroom. One of the participants said:

> Muda mwingine natumiaga simu, hizi smart phone. Kuna material napakua kwenye mtandao hasa YouTube napenda kutumia audio ko huwa najaribu kuwawekea wale wanasikilizaaa, ni wote sasa hapo yaani wenye low vision na wasioona. Inarahisisha kujifunza hata akitaka kurudia ni rahisi (TLVI 4)
>
> *[Some time I use the phone, these smart phones. There are materials I dowload on the internet, especially YouTube, which I like to use the audio, so I always try to put it on for those listening, all of them now; those with low vision and the blind. It makes it easier to learn, even if he wants to repeat it, it's easy]*

Another participant added: "*Wakati mwingine unarekodi hata kwa simu. Unaweza kurekodi kitu ambacho unakifundhisha halafu baadae ukawauliza kama wataonekana bado unaweza kuwaachia simu wasikilize na wakaendelea*

kujifunza" (TLVI 5) [Sometimes you record with a phone. You can record what you are teaching and then ask them, if they have not understood you can leave them with phone to listen and continue to learn]

The above caption indicate that teachers use ATs to access instructional materials from the internet. Since teachers have no access to digitalized technologies such as computers connected to network, they use personal smartphones and bundles to download audio materials from YouTube which they give to the LwVI in classroom. There is also an indication that teachers make use of ATs to record and present information to enhance the learning of LwVI. This suggest that, whereas the school has no access to high-tech ATs and systems such as; tablets, Victor readers, Digital tape recorders, and internet, teachers are keen to help LwVI equally access all educational opportunities. This situation calls for concerted efforts by stakeholders to ensure adequacy of ATs and their enabling infrastructures such as internet connectivity in primary schools.

The findings above line with Alshahrani (2020) who suggests that smart phones are currently the only ATs which are easily accessible anywhere any time. They explain that a smartphone bears a lot of qualities that may help teachers to render information to LwVI in a way that is accessible. These findings suggest that whereas primary schools are challenged with meagre ATs, teachers can still make use of smartphones to help LwVI. The findings also concur with a study conducted by Edgar Pacheco et al. (2017) who observes that teachers make use of ATs to access information by downloading from online platforms, recording using digital recorders and presenting through PowerPoint to enhance the teaching and learning. This observation

calls for teachers in primary schools to adopt different ATs available and those that they can possibly access to enrich the learning of LwVI.

4.4.2 How LwVI use ATs in Learning

The study was also meant to find out how LwVI were utilizing ATs in the learning process. The main issues that arose include writing, reading, and orientation and mobility. They are presented as follows;

Participants (LwVI 1, LwVI 4, LwVI 2) responded that LwVI use ATs to write. They stated that LwVI use A4 frames with stylus, and the Perkins brailler to write different classroom activities. One of the participants said: *"Kuna vifaa saidizi kama A4 frame na stylus hivi navitumia kuandika nukuu na zile nukta nundu ili niweze kuzisoma kwa kutumia hisia za vidole"* (LwVI 1) *[There are assistive technologies such as A4 frame and stylus which I use to write notes with dots (referring to braille) so that I can read them using the feeling of my fingers]*

Another participant said: *"Natumia kuandika, mfano stylus na A4 frame. Labda ningetumia mashine (perkins) sijui kuitumia"* (LwVI 4) *[I use a stylus and an A4 frame to write. Maybe I should use a machine (Perkins) I don't know how to use it too]*

Another participant added: *"A4 frame mara nyingi tunazitumia kuandika mazoezi na mitihani"* (LwVI 2) *[We often use A4 frame to writing exercises and exams]*

The responses above indicate that LwVI use ATs to write different classroom activities including notes, assignments, and exams provided by teachers. They

also indicate that some LwVI do not know how to use some of the ATs, for instance Perkins braillers.

The findings above suggests that ATs are being used by LwVI as tool to follow classroom instructions by ably write the learning information provided by teachers during lessons. Similary, LwVI use ATs to engage in every classroom activity just like sighted learners. The findings further reveal that the school has inadequate high-tech ATs which LwVI can use to simply write and learn. Besides, it is also unfortunate that many LwVI are not able to use some of the ATs available in the school, most of them use slates but not the Perkins brailler. All these may undermine the use of ATs which may also cause poor performance of LwVI in primary schools.

The above findings are in line with Chikonzo et al. (2021) who reports writing and notes taking as one of the academic activities students perform using ATs. They further elaborate that ATs make it easy for learners to access learning material and accomplish different academic activities and enrich their learning. Similarly, Chanana et al. (2022) observe that students use ATs to do activities that needs writing. For instance, writing assignments and exams. Likewise, Senjam (2019) outline that there are numerous ATs that can be used by LwVI to write. Among others, Senjem mention a Typoscope, braille computer keyboard, braille electronic note taker that may simplify writing activities compared to the low-tech ATs. The findings call for a collaborative measure to ensure ATs availability in schools to simplify and promote learning.

Other participants (LwVI 3, LwVI 4, TLVI 2) indicated that LwVI use ATs to read. They specifically said that they do so by using lenses, sunglasses and enlarged text. One of the participants said:

> Mimi hizi (teknolojia saidizi) huwa ninazitumia kujisomea na kukuza maandishi ninapofanya kazi mbalimbali za darasani mfano lenzi. Kwa upande wa muwani nikiona jua ni kali ndiyo ninavaa ili kujikinga na ile mionzi ili nisome vizuri (LwVI 3)
>
> *[I usually use these (referring to ATs) to read and magnify the text when I do various classroom tasks; for example, lenses. In case of sunglasses, if I notes that there is a lot of sunshine, I wear it to protect myself from the rays for me to read well]*

Another participant said: *"Hizi (teknolojia saidizi) ninazitumia kusoma, na kujifunza vitu mbalimbali"* (LwVI 4) *[I use these (referring to ATs) to read and learn various things]*

Another participant added: *"Lakini pia mwanafunzi anaweza kusoma kile ambacho nimekiandika ka akishapata message (ujumbe) atafanya kazi zake, Pamoja na kujibu maswali"* (TLVI 2) *[But also the learner can read what I have written so that once he gets the message, he will do his work, including answering the question]*

The data above provides insight to the fact that ATs are important tool that LwVI use to access various learning information, comprehend concepts, and perform different activities in and outside classroom. Assistive Technologies in this case are solutions to problems faced by LwVI in accessing information provided to them in formats which are hard to read. For instance, they can read normal text with magnifying ATs; enlarged text; and braille text and then perform activities performed by sighted learners. Nonetheless, there are

66

different ATs that can be used by LwVI to read different works in a simplified mode, including; CCTVs, Victor readers, OrCam My Eye, Clear reader, Computers with JAWS, OCR and OCR software, electronic magnifiers, and Binoculars. Unfortunately, LwVI in the school are highly dependant on extremely few low-tech ATs such as manual lenses, and enlarge prints. This may negatively demoralize them from interacting with text let alone reading process, which may also lead to poor performance.

The above findings are in line with D&M IS Success model which suggest that, a system well used is that which yields positive impacts, and that which is well used depends on the availability of provisions (DeLone & McLean, 2016). In this case, the reading of LwVI is unsatisfactorily enhanced due to inadequacy of ATs which learners could use to read. The findings concur with Edgar Pacheco et al. (2017) who observe that students make use of ATs such as CCTVs and other software that can easily enlarge text to read different course materials that are provided in different formats. Similarly, Chikonzo et al. (2021) observes that students with visual impairment use ATs to perform different activities, among others they mention reading. Svensson et al. (2021) observes that ATs including smartphones, computers with their associated software programs are used by learners with reading difficulties, including LwVI. These findings serve as important massage on how ATs could minimize barriers for LwVI to read and perform activities, therefore should be taken serious.

Other participants (LwVI 1, LwVI 4, AD 2) stated that LwVI use ATs for orientation and mobility. They specifically pointed out that they do so by using a white cane. One of the participants said:

Aaah…kwa mfano kuna vifaa saidizi kama white cane, hii naitumia kuangalia miundo mbinu kama njia hizo. Naitumia kupapasa njia ilivyo, inaelekea wapi. Nikisha gundua basi nami ndiko ninakoelekea hukohuko kulingana na hitaji langu nataka Kwenda wapi (LwVI 1)

[Aaah...for example, there are ATs such as a white cane, which I use to lookout for facilities like pathways. I use them to lookout for how the pathways are and where they are directed to. After I discover, then I follow the direction considering of where I want to go]

Another participant said: *"white cane (fimbo nyeupe) huwa ninatumia kutembelea na kujua mazingira ili kujua kama hapa kuna usalama au hakuna"* (LwVI 4) *[I always use a white cane for walking to know the environment. To know if the place is safe or not]*

Another participant added: *"Mmm...lakini kuna vile vya nje ambavyo ni wanavitumia katika kumove (kutembea) kutoka sehemu moja na nyingine"* (AD 2) *[Mmm...but there are those meant to be used outside that they use to move (meaning walking) from one place to another]*

From the narrations above, it is noted that LwVI use ATs to orient themselves with the school environment, to be sure of their safety, and be able to navigate with the help of a white cane.

Learners with visual impairment are limited in their abilities to interact with the learning environment. Learners who are blind may not be able to move from place to place without the help of another person. Bumping into objects, crushing on walls and doors may make them feel insecure and consequently limit their ability to learn. From the findings above, LwVI make use of ATs to make it possible for them to reach out for information regardless of where it may be, while avoiding dangers. Whereas ATs such as Electronic long cane,

Android smartphones with applications, OrCam My Eye can ease orientation and mobility, LwVI in primary schools rely on manual white canes which may not be efficient to help them navigate their learning environment, calling for concerted efforts to ensure availability of ATs to LwVI.

The findings above concur with Kisanga and Kisanga (2020) who state that LwVI use ATs to navigate the schools environment. They add that a white cane can be used by learners to simplify their Daily School Activities (DSAs). This is because LwVI are able to plan activities and execute them without needing help of a guide. Contrary to the above findings from Kisanga and Kisanga, Hakobyan et al. (2013) display a broad range of ATs that can be used for orientation and mobility to persons with visual impairment including those in primary schools. They mention Smart vision, Mobile Eye, Haptic direction indicator, Guide cane, and various smart phones with assistants. Tanzania primary school authorities should therefore consider ensuring availability of adequate ATs for orientation and mobility in order to improve learning of LwVI.

4.4.3 Challenges in Using Assistive Technology

The researcher made a follow up to find out whether there were challenges encountered by teachers and LwVI when using different ATs. Numerous issues emerged and are presented hereunder;

Participants (TLVI 2, TLVI 3, TLVI 4, TLVI 5, AD1, AD2, LwVI 1, LwVI 4) stated that insufficient training in colleges made teachers to have inadequate skills on using ATs. One participant said: *Mmmh...mimi kwakweli ninatumia Perkins na A4frames. Kwenye suala la kompyuta kwakweli mimi bado*

sijawahi kutumia naa, yaani kwaufupi sijui kuitumia vizuri (TLVI 3)

[Hmmm...I actually use Perkins and A4frames. On the side of computers, I have actually never used it, that is, in short, I don't know how to use it well]

Another participant said:

> Naam…changamoto kubwa hapa ni kwamba wengi utaalamu wa kutumia kompyuta hatukuupata mashuleni tulivyokuwa wanafunzi na tulivyokuwa vyuoni tulikuwa bado hatujapata utaalumu huo na teknolojia hii sasa inapotukuta tupo kazini tuu, tunashindwa kuupata pia wa kutosha (TLVI 2).
>
> *[Well... the big challenge here is that many of us did not get the skills to use computers in the schools when we were students and when we were in the colleges, we didn't get that ability and this technology now finds us only at work, we fail to get enough of it]*

Another participant added:

> Changamoto ya utaalamu, hii nadhani ndiyo inatukabiri hasaa. Kwa mfano tuliletewa hii, hiyo embosser, embosser alienda mwalimu mmoja kwenye, mafunzo, namna ya kutumia lakini kwa bahati mbaya ni kama hakugain vizuri, eehee...Mafunzo yalikuwa mafupi (TLVI 4)
>
> *[The challenge of skills, I think this is what is mostly troubling us. For example, we were presented with this embosser, embosser, one teacher went to, to the training on how to use it but unfortunately, he did not gain enough, yeah...the training was very brief]*

The statements above indicate that teachers are not using most of the ATs, especially the high-tech ATs such as computers and embossers because they lack skills to use them. The responses also show that the reason why teachers do not have skill, is because they did not receive enough training while in colleges, and equally have limited training while at work.

The data above suggests that proper use of ATs depends on how users (teachers and learners) are prepared with skill and knowledge on how to

operate the different ATs. That lack of training has contributed to inadequate skills among teachers, LwVI, and other support teams in school leading to underutilization of different ATs, more especially high-tech ATs. Furthermore, the data suggests that higher learning institutions including universities and colleges that offers programs in special needs education do not provide adequate training on the use of ATs. This is because even though teachers have had opportunities to attend training in colleges and in workshops, they do not sufficiently acquire the necessary skills required to put ATs into use. The findings are in line with Kirboyun (2020) who points out that inadequate skills on the utilization of AT among teachers had negatively affected the use of ATs to assist LwVI in learning. Chukwuemeka and Samaila (2020) are consistent with this and explain that lack of training among teachers and student leads to poor use of ATs. Likewise, lack of training of LwVI on the use of AT, more especially on the high-tech ATs in their learning process made most of them not to use ATs due to lack of skills, which may undermine their academic performance.

Other participants (TLVI 1, TLVI 4, LwVI 3) also indicate that scarcity of ATs is a challenging issue, explaining that inadequate and lack of ATs hinders teaching and as a result, LwVI struggled while learning. One of the participants had this to share: "*Changamoto zilizopo ni nyingiii...kwanza mmm...uchache wa vifaa ambao unapelekea wakati mwingine mtu angetamani, kila mmoja angetamani amiliki kitu chake (kifaa) lakini ule uwezekano haupo*" (TLVI 1) *[There are many challenges...first of all...the shortage of ATs, that sometimes someone would wish, everyone to own something (ATs) but there is no such possibility]*

Another one said: *"Changamoto nyingine ndo uhaba wa vifaa, eehee. Kwamba kwa mfano tungekuwa na hizo talking kompyuta, tumeingia sehemu sasa tunafungua kitu kila mtu anakuwa nacho" (TLVI 4) [Another challenge is inadequate of ATs, as we mentioned. for example, if we would be having those talking computers, it would be possible that we open something that everyone has]*

Another participant added: *"Vifaa vinakuwa havijatosha Eee...kwasababu binocular haipo" (LwVI 3) [The ATs are not enough. Yeah... because the binoculars are not available]*

The narratives above indicate that, the school has limited number of ATs. There existed some of the low-tech ATs which are very few to enhance teaching and learning of LwVI. Whereas the school has some of the high-tech ATs, most of them were not operating. The digitalized ones such as digital tape recorders, talking computers are few and many were not available in the school, which may be posing a serious challenge towards the teaching and learning in the school.

The results above suggest that LwVI in primary schools may have limited opportunities to learn and comprehend concepts as well as engaging in different academic and non-academic activities due to inaccessibility of necessary ATs, especially those that are adapted to suit their needs. This finding is supported by Chukwuemeka and Samaila (2020) who point out that deficiency of ATs, mostly high-tech limits how ATs are being put to use for enhancing learning of LwVI. Correspondingly, Kirboyun (2020) explains that inadequate AT including computers limit their utilization. Kirboyun further

points out that the cost and unequal distribution of these equipment is the reason why most high-tech ATs are not available in schools. Al-Zboon (2020) also identifies insufficient ATs in most schools which poses a barrier towards the utilization of ATs for students with visual impairment. These studies are coherent to the context of a developing country like Tanzania where low economic condition has led to low budget allocations, causing lack of special budget for purchasing and repair of ATs, leading to unequal supply of ATs. Thus, effort should be invested to ensure ATs both the low-tech and the high-tech are made available.

The data also shows that inadequacy of ATs in the school was due to damage or breakdown and lack of skilled experts who could repair them. Participants (AD 2, TLVI 2, TLVI 5) pointed out that some of the ATs are available in the school but the challenge was that once they are damaged, they are not repaired. One of the participants said:

> Aaa! Changamoto, changamoto zilizopo kwanza sana sana ni kuharibika kwa mashine, hilo ndilo linasumbua sana. Aaa, mashine zikiharibika zinawekwa pembeni, mtoto anahitaji nyingine, mwalimu naye anahitaji kutumia (AD 2).
>
> *[Aah! The challenge, the first and foremost is the breakdown of the machine; that is the most troubling thing. Aaah, if the machines break down, they are put aside, the child needs another one, the teacher also needs to use it]*

Another participant added:

> Perkins na embosser zinapoharibika zikaja na wewe unashindwa kuzitengeneza zikawarudia kwa wakati muafaka. Kwahiyo hilo nalo ni changamoto. Maana leo atatumia A4 frame kabla mashine yake haijakaa vizuri kwahiyo unakuta ni shida (TLVI 2).
>
> *[When the Perkins embosser gets damaged, they come when you are busy and unable to repair and return them on time.*

So, that is also a challenge. Because today he will use an A4 frame before his machine is repaired, so you find that it is a problem]

Another participant said: *"Changamoto ninazokutana nazo ni hasa uharibifu wa vifaa, hivi vinapoharibika au wanapoviharibu wao Watoto unakuta ni changamoto. Mtoto anataka kuandika anashindwa sasa inakuwa ni changamoto" (TLVI 5) [The challenges I encounter are mainly the damages of these devices, when they are damaged or when children damage them, they find it hard to write when they need to]*

That the reason for ATs scarcity in the school was attributed to damage and non timely repair. Even when the researcher visited the field of study, the observation affirmed that most ATs including CCTVs, thermoform, printer, embossers and some of the Perkins Brailler machines were not functioning due to different faults and were packed in the store. Although some teachers have informal training on how to repair some ATs including the Perkins brailler, it was very hard for them to handle the modern ATs such as CCTVs and thermoform. Besides, the teachers are very busy with their core responsibilities of teaching and assisting LwVI including other learners since they are in an inclusive school. This is in line with Al-Zboon (2020) who reports that breakdown of some of the ATs is one of the challenges that hinders LwVI from using the ATs in their learning process. A-Zboon's expression is that learners who rely on the use of ATs to complete academic and non-academic activities may be affected when the ATs break and not timely repaired. This may be the reason why teachers and LwVI are restricted to use ATs, which may lead to continuous inaccessibility of necessary information in their learning.

Another emerging issue was the unreliable electricity supply. Participants (TLVI 1, TLVI 2, and TLVI 5) pointed out that the school has only one source of power which usually goes off and on. One of the participants lamented:

> Lakini zipo na zingine, kwa mfano; unaweza kukuta kwamba ulikuwa unafanya kazi halafu umeme ukakatika ghafla; mfano umeme tulio nao kwa sasa ni umeme ambao, eee, una katika katika mara kwa mara, kwa hiyo kukatika kwa umeme ni changamoto (TLVI 1).
>
> *[But there are others, for example; you may find that you were working then abruptly the electricity goes off; For instance, the electricity we have currently is that which goes off and on. So, power outage is a challenging issue]*

Another participant said:

> Changamoto nyingine ambayo lazima iathiri ni umeme, lazima iathiri kwa sababu kuna vifaa vingine pasipo umeme hatutumii. Kwa mfano tumesema tunayo thermoform na perkins, na printer na desktop hizi bila umeme hazitumiki kabisa (TLVI 2)
>
> *[Another challenge that must affect is electricity, it must affect because there are other devices which cannot be used without electricity. For example, we have said that we have a thermoform, printers and desktops which are not used without electricity]*

Another one added: *"Changamoto nyingine ni changamoto kama labda ya umeme, hasa umeme unapokatika na tunahitaji kuzalisha labda copy za wanafunzi wasioona inakuwa ni changamoto kwa kweli" (TLVI 5) [Another challenge is electricity, especially when the electricity goes out and we need to produce copies for students who can't see, it becomes a real challenge]*

The above statements indicate that whereas the school is faced with inadequate ATs, teachers face challenges to use the available ATs due to unstable electricity supply. This may interrupt the efforts of teachers in trying to ensure that LwVI access learning through the use of ATs. Electricity supply

in most primary schools, especially those in rural areas is compromised causing underuse of ATs for learning which may lead to poor performance of LwVI in schools.

The findings above concur with the Eligi and Mwantimwa (2017) observe that power inconsistence as a challenge in utilizing ICT resources, particularly modernized ATs that requires stable electricity to function. They recommend that an alternative source of power supply which is automatic rather than manual is important for the use of ATs in teaching and learning of LwVI in schools. In line with this, Chukwuemeka & Samaila (2020) found out that insufficient electricity supply is amongst the barriers that undermine the use of assistive devices and software programs in classrooms, something which may in turn affect the learning of LwVI.

From the expression of participants (LwVI 2, TLVI 2), it was revealed that some of the available ATs in the school were not suitable for the teaching and learning process of LwVI. They specifically elaborated that the use of A4 frames, Perkins brailler and un-adapted white cane was to some extent very had. One of the participants said: *"Aaaa labda changamoto ninazozipata ni kunanii, kutumia labda A4 frame unapotumia, labda ukiwa unaandika darasani aaa! Unakuwa unachelewa kumaliza kuandika au ninapoandika ninawahi kuchoka"* (LwVI 2) [*Aaa, maybe the challenges I face are in reading, using maybe an A4 frame when you're using it, maybe while you're writing in class aaa! You delay to finish writing or I easily become tired*]

Another participant said:

> Kuna changamoto, kwa mfano kuna kipindi tulipata Watoto wenye shida katika physical lakini pia anashida ya uoni.

> Sasa mtoto yule unakuta ni vigumu sana kumfundisha kutumia hivi vifaa visaidizi tulivyonavyo akaweza kutumia kwa wepesi (TLVI 2)

> *[There are challenges, for example there was a time when we got children with physical problems who also had vision problems. So, you will find it difficult to teach that child to use these aids we have, for her to be able to use them easily]*

The data above show that the school has some few ATs which are not adapted to suit the needs of LwVI. They also indicate that some LwVI may be having other challenges including physical challenges. This alone makes them fail to use some ATs including Perkins braille and an A4 hand frame which require application of some energy in writing. This finding provides insight that the use of ATs by teachers and LwVI in primary schools is also hampered by inappropriate choices of ATs. Some ATs available in school are not relevant to the needs of LwVI due to the fact that they are not adapted and flexible to the needs of LwVI who have additional disabilities. The findings concur with Opie (2018) who points out that some of the participants felt discomfort in using the ATs due to mismatch with their needs. Opie, specifically noted one participant lamenting on the slowness of the braille machine that caused him to miss out classroom information when writing. This suggests that relying on ATs that are not adapted may demotivate LwVI and teachers in utilizing ATs in teaching and learning process.

Another emerging issue is the absence of specialized rooms where ATs could be stored. Participant (AD2, TLVI 1) pointed out that the school has no specialized rooms including resource room and computer lab. One of participants lamented:

> Kuna chanagamoto nyingi sana zinazotokana na miundo mbinu. Kwanza maktaba hatuna kabisa, lakini pia resource

room lakini pia hatuna chumba cha kufanyia assessment (upimaji). Hii inafanya tukose sehemu ya kuweka hivi vifaa kama unavyoona; vingine viko kwenye maofisi (AD 2)

[There are many challenges that arise from the infrastructure. First, we don't have a library at all, but we also don't have a resource room, and an assessment room. This makes us miss where to keep these devices as you can see; others are in offices]

Another participant said: *"Hatuna maktaba, na hata maktaba mtandao ambako mtoto angekuwa na nafasi, wakati mwingine anasema amepata nafasi na kwenda kukaa na kutumia vifaa"* (TLVI 1) *[We don't have specialized places, we don't have a library, and even an e-library where a child would have a place, sometimes to sit and use the ATs]*

The statements above indicate that the school has neither resource room nor computer lab which is vital for keeping ATs. They express that this has caused most of the available ATs to be kept in offices which could not give opportunities for LwVI to read and perform some activities at their own time. The data also shed light on the fact that lack of important infrastructure such as resource rooms, and computer laboratories in primary school is one of the challenges towards utilization of ATs, thus limiting LwVI from accessing some of the learning opportunities. This is in line with Wilfred (2017) who reports that schools' poor infrastructure such as school buildings including classrooms and resource room act as one of the many barriers in utilization of ATs in most schools in Dar-Es salaam and Dodoma city. The report indicates that if this is a case in developed areas, then there might be a worst condition in rural primary schools. In line with the above, Avagyan (2019) identifies inadequate infrastructure in schools as the result of insufficient resources which may in turn hinders learning for LwVI. These studies call for

collaborative effort among stakeholders to ensure a conducive environment that supports the use of ATs for inclusion of LwVI in primary schools.

4.5 How ATs might be enhancing the learning of LwVI in primary schools.

The study sought to explore how ATs might be enhancing the learning of LwVI in primary schools. This arose due to the fact that LwVI have a condition that limits their academic performance. The researcher's interest therefore, was to find out how ATs helps to minimize the barriers while increasing learning opportunities. To obtain data, questions were posed for participants to state different ways their learning was enhanced as a result of using ATs. Issues that arose include; saving time, increase of learning independence, confidence, opportunities for participation, motivation, and access to information, enhanced performance, safety, and opportunities to express themselves. These issues are presented and discussed as follows;

Most of the participants (AD 2, TLVI 2, TLVI 5, AD 1, TLVI 3, LwVI 2, and LwVI 5) had the view that ATs save time. They specifically stated that ATs allows them to perform activities within a short period of time because they can do their work easily and faster. One of the participants had this to say: *"Aaa… mwanafunzi sasa hivi anatumia muda mfupi kuandika. Hili linasaidiwa sana anapotumia mashine 'Perkins brailler' kwa kweli anaweza akaandika vitu vingi kwa muda mfupi sana"* (AD 2*) [Aaa...A student right now spend little time to write. This helps a lot when he uses a machine (Perkins brailler) actually they can write many things in a very short time]*

Another participant said:

> Yeah! Teknolojia saidizi zinaboresha kwa namna kwamba wakati unapotumia teknolojia za kiwango cha juu hata zile za chini unarahisisha zaidi ujifunzaji kwa maanake kwanza muda unaotumika unakuwa mchache katika kufanya mambo mengi (TLVI 2).
>
> *[Yeah! Assistive technologies enhance in a way that, when using high-tech technology, even the low-technology you make the learning easier because first of all less time is spent in perform many activities]*

Another one added:

> Kwa kiwango kikubwa hizi teknolojia saidizi zinaokoa muda. Sasa hizi zilizopo tunaweza kusema zinaokoa muda kwa wastani, mfano perkins brailler ili aandike kuna muda fulani nafikiri zinadelay kidogo ukilinganisha na yule anayeweza kutumia kimpyuta lakini zinasaidia (TLVI 5).
>
> *[To a large extent these assistive technologies save time. Now these existing ones we can say they averagely save time. For instance, the use of Perkins Braille to write takes some time compared to one who can use a computer. I think they delay a little but they help]*

The narrations above indicate that where there is sufficient ATs, LwVI have the opportunity to perform and complete activities such as writing and reading within stipulated time. Furthermore, the data suggest that if LwVI could have access to high-tech ATs such as tape recorders, and computers to mention but a few their working time could be reduced to a greater extent rather than highly depending on the Perkins braillers and A4 frames

The above data provide insight on the fact that ATs lessen the time spent by LwVI in performing different activities including assignments, tests and examinations by providing ease mode of doing them compared to those who have not been introduced to its use. It is unfortunate that LwVI in primary schools have been highly depending on low-tech ATs which may not save time satisfactorily. These findings align with Eligi and Mwantimwa (2017)

who found out that one of the potentiality of ICTs in form of assistive technology was that it facilitates LwVI to save time when working on different academic activities. They observe that ATs play a role to simplify the entire learning by transforming learning material into formats that are easily read by LwVI. They mention ATs such as embosser, tape recorders and computers with specialized software to be most important ATs in helping LwVI save a lot of time when working. Similarly, this is supported by Demirok et al. (2019) who analyzed the use of ATs to overcome the reading difficulties and state among others that ATs enhance learners including those with visual impairment access instructions and perform their activities instantly. They specifically explained that technology-enhanced lessons enable reading and lessen time duration in reading.

Participants (TLVI 2, TLVI 4, LwVI 1, TLVI 1, and LwVI 4) were of the view that ATs increase independence for LwVI. They expressed that they remove dependence while giving them opportunities to do their activities at their own time and pace. One of the participants said:

> Hii pia inatoa utegemezi. Yeah, na kwasababu utegemezi unakuwa umetoka, mtoto anafanya mwenyewe hivyo anakuwa na uhuru kufanya kazi zake kwa sababu inawezekana kabisa kwamba sasa akakaa darasani akaona, aaa...kwa sasa hivi najisikia siwezi kufanya chochote, nitaenda kufanya baadae na anakifaa chake, anamaterial, anakwenda anafanya kwa uhuru kabisa (TLVI 2)
>
> *[This also removes dependencies. Yeah, and because the dependency is gone, the child does it by himself, so he has the freedom to do his work because it's quite possible that now he can be in class and see, aaa... right now I feel like I cannot do anything, I will do it later, he has his material, he goes and does it completely freely]*

Another one participant said:

> Lakini pia ipo kwamba; kwa mfano unaweza ukatoa kazi labda iko kitabuni au ni mtihani fulani, umepata paper sehemu fulani sasa badala ya kutegemea awe dependent asomewe na mwingie, unajikuta anasoma yeye mwenyewe kwasababu anakifaa kinachomwezesha kuweza kusoma *(TLVI 4)*
>
> *[But there is also that; for example, you can give a task, maybe it is in a book or it is a certain exam, you got a paper somewhere, now instead of him to be dependent to rely on others to read for him, he finds doing it by himself because he has an equipment that enables him to be able to read]*

Another one had this to share:

> Mmm…kwa ujumla ninapojifunza kwa kutumia teknolojia saidizi inanisaidia sana, inanisaidia sana kujiongoza mwenyewe na kufanya shughuli zangu mimi mwenyewe, lakini kama situmii teknolojia saidizi shughuli nyingi zangu hazitakwenda (LwVI 1).
>
> *[Mm...in general, when I learn using assistive technology, it helps me a lot, it helps me guide myself and do activities by myself, but if I don't use assistive technology, most of my activities will not go]*

The statements above indicate that ATs remove dependence among LwVI, and promotes freedom to perform activities by themselves thereby restoring their abilities to do things on their own without depending on other people. This means that ATs create a learning arena where LwVI have opportunity to successfully engage and perform any activity, and at any time without waiting for help from another person. This way, LwVI have opportunity to access most of the learning opportunities like others.

The above findings are in line with the D&M IS Success model which states that ATs are aimed at creating opportunities in which a person with restrictions can be able to perform activities autonomously as a measure of a system function (DeLone & McLean, 2016). Similarly, McNicholl et al. (2019) found out that ATs promotes learning independence of students with

disabilities including those with visual impairment in higher learning. Although this study was based in higher learning, it serves the same purpose as a call for ATs consideration in the learning of LwVI in primary schools. Relatedly, Satsangi et al. (2019) observed that ATs encourage learning independence among students with disabilities including those with visual impairment. Likewise, Montenegro-rueda (2022) reports that ATs enhance learners with disabilities including those with visual impairment to develop independence in their learning. The reports above serve as an alarming massage to primary school authorities to promote the use of ATs for LwVI as they promote learning autonomy and may lead to their better performance.

Other participants (LwVI 3, AD 1, and AD 2) stated that ATs increases learners' confidence. They specifically pointed out that because LwVI understand that they can perform just like others, they are confident towards learning. One of the participants said: *"Lakini kingine nakuwa najiamini kwamba na mimi ninaweza kusoma chochote hata kama wameweka vimandishi vidogo, nami nasoma (LwVI 3) [But on the other hand, I believe in myself that I can read anything, even if they put small texts, I can read]*

Another participant said: *"Lakini pia anajiamini kwa sababu anaitumia kwa sababu anaifahamu, anaifanya, ana anaitumia kwa kujiamini kwa kazi ile aliyopewa na mwalimu" (AD 1) [But he is also confident because he uses it and because he knows it, he does it, he uses it with confidence for the work given to him by the teacher]*

Another one added that:

> Yeah! Aaa...zinaongeza kujiamini kwa mwanafunzi tena
> kwa kiasi kikubwa. Sasa kama anajua kuvitumia hivi vitu

mana yake atashiriki kama wenzake. Hakuna kitakachompita na atafanya kila kitu kwa kujiamini kwahiyo haya yote yanamuongezea kujiamini kwa sababu kila kitu anaweza kukifanya (AD 2)

[Yeah! Aaa... they increase the confidence of the learner to a great extent. Now if he/she knows how to use these things (meaning ATs) he/she will do like others. Nothing will evade him and will do everything with confidence. So, all this increases his confidence because he can do everything]

The responses above show that ATs play a great role in building learners' self-confidence and trust on themselves. Although LwVI were variably limited with poor access to most of ATs in the school, the few available help them feel part and parcel of all the teaching and learning process. LwVI develop the feeling that they are no different from their counterparts because they can do anything that would be done by the sighte learners.

The above findings suggest that ATs are measures for addressing low self-confidence, anxiety and even fear of LwVI which is the result of limited ability to use their vision in performing activities. The use of ATs in schools provide LwVI with an assumption that they are not different to others and therefore, participate in learning knowing that they can perform and pursue their dreams just like others. These findings corroborate with Shinohara and Wobbrock (2016) who reports that ATs were potential in influencing self-consciousness and confidence in performing different tasks and social interaction when those with visual impairment could feel that they can accomplish any task assigned to them. Demirok et al. (2019) add on this and express that ATs are the gist towards learners' self-reliance and constructive attitudes. The studies suggest that for LwVI to be able to learn, they must have positive attitudes between what they want and what they can accomplish. This

way ATs make them afford to interact with any social group, activity and text to acquire information. It is therefore a suggestion that ATs should be made available for LwVI and their use mandated in primary schools.

Participants (TLVI 2, LwVI 1, and LwVI 2) stated that ATs increases participation for LwVI in lessons and other activities. Their expression was that ATs enhance LwVI to engage in lesson, group discussion and sports. One of the participants said:

> Yeah! Mtoto ambaye anavifaa tayari ameletewa na yeye kitabu hapo, ameletewa na yeye nukuu hapo, anasoma mwenyewe halafu anaambiwa jibu maswali, anatumia kifaa maalumu kujibu maswali. Huyo darasani kushiriki ni kukubwa kuliko mwingine (TLVI 2)

> *[Yeah! A child who is given the equipment, already is given a book, given notes and is reading by him/herself and then is being told to answer the questions, he uses a special device to answer the questions. He/she participates to a greater extent in class than others]*

Another participant said:

> Kwa upande wa taaluma hivi vifaa vinanisaidia kwa sababu wakati tunajifunza kwenye makundi, tunapojadili ninauwezo wa kukiandika kile tunachojadili lakini pia tunapokuwa kwenye michezo nina uwezo wa kutumia kifaa kama white cane eee kuangalia sehemu ambayo naweza nikaelekea (LwVI 1)

> *[On the side of academics, these devices help me because when we learn in groups, when we discuss, I can write down what we are discussing, but also when we are in games, I have the ability to use a device such as a white cane, eee to check where I can go]*

Another one added that: *"Aaaa! Tunapokuwa tunajadili labda maswali, ili nisisahau mimi nakuwa naandika kwa kutumia mashine na hizi za kuprint hapo"* (LwVI 2) *[Aaaah! When we are discussing maybe the questions, so that I don't forget I write using the machine and these (thermoform) to print]*

The narratives above indicate that LwVI have opportunities to participate in different activities including those provided by their teachers in classroom. Assistive technologies make it easy for teachers to provide LwVI with appropriate materials for reading, and are able to follow the lessons and answer teachers' questions. The results also show that LwVI are able to safely engage in co-curricular activities such as sports, engage in group discussion and take notes of everything in discussions. This may enhance the performance of LwVI.

Participation is one of the factors that make learners including those with visual impairment to be part of the lesson. It makes them feel valued and most important feel included. While other learners may be fully engaged through audio-visual presentation of information by traditional teaching, it may be different for LwVI who have little or no access to information provided. The above data therefore provide a revelation that the use of ATs in primary schools have the power to turn the story of sorrow to happiness. This is because the findings suggest that LwVI in primary schools gain opportunities to participate, and feel part of every activity in and outside classroom with their fellow with the help of ATs.

The above findings are in line with Satterfield (2016) who argue that ATs are useful in education as they facilitate learning and create opportunities for leaners to perform and be involved in each classroom activities. Equally, McNicholl et al. (2020) who point out that ATs are the pathways in which learners with disabilities can participate in daily school activities including group deliberations. Though McNicholl et al. (2020) study was conducted in higher learning institutions, it indicates that ATs provide a room for

participation and should be considered in a broad range of academic engagement and participation as an important parameter for inclusion of LwVI in primary school activities. Viner (2020) was of the same argument and reported that ATs are outstanding device that creates conducive environment for learners with different needs, particularly those with visual impairment to participate in different learning activities including writing, reading, and discussions. The authors convey a message that the use of ATs should be availed in primary schools so that to ensure participation of LwVI in academic arenas.

Other participants (AD 1, TLVI 1) had the view that ATs act as the motivating gear towards the learning of LwVI in schools. They point out that ATs ease the work, create the conducive learning environment and all this make LwVI to love learning. One of the participants said: *"Mmmh…teknolojia imerahisisha kazi ya ufundishaji na ujifunzaji. Zinafanya wanfunzi waweze kupenda hata kujifunza kwa sababu kazi ambayo angeifanya kwa muda mrefu, anaifanya kwa muda mfupi" (AD 1) [Hmmm...technology has made teaching and learning easier. They make students love to learn because the work that he would do for a long time, in done in a short time*

Another participant said:

> Teknolojia hizi zimetusaidia kwa hali ya juu sana, imepelekea hata wao wenyewe kuu, ndo mana hata wakati mwingine wanafaulu. Labda wanafurahia mazingira kiasi Fulani eee...ya hizi teknolojia, wanazifurahia. Eehee…kwahi yo wanaa...jifunza Kwa urahisi na wanapenda (TLVI 1).

> *[These technologies have helped us; it has even led too…That is why sometimes they perform. Maybe they enjoy the atmosphere to some range of these technologies, they enjoy them. Eehee...so they...learn very easily and enjoy it]*

The responses above provide insight to the fact that LwVI may be motivated to learn because they know that they can easily perform what they could not perform without the use of ATs. Moreover, the results suggest that ATs are tools that help to improve the learning environment of LwVI and because of that, LwVI do enjoy and feel motivated to engage in different learning activities, which in one way or another may enhance their performance.

Motivation is a determinant for a successful learning of LwVI in primary schools. When LwVI are restricted to access information, learn in a stressful environment, complete tasks late or are excluded in some activities because they are considered unable, they find it hard to pursue their dreams. From the findings above, the use of ATs creates a simplified and encouraging learning atmosphere which makes LwVI easily learn, thus motivating them to pursue their learning. Therefore, primary schools should ensure that ATs are utilized to the maximum as it is a source of motivation for LwVI to learn, which may also raise their performance.

The findings above align with Arpacık (2018) who says that ATs are powerful tools that increase motivation and attention to learners with disabilities. Although Arpacık (2018) study was specifically referring to learners with intellectual disabilities, the author mentions a smartboard, audio and video files that were used as motivation for learners. These can also be useful to LwVI and they can as well motivate them to engage in the learning processes. In addition, Montenegro-rueda (2022) reports that leaners were motivated to engage in learning as a result of using ATs. Nordström et al. (2018) also investigated on the power of ATs and suggest that assistive software promote motivation for learners to interact with text which is one of the very important

source of information for learning. Regarding these findings, it is worth stating that ATs are vital for they restore the lost motivation of LwVI due to visual challenges. This calls for authorities in primary schools; school administrators, district directors and stakeholders to promote the use of ATs while availing the high-tech ATs in those schools.

Participants (TLVI 3, TLVI 4) stated that ATs create opportunities for LwVI to access information. They specifically pointed out that because of ATs, they were able to access the information given by the teachers in accessible format. One of the participants said:

> Tukija kwenye suala la hivi vifaa saidizi, kama nataka wapate taarifa fulani, lazima niandae mimi vya kwangu, mfano kama kuna habari fulani izalishwe then nitapeleka kwenye thermoform nizalishiwe hizo hapo, then niwape watazisoma watajua lengo nililotaka walipate (TLVI 3).
>
> *[Coming to these assistive technologies, if I want them to get certain information, I have to prepare my own, for example, if there is a story to be produced, then I will take it to the thermoform and have it produced, then I will give it to them for reading and they will know what I wanted them to get]*

Another participant said:

> Kwa mfano, siyo kila kazi unayoipata inakuwa iko kwenye large fonts, zingine unazikuta ziko kidogo na uwezo wa kuzikuza kwa muda huo haupo. Kwa kupitia zile teknolojia saidizi kama hizo magnifier zile lenzi zao zile unajikuta mtoto anaweza akasoma tu na yeye akapata kitu (TLVI 4)
>
> *[For example, it is not every work you get is in large fonts. Others are small and there is no possibility to enlarge them at the moment. Therefore, through such assistive technologies, such as magnifiers, their lenses, you will find a child can just read and get something]*

The narrations above indicate that ATs help LwVI to access learning information in different formats including; use of braille format with the help of a Perkins brailler, and thermoform; use of enlarged texts with the help of

Desktop computers and a printer; and use of magnified text with the help of the magnifying lenses.

The above data suggest that LwVI in primary schools have access to information necessary for their learning with the help of ATs. It should be noted that information is a base of learning. That is to say, a learner must be able to receive, comprehend and convey information through which they learn from. While sighted learners may be able to receive information, comprehend and convey thoughts through different formats, LwVI are restricted because they receive less/or no information in some forms. In a situation such as this, the findings above provide a revelation that indeed ATs may provide hope for the LwVI because it gives them alternative means through which they use to receive, comprehend and even convey their thoughts and enrich their learning.

The findings above align with Nordström et al. (2018) who states that ATs in forms of applications that changes speech into text and text into speech increase learners' accessibility to text information and ability to express with text. Similarly, Koehler et al. (2019) found that students were able to engage in science subjects because they could access all the information in the subject content. Furthermore, Kirboyun (2020) investigated on the impacts of ATs and compared the efficiency of high-tech and the low-tech ATs. He observes that though all categories were viable for accessibility, the high-tech ATs create greater opportunities for LwVI to access information in various formats such as; soft from internet, prints that are enlarged and even braille texts. However, contrary to the above observation the school in this study have been relying on old-fashioned ATs such as Perkins, A4 frames and low-tech magnifies. This calls for schools to ensure that a variety of ATs more especially the high-tech

ATs are available for LwVI to access adequate information which may enhance learning.

Other participants (AD 1, LwVI 3) were of the view that ATs improve performance of LwVI. They specifically explained that ATs help LwVI easily understand the teachers compared to those who have no access to ATs. One of the participants said: *"Kwa upande wa ufaulu kwa asilimia kubwa tukachukua wanafunzi wasioona, wanafaulu zaidi hata ya wanafunzi ambao ni viziwi. Sasa ule utofauti unatokana na vifaa vyao, wanafunzi viziwi hawana teknolojia" (AD 1) [In terms of success, if we take blind students, they perform even more than those who are deaf. The difference comes from their equipment; deaf students don't have technology]*

Another participant added: *"Vinanirahisishia kingine kumwelewa mwalimu na nafaulu vizuri" (LwVI 3) [They make it easier for me to understand the teacher, and I perform better]*

The results above indicate that ATs provide opportunities for LwVI to understand the lessons presented by the teachers. The data further explains that, since the LwVI' understanding is increased, their performance is also enhanced.

The data above provide insight to the fact that indeed ATs are the gist towards better performance of LwVI in primary school. They create a room where LwVI easily comprehend the concepts presented by their teachers. The impression is that, it is hard for LwVI to do better in learning if they are not using ATs. This is a call for schools to consider provisions and use of ATs imperative in supporting the learning of LwVI.

The above findings is in line with the D&M IS Success model which suggest that ATs availability and use can be measured through performance as an outcome for learning (DeLone & McLean, 2016). McNicholl et al. (2021) found out that ATs have positive impacts on the academic performance of students with disabilities including those with visual impairment in higher learning institutions. They added that students were able to obtain and retain good grades due to the reason that ATs provided them with opportunities to engage in all academic grounds. Although this study was based on higher learning, it still expresses how ATs is an imperative tool for learners with disabilities in which those with visual impairments in primary schools are part. According to Ahmed (2018) ATs create supportive environment in which every learner can accomplish their academic dreams. This is because ATs enhance learners, particularly those with visual impairments to perform academic tasks that they would not to perform.

Participants (LwVI 1, LwVI 5) expressed that use of ATs assures LwVI with safety and security when in school and at home. One of the participants said: *"Lakini pia itanisaidia, inanisaidia kuonesha mazingira salama na yasiyo salama kipindi ninatembea sehemu nisiyoijua" (LwVI 1) [But it will also help me, it helps me to know a safe and unsafe environment while I'm walking in a place I don't know]*

Another participant added: *"Nyingine hizi teknolojia saidizi mfano white cane inaniepusha na vitu vilivyoko njiani kama vile mawe" (LwVI 5) [These other assistive technologies, such as the white cane, prevent me from things on the road such as stones]*

The statements above show that LwVI use ATs for their safety. Learners with visual impairment are able to interact with the school environment, move from home to school, school to home, and from dormitories to classroom with the help of a white cane which helps them detect whether there are dangerous objects. This way, ATs play a great role to help LwVI safely interact with the school environment and move from one place to another when attending to different learning activities, something which may provide opportunities for LwVI to learn from the environment and lessen the fear of being isolated which may eventually enhance their academic performance.

The findings above concur with Kisanga and Kisanga (2020) who reports that LwVI needs are not only academic but also space, self-reliance, safety and liberty to interact with the environment. Learners with visual impairment learn best by interacting with the environment at school and home. They need to be able to reach out for information anytime they need. To do so, they need to use ATs dedicated to orientation and mobility such as a white cane. Hakobyan et al. (2013) in their review on Mobile assistive technology agrees that ATs such as smartphone, Smart Vision, the Guide Cane, R-Map, haptic Sight study to mention but a few are potential for safety of the LwVI. They add that ATs decrease the fear of stigma, anxiety and reassures them with self-confidence to move outdoors and indoors and create conducive environment where LwVI feel free to socially interact with others, including sighted peers. From these findings, Schools have to ensure conducive learning environment by ensuring availability and use of ATs for orientation and mobility, which may adequately enhance the performance of LwVI.

Another participant (AD 2) was of the view that ATs provide LwVI opportunities for self-expression. He specifically explained that LwVI can present and express their thoughts in formats they wish with the help of ATs. He was noted saying: *"Aaa...lakini pia hizihizi teknolojia zinaweza zikamsaidia mwanafunzi kufanya mambo mengi, eee...kwamfano anaweza akajieleza kimaandishi, anajieleza tu tena vizuri kwa kutumia maandishi" (AD 2) [Aaah...but also these technologies can also help a learner to do many things, yeah...for example, he can express himself in writing, he just can express himself very well using text or writing]*

The narrative above shows that ATs help LwVI to express themselves in writings in a format that is suitable for them. That LwVI can express their ideas through normal text and braille.

The finding provides an impression that LwVI experience numerous limitations to express in writing as a result of limited visual ability and poor hand-eye coordination. In such a situation, ATs act as a gist to enhance LwVI ability to express in whatever style they may wish just like others without visual restrictions. These findings concur with the D&M IS Success model under the aspect of "Net impacts" which suggests that a system is success because it has managed to reduce or eliminate barriers for LwVI to express their thoughts from which the learning is also enhanced (DeLone & McLean, 2016). It is also consistent with McNicholl et al. (2020) who suggest that those learners including LwVI whose AT requirements were met interacted and shared their thoughts freely with their colleagues. The vice versa was true to those whose requirements was not fulfilled. Thus, ATs provide opportunities for LwVI to overcome barriers excel in all spheres, thereby promoting

learning. Notably therefore ATs should be considered the basic requirement

for LwVI in primary schools to successfully engage in learning.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusion and recommendation basing on the findings provided in chapter four. It is arranged following the objectives of the study which are; to establish the ATs available for teaching and learning of LwVI, examine how ATs are used, and investigate how ATs might be enhancing the learning of LwVI in primary schools. Lastly, the chapter presents the suggestions as gaps for further research.

5.2 Summary of the Findings

The study revealed that Primary school X have access to some of the ATs necessary for teaching and learning of LwVI. However, it was found out that the available ATs are not adequate to cater for the needs of LwVI because they are extremely few. Although two types of AT that is; low-tech ATs and high-tech ATs were found to be available and being used in the school, many of them are low-tech, the high-tech ATs are very limited. This suggests that the school still lacks necessary ATs for teaching and learning of LwVI more especially the adapted ones (high-tech) which would sufficiently enhance the teaching and learning of LwVI. Many of ATs that are available are also not operating because they are broken down and not timely repaired. Relatedly, the study found that the enabling infrastructure for the use of ATs in the school are not in a good condition and that the only enabling infrastructure available is the electricity connectivity which is also unstable to facilitate the use of ATs.

The study revealed that teachers and learners with visual impairment in primary school X use ATs in different ways; Teachers make use of ATs to prepare the lessons, assess learner' progress, download study material for teaching different subject to LwVI. Learners with visual impairment use ATs for writing, reading, and for navigating within the school environment. On another hand, the study findings indicate that the use of ATs was hindered by different challenges including inadequate training of teachers which leads to insufficient skills in using most of the ATs, scarcity of the ATs, damage and breakdown of the ATs, unreliable electricity supply, unsuitability ATs and absence of resource room and other important enabling infrastructures in the school which may deny LwVI from accessing learning opportunities which are accessed by sighted learners.

Lastly, the study found out that although LwVI are hindered in different ways when using ATs, their learning is to some extent enhanced. The learners are able to access different types of learning information, saves time when performing tasks; they are able to explore the school environment, become independent and confident in their learning. The ATs also create opportunities for the LwVI to participate in different learning activities, and motivates them to pursue their learning which in turn improves their performance.

5.3 Conclusion of the Study

The study shows that the use of ATs is vital to minimize barriers while creating a room for LwVI to access educational opportunities. However, it establishes that primary schools are constrained by limited ATs. They are limited with few low-tech and barely have high-tech ATs, poor enabling

infrastructure which are not sufficient to cater for the teaching and learning of LwVI.

Teachers and LwVI make attempt to use ATs as important tools to enhance the teaching and learning. However, they are constrained by different challenges including inadequate skills to use ATs, especially high-tech ATs and dependency on low-tech ATs.

Although the use of ATs by LwVI is minimal, it has to some extent enhanced the learning and improved their optimism towards achieving their dreams through accessing education like others.

5.4 Recommendations

1. The government through MoEST, President's Office Reginal Administration and Local government (PO-RALG), NGOs and other stakeholders should combine efforts to ensure availability of adequate ATs, especially the high-tech ATs that may satisfactorily enhance the teaching and learning of LwVI in primary schools.

2. The government should make sure primary school's infrastructure are improved by putting in place resource rooms, computer laboratories, increasing classrooms, stable electricity and more importantly ensure internet connectivity to schools for digital technology use.

3. The MoEST should collaborate with, Tanzania Commission for Universities (TCU), universities, the Tanzania Institute of Education (TIE) and other stakeholders should consider reviewing and improving the training programs in colleges and universities so that teachers may be prepared with practical skills on the use of different ATs for LwVI in primary schools.

4. It should be considered that there are new innovations arising everyday due to technological advancement. Therefore, new ATs products are being innovated. This means that teachers should be routinely trained to remain relevant and update with ermeging trends.

5. Primary school authorities should advocate for proper budget allocation specifically for repair and maintenance of the available ATs so that they are in good condition to use the

6. Teachers should combine efforts among themselves and LwVI who are the prime users to keep the ATs in care to avoid breakdown. This way the scarcity of ATs may be reduced.

7. Teachers who have some skills to use ATs can train their fellow teachers through peer-to-peer coaching to strengthen the use of ATs. Similary teachers should commit themselves intergrate to sensitize, train and encourage LwVI to use ATs for their betterment.

5.5 Suggestion for Further Research

Based on the study findings, I hereby suggest the following areas to be researched to improve the use of ATs in primary schools for the learning of LwVI;

1. Stakeholders' perception on the use of ATs as pedagogical tools to enhance the teaching and learning of LwVI in primary schools in Tanzania.

2. Maintenance and repair status of ATs for LwVI in primary schools, Tanzania.

3. The correlation between ATs utilization and the transition of LwVI from primary schools to secondary schools in Tanzania.

4. The applicability of ATs for learners with multiple disabilities in primary schools in Tanzania.

5. The primary school teacher's competences in using ATs to teach LwVI in Tanzania.

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APPENDICES

Appendix i: Interview guide for District Needs Special Education officer

I am John Karusha Bahati a student at Kyambogo University in Uganda, pursuing a Master's degree in Special Needs Education. I am conducting a research study on "Use of Assistive Technology in Teaching and Learning of learners with visual impairment in Primary Schools in Kasulu District, Tanzania. I hereby request for your cooperation.

Background information

1. What is your age range?

2. How long have you been supervising this school?

3. What are your roles in relation to assistive technologies for learners with visual impairment in primary school?

Questions

1. What is the state of assistive technology (AT) in terms of availability and use in the school you are supervising?
2. What are the infrastructures in place to enable the use of assistive technologies (ATs) in the school?
3. Are there Information and communication technician ready to provide assistance for learners and teachers in using ATs? If yes, how do they function?
4. What are the sources of ATs for LwVI that are being provided to the school?
5. What is your role in ensuring ATs are available in primary schools that accommodate learners with visual impairment?
6. Based on experiences from your supervision of the school, explain how teachers and LwVI use ATs.
7. What problems do exist regarding AT use by LwVI in learning and teachers in teaching
8. In your own opinion suggest mitigative measures for the existing problems regarding the use of ATs in teaching and learning for LwVI?
   ………………...Thank you so much for participating…………………

Kiambatisho i: Hojaji kwaajiri ya Afisa Elimu-Elimu maalum wilaya.

*Mimi ni John Karusha Bahati mwanafunzi wa shahada ya Uzamili katika Elimu ya watu wenye mahitaji Maalum chuo kikuu cha Kyambogo kilichopo Uganda. Ninafanya utafiti kuhusu "**Matumizi ya teknolojia saidizi (TS) katika Kufundisha na kujifunza kwa wanafunzi wenye ulemavu wa uoni katika shule za msingi, Wilaya ya Kasulu, Tanzania.** Tafadha naomba ushirikiano wako.*

Sehemu A: Taarifa tunduizi

1. Una wako ni kati ya ………. Na…………?
2. Ni kwa muda gani sasa umesimamia shule hii?
3. Wajibu wako/majukumu yako ni yapi hususani juu ya Teknolojia saidizi kwa wanafunzi wenye ulemavu wa uoni?

Sehemu B: Maswali ya jumla

1. Teknolojia saidizi ziko katika hali gani kwa muktadha wa uwepo, utoshelevu, ufaafu na matumizi yake?
2. Ni miundo mbinu gani wezeshi iliyopo, inayosaidia au kuchochea matumizi ya TS shuleni? Unadhani inatosheleza?
3. Je kuna wataalamu wa TEHAMA ambao wapo shuleni ili kuhakisha TS zinatumika ipasavyo. Kama ndiyo eleza namna wanavyotimiza wajibu wao, na kama Hapana kwa nini hasa?
4. Teknolojia saidizi ambazo ni kwaajiri ya wanafunzi wenye ulemavu wa uoni zinatoka wapi? Zinapoharibika huwa mnafanyaje? Kuna fungu limetengwa kwaajiri hiyo, linatosha?
5. Unawajibikaje katika kuhakikisha TS zipo na zinatosheleza mahitaji ya wanafunzi wenye ulemavu wa uoni?
6. Kulingana na uzoefu wako, eleza ni kwa namna gani walimu na wanafunzi hutumia TS katika shughuli mbalimbali darasani na nje ya darasa.
7. Ni changamoto zipi umefanikiwa kuziona juu ya matumizi ya TS kwa walimu kufundishia na wanafunzi kujifunzia?
8. Kwa ufahamu wako mwenyewe, pendekeza hatua zinazoweza kuchukuliwa ili kutatua changamoto zinazozorotesha matumizi ya TS kwa walimu kufundishia na wanafunzi kujifunzia.

……………… Asante sana kwa ushirikiano wako…………..……………

Appendix ii: Interview guide for a head teacher

I am John Karusha Bahati a student at Kyambogo University in Uganda, pursuing a Master's degree in Special Needs Education. I am conducting a research study on **"The use of Assistive Technology in Teaching and Learning of learners with visual impairment in Primary Schools in Kasulu District, Tanzani"** *I hereby request your cooperation.*

Section A: Background Information

1. What is your age range?

2. For how long, have you served as a head teacher in this school?

3. what are your responsibilities as a head teacher regarding the use of ATs in teaching and learning of LwVI in this school?

Section B: Assistive Technologies available for Teaching and Learning of LwVI

1. What is the status of ATs in terms of availability, suitability and use in the school?
2. What are the different sources of ATs for LwVI in the school?
3. Mention different enabling infrastructure available in the school to enhance the use ATs in teaching LwVI? What is the condition of the infrastructures?
4. How do the available ATs enable learners to access learning? Do you think the ATs available in the school meet learners' accessibility needs?
5. Do teachers have knowledge of the available ATs and how they are used?
6. What do you think should be done to improve the current status of ATs in terms of availability and suitability and use?

Section C: Usability of ATs in Facilitating the Teaching and Learning of LwVI

1. Explain different ways in which teachers and LwVI use ATs in teaching and learning.

2. Are teachers competent in using the ATs for LwVI available in the school? Do you have training programmes for teachers regarding the use of ATs for LwVI?

3. Do you think teachers and LwVI are willing to use ATs? If yes why?

4. Based on your experiences and from complaints what challenges do teachers and LwVI face when using ATs?

5. In your view, suggest what other authorities; the government, NGOs and others should do to mitigate the challenges regarding the use of ATs in teaching LwVI?

Section D: How ATs might be enhancing the learning of LwVI

1. Comment on how the learning of LwVI is enhanced as a result of teaching and learning by using AT?

2. Apart from the above, what other benefits LwVI gain from using ATs when completing in and outside classroom academic activities?

3. What differences do you see exist when LwVI learn by using ATs and when learning without using ATs?

4. What advice do you give to other authorities to increase the use of AT based on the benefits it renders?

………………...Thank you so much for participating…………………

Kiambatisho ii: Hojaji kwaajiri ya Mwalimu mkuu wa shule.

*Mimi ni John Karusha Bahati mwanafunzi wa shahada ya Uzamili katika Elimu ya watu wenye mahitaji Maalum chuo kikuu cha Kyambogo kilichopo Uganda. Ninafanya utafiti kuhusu "**Matumizi ya teknolojia saidizi (TS) (Vifaa saidizi) katika Kufundisha na Kujifunza kwa wanafunzi wenye Ulemavu wa uoni katika shule za msingi**, wilaya ya Kasulu, Tanzania. Tafadhari naomba usirikiano wako.*

Sehemu A: Taarifa tunduizi

1. Una umri gani?

2. Ni kwa muda gani sasa umehudumu kama mwalimu mkuu was hule katika shule hii?

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3. Kama mwalimu mkuu, majukumu na wajibu wako ni upi hususani juu ya matumizi ya teknolojia saidizi katika ufundishaji na ujifunzaji wa wanafunzi wenye ulemavu wa uoni?

Sehemu B: Teknolojia saidizi zilizopo kwaajiri ya kufundishia na kujifunzia wanafunzi wenye ulemavu wa uoni.

4. Teknolojia saidizi ziko katika hali gani kwa muktadha wa uwepo, utoshelevu, Ufaafu na matumizi yake?

5. Kama shule, teknolojia saidizi ambazo ni kwaajiri ya wanafunzi wenye ulemavu wa uoni mnazitoa wapi? Na zinapoharibika huwa mnafanyaje, kuna fungu lolote serikali imetenga katika kufanya marekebisho ya vifaa hivi?

6. Ni miundo mbinu gani wezeshi iliyopo, inayosaidia au kuchochea matumizi ya TS shuleni? Na je iko katika hali gani?

7. Ni kwa namna gani TS zilizopo zinawezesha ufikifu wa ujifunzaji wa wanafunzi wenye ulemavu wa uoni? Na unadhani zinatosheleza mahitaji yao?

8. Walimu wanafahamu TS zilizopo na jinsi zinavyotumika?

9. Unadhani nini kifanyike ili kuboresha hali ya sasa ya TS kwa minajiri ya uwepo, ufaafu na matumizi?

Sehemu C: Utumikaji wa Teknolojia saidizi katika kuwezesha ufundishaji na ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Kulingana na uzoefu wako, eleza ni kwa namna gani walimu na wanafunzi hutumia TS katika shughuli mbalimbali darasani na nje ya darasa. Unadhani wanazitumia ipasavyo?

2. Je, walimu na wanafunzi wanao ujuzi wa kutosha wa kutumia TS zilizopo katika kufundishia na kujifunzia?

3. Kwa unavyoona, walimu na wanafunzi wanao utayari wa kutumia TS? Kwa nini?

4. Kulingana na uzoefu wako na kutokana na malalamiko ya walimu na wanafunzi, ni changamoto zipi zinazowakabiri walimu na wanafunzi katika kutumia TS?

5. Kwa maoni yako, pendekeza nini mamlaka nyingine kama vile wafadhiri binafsi, serikali, wazazi na wadau wengine wafanye ili kutatua changamoto hizo na kuboresha matumizi ya TS ili kuboresha ujifunzaji.

Sehemu D: Namna ambavyo TS zinaweza kurahisha ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Eleza juu ya namna ambavyo ujifunzaji wa wanafunzi wenye ulemavu wa uoni umeboreshwa kama matokeo ya matumizi ya TS

2. Ukiacha hizo, ni faida zipi nyingine wanawezazipata wanafunzi wenye ulemavu wa uoni wanapotumia TS kufanya shughuli mbalimbali za darasani nan je ya darasani?

3. Ni tofauti zipi unazoziona, wakati wanafunzi wenye ulemavu wa uoni wanapotumia TS na wakati wasipotumia TS wakati wa kujifunza?

4. Unatoa ushauri gani kwa mamlaka nyingine, ikiwemo serikali ili kuongeza na kuboresha matumizi ya TS kulingana na faida zake?

……………… Asante sana kwa ushirikiano wako………….……………

Appendix iii: Interview Guide for LwVI

*I am John Karusha Bahati a student at Kyambogo University in Uganda, pursuing a Master's degree in Special Needs Education. I am conducting a research study on **"The use of Assistive Technology in Teaching and Learning of learners with visual impairment in Primary Schools in Kasulu District, Tanzania.** I hereby request for your cooperation.*

Section A: Background Information

1. What is your age range?

2. Which class are you in?

3. What is the severity of your visual impairment?

Section B: Assistive Technologies Available for Teaching and Learning of LwVI

1. What are the different Low-tech assistive technologies (ATs) available in the school which you can use in completing different academic activities?
2. What are the different High-tech assistive technologies (ATs) made available for you to access instructions and independent learning?
3. Do you think the ATs available in the school meet your accessibility needs?
4. How do the available ATs help you to learn and participate in school activities?
5. What do you think should be done to improve the current status of ATs in terms of availability?

Section C: Usability of ATs in facilitating the teaching and learning of LwVI

6. Explain the way you use different Low-tech and High-tech ATs in accessing teachers' instructions?
7. How do teachers use the AT to facilitate your learning?
8. How do you use different ATs to perform in and outside classroom academic activities?
9. What challenges do you face when using different ATs in your learning?

10. What challenges do the teachers face when using ATs to support your learning?

11. In your view, what do you think can be done to mitigate the challenges regarding how you use ATs in learning?

Section D: How ATs might be enhancing the learning of LwVI

1. What benefits do you gain from using ATs in classroom instructions and outside activities?

2. Apart from the above, how do you benefit from using ATs when completing in and outside classroom academic activities?

3. What differences do you see exist when learning by using ATs and when learning without using ATs?

4. What advice do you give to the school to increase the use of AT based on the benefits it renders?

………………. Thank you so much for cooperating………………...……

Kiambatisho iii: Hojaji kwa wanafunsi wenye Ulemavu wa Uoni.

*Mimi ni John Karusha Bahati mwanafunzi wa shahada ya Uzamili katika Elimu ya watu wenye mahitaji Maalum chuo kikuu cha Kyambogo kilichopo Uganda. Ninafanya utafiti kuhusu "**Matumizi ya teknolojia saidizi (TS) katika kufundisha na kujifunza kwa wanafunzi wenye ulemavu wa uoni katika shule za msingi**" Tafadhari naomba ushirikiano wako.*

Sehemu A: Taarifa tunduizi

1. Una umri gani?

2. Unasoma darasa la ngapi?

3. Ulemavu ulionao una hali gani?

Sehemu B: Teknologia saidizi zilizopo kwaajiri ya kufundishia na kujifunzia kwa wnafunzi wenye ulemavu wa uoni.

6. Ni teknolojia saidizi zipi za teknolojia ya chini zilizopo shuleni unazoweza kutumia kukamilisha shughuli mbalimbali za kujinza?

7. Ni TS zipi za teknolojia ya juu zilizopo shuleni zinazokuwezesha kupata taarifa darasani na katika ujifunzaji binafsi?

8. Unadhani teknolojia saidizi zilizopo zinakidhi mahitaji yako ya ufikiaji wa taarifa za ujifunzaji? eleza ni TS zipi ungependa ziwepo ili ujifunzaji wako uwe bora.

9. Ni kwa namna gani Teknolojia saidizi zinakusaidia kujifunza na kushiriki katika shughuli mbalimbali?

10. Unadhani nini kifanyike ili kuboresha hali ya TS kwa upande wa uwepo/utoshelevu na ufaafu?

11. Kwa maoni yako taja TS ambazo ungependa ziwepo ili kuongeza ufanisi katika ujifunzaji wako.

Sehemu C: Matumizi ya teknolojia saidizi katika ufundishaji na ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Eleza namna mbalimbali unavyotumia TS za teknolojia ya chini na ya juu katika kufikia ufundishaji wa mwalimu darasani.

2. Ni kwa namna gani walimu hutumia TS kuwezesha ujifunzaji wako?

3. Unatumiaje TS mbalimbali katika kufanya shughuli mbalimbali za darasani na nje ya darasani?

4. Ni changamoto zipi unazozipita unapotumia TS katika kujifunza? Huwa unafanyaje kuzitatua?

5. Ni changamoto zipi zinazowapata walimu wanapotumia TS katika kuwezesha ujifunzaji wako? Huwa wanafanyaje kuziepuka na kuzitatua?

6. Kwa maoni yako, nini kifanyike ili kutatua changamoto juu ya unavyotumia TS?

Sehemu D: Namna ambayo teknolojia saidizi vinaweza kuboresha ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Ni faida zipi unazozipata kutokana na kutumia TS wakati wa somo darasani na katika shughuli za nje?

2. Ukiacha hizo ulizozitaja, unaweza kufaidikaje ukitumia TS unapokuwa ukifanya shughuli za darasani nan nje ya darasa?

3. Kuna tofauti gani unazoziona unapojifunza kwa kutumia TS na pale unapojifunza bila kutumia TS?

4. Unatoa ushauri gani kwa shule na wadau wengine ili kuongeza na kuboresha matumizi ya TS kulingana na faida unazozipata?

……………… Asante sana kwa ushirikiano wako………….……………

Appendix iv: Interview Guide for Teachers

I am John Karusha Bahati a student at Kyambogo University in Uganda, pursuing a Master's degree in Special Needs Education. I am conducting a research study on ***"The use of Assistive Technology in teaching and Learing of learners with visual impairment in Primary Schools in Kasulu District, Tanzania"*** *I hereby request your cooperation.*

Section A: Background Information

1. What is your age range?

2. Which class do you teach?

3. How long have you been teaching LwVI in this school?

Section B: Assistive Technologies available for teaching and learning of LwVI

1. What are the different Low-tech assistive technologies (ATs) available in the school which you can use to teach LwVI?
2. What are the different High-tech assistive technologies (ATs) made available for you to use in teaching LwVI?
3. Mention different enabling infrastructure available in the school which enhance you to use ATs in teaching LwVI.
9. What is the condition of the infrastructure?
10. Do you think the ATs available in the school meet learners' accessibility needs of your instructions? How do the available ATs enable learners to access learning?
11. What do you think should be done to improve the current status of ATs in terms of availability and suitability?

Section C: Usability of ATs in facilitating the teaching and learning of LwVI

1. Explain the way you use different Low-tech and High-tech ATs in teaching LwVI?
2. Apart from the above what are other ways do you make use of ATs to facilitate the learning of LwVI in and outside classroom?

3. What challenges do you face when using different ATs to teaching LwVI?

4. What challenges do the LwVI face when using ATs in different learning acticities?

5. In your view, what do you think can be done to mitigate the challenges regarding the use of ATs in teaching LwVI?

Section D: How ATs might be enhancing the learning of LwVI

6. Comment on how the learning of LwVI is enhanced as a result of teaching by using AT?

7. Apart from the above, what are other benefits LwVI gain from using ATs when completing in and outside classroom academic activities?

8. What differences do you see exist when LwVI learn by using ATs and when learning without using ATs?

9. What advice do you give to the school to increase the use of AT based on the benefits it renders?

……………Thank you so much for your support………………..

Kiambatisho iv: Hojaji kwa walimu wa wanafunsi wenye Ulemavu wa Uoni.

*Mimi ni John Karusha Bahati mwanafunzi wa shahada ya Uzamili katika Elimu ya watu wenye mahitaji Maalum chuo kikuu cha Kyambogo kilichopo Uganda. Ninafanya utafiti kuhusu "**Matumizi ya teknolojia saidizi (TS) katika kufundisha na Kujifunza kwa wanafunzi wenye ulemavu wa uoni katika shule za msingi**" Tafadhari naomba ushirikiano wako.*

Sehemu A: Taarifa tunduizi

4. Una umri gani?

5. Unafundisha darasa la ngapi?

6. Ni kwa muda gani umewafundisha wanafunzi wenye ulemavu wa uoni katika shule hii?

Sehemu B: Teknolojia saidizi zilizopo kwaajiri ya kufundishia na kujifunzia wanafunzi wenye ulemavu wa uoni

1. Ni teknolojia saidizi zipi za teknolojia ya chini zipo shuleni ambazo unaweza kutumia kufundishia wanafunzi wenye ulemavu wa uoni? Taja ambazo ungependa ziwepo.

2. Ni teknolojia saidizi zipi za juu zilizopo shuleni ambazo wewe unapaswa kuzitumia kufundishia wanafunzi wenye ulemavu wa uoni? Taja ambazo ungependa ziwepo.

3. Ni miundo mbinu gani wezeshi iliyopo shuleni inayokuwezesha kutumia teknolojia saidizi kuwafundisha wanafunzi wenye ulemavu wa uoni? Na iko katika hali gani?

4. Unadhani teknolojia saidizi zilizopo shuleni zinakidhi mahitaji ya ufikikikaji wa ufundishaji wako kwa wanafunzi wenye ulemavu wa uoni? Eleza ni kwa nini?

5. Unadhani nini kifanyike ili kuboresha hali ya TS kwa muktadha wa utoshelevu na ufaafu wake kwa wanafunzi wenye ulemavu wa uoni.

Sehemu C: Utumikaji wa Teknolojia saidizi katika kuwezesha ufundishaji na ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Eleza ni kwa namna gani unatumia Teknolojia saidizi mbalimbali zikiwemo za chini na za juu katika kufundisha wanafunzi wenye ulemavu wa uoni.

2. Ukiacha hizo ambazo umezitaja, fafanua namna nyingine unavyowezakutumia teknoljia saidizi kuwezesha ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

3. Ni changamoto zipi unazokumbana nazo unapotumia teknolojia saidizi kufundishia wanafunzi wenye ulemavu wa uoni?

4. Wanafunzi wenye ulemavu wa uoni, wanapata changamoto gani wanapokuwa wakitumia TS katika shughuli mbalimbali? Wewe kama mwalimu huwa unafanyaje kuzitatua?

5. Kwa maoni yako, unadhani nini kinawezakufanyika ili kutatua changamoto juu ya matumizi ya TS katika kufundisha wanafunzi wenye ulemavu wa uoni?

Sehemu D: Namna ambavyo TS zinaweza kurahisha ujifunzaji wa wanafunzi wenye ulemavu wa uoni.

1. Toa maoni yako juu ya namna ambavyo TS zinaboresha ujifunzaji wa wanafunzi wenye ulemavu wa uoni kama matokea ya kufundisha kwa kutumia TS

2. Ni kwa namna gani ujifunzaji wa wanafunzi wenye ulemavu wa uoni umerahisishwa kutokana na wao kutumia TS?

3. Ukiacha hizo ulizotaja, je ni faida zipi nyingine wanazoweza kupata wanafunzi wenye ulemavu wa uoni wanapotumia TS kukamilisha shughuli mbalimbali za darasani na nje ya darasa hasa wakipata vifaa vyote stahiki?

4. Ni tofauti zipi unazoziona, wakati wanafunzi wenye ulemavu wa uoni wanapotumia TS na wakati wasipotumia TS wakati wa kujifunza?

5. Kwa maoni yako, unatoa ushauri gani kwa shule na wadau wengine ikiwemo serikali ili kuongeza na kuboresha matumizi ya TS kulingana na faida zake?

………………… Asante sana kwa ushirikiano wako…………..……………

Appendix v: Observation Checklist Guide

Aspects to observe	Expected ATs to be available in the school	User category	Available	Operat ional	Funct-ion
1.Enabling infrastructure	Laboratory/resource Room				
	Electricity				
	Suitable classrooms				
	Internet connectivity				
	Shelves in classrooms				
	Tables in classrooms				
2.High-tech ATs	Computers with screen readers				
	Computers with screen magnifiers				
	Closed circuit Televisions				
	Digital recorders				
	Smart boards				
	Embossers				
	Duxbury Braille Translator				
	Scanners				
	OCRs and OCR software				
	Projectors				
	Digital books/DAISY				
	Braille duplicators/ Thermoform				
	Printers				
	Android phones				
	Photocopy machine				
	Desktop computer				
Low-tech ATs	Perkins Braille				
	A4 frames/slates				
	Braille globe				
	Electronic globe				
	Electronic magnifiers				
	White canes				
	Abacus				
	Audio recorders				
	Victor readers				
	Table lamps				
	Card stock papers				
	Talking watches				
	Ear/head phones				

Appendix vi: Consent Form

Dear participant

I am John Karusha Bahati a student at Kyambogo University in Uganda, pursuing a Master's degree in Special Needs Education. I am conducting a research study on "The use of Assistive Technology in teaching and Learning of learners with visual impairment in Primary Schools in Kasulu District, Tanzania.

I am happy to inform you that you are identified as one of the participants who are legible to provide appropriate information on this study through interviews. As you willingly accept to participate in this free of charge interview which will prospectively last for about 25-45 minutes, I am also requesting you to allow the recording of your voice for proper analysis at the end results. Whatever responses provided by you will be handled with utmost confidentiality and will only be used for research purpose as academic requires. To maintain justice, your freedom is of my great concern, thus, you will be at liberty to withdraw from participating in the study in case you feel uncomfortable to proceed.

Name of the interviewee ……………………Signature …… Date……….

Confirmation of acceptance

Having read and understood the purpose of the study, I hereby consent to participate in the study

Name of the interviewee ……………………Signature …… Date……….

……...… **Thank you for your cooperation**…………….…….

Kiambatisho vi: Fomu ya idhini ya ushiriki katika utafiti

Mpendwa mshiriki

Mimi ni John Karusha Bahati mwanafunzi wa shahada ya Uzamili katika Elimu ya mahitaji Maalum chuo kikuu cha Kyambogo kilichopo Uganda. Ninafanya utafiti kuhusu "Matumizi ya teknolojia saidizi katika kufundisha na kujifunza kwa wanafunzi wenye changamoto za uoni katika shule za msingi"

Ninayo furaha kukujulisha kuwa umeteuliwa kuwa mmoja wa washiriki wanaoweza kutoa taarifa stahiki ili kufanikisha utafititi huu kupitia mahojiano. Kwa kukubali kwako kwa hiari kushiriki katika mahojiano haya yatakayo dumu kwa takribani dakika ishirini na tano (25) hadi arobaini na tano (45) ninakuomba pia ukubali sauti yako irekodiwe ili kurahisisha uchambuzi wa matokeo. Taarifa yoyote utakayoitoa itatumika kwa madhumuni ya kitafiti kama ambavyo taaluma inahitaji na itahifadhiwa kwa siri. Uhuru wako ni kipaumbele changu na hivyo utakuwa huru kujitoa kwenye mahojiano endapo hautaridhika kuendelea.
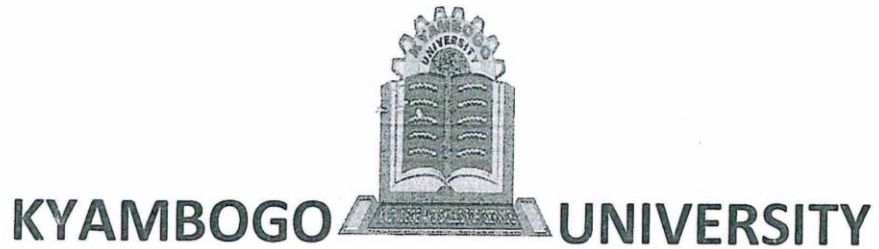
Jina la mtafiti……………..…………………. saini …………Tarehe...……..…

Uthibitisho wa kukubali

Baada ya kusoma na kuelewa dhumuni la utafiti huu, nakubali kushiriki katika utafiti.

Jina la mshiriki ……………………………. Saini………..…Tarehe……….

……………….… **Asante kwa ushirikiano wako**…………………………

Appendix vii: Introductory Letter for Data Collection.

KYAMBOGO UNIVERSITY

P. O. BOX 1, KAMPALA
FACULTY OF SPECIAL NEEDS & REHABILITATION
Tel: 0414-286237/285001/2   Fax: 0414-220464
DEPARTMENT OF SPECIAL NEEDS STUDIES

21st November 2022

To whom it may concern

Dear Sir/Madam,

SUBJECT: INTRODUCTORY LETTER FOR DATA COLLECTION

This is to introduce the bearer *BAHATI KARUSHA JOHN*

Reg. No: *20|x|GTMSN|13265|WKD* who is a bonafide student of Kyambogo University in the Department of Special Needs Studies. As partial fulfillment of the requirements for the award of a Master of Special Needs Education, she/he is required to undertake a research on the approved area of study.

The purpose of this letter is to request you to allow him/her to collect data for his/her research study.

Kyambogo University will be grateful for any assistance rendered to the student.

Sincerely,

Dr. Okwaput Stackus

HEAD OF DEPARTMENT

Appendix viii: Research clearance from the Reginal Commissioner's Office.

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

KIGOMA REGION:
Telegrams: "REGCOM"
Tel. No. 028 2802330:
Fax: 028 280233 0"
Email: ras @kigoma.go.tz
In reply please quote:

Regional Commissioner's Office,
P.O. Box, 125,
KIGOMA.

Ref. No.DA.73/274/02'N'/107

30th November, 2022

District Administrative Secretary,
District Commissioner's Office,
P.O. Box 1,
KASULU
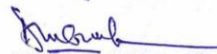
RE: <u>RESEARCH CLEARANCE</u>

Kindly refer to the heading above.

2   The Regional Commissioner's Office has received a letter from Head of Department Kyambogo University dated 21 November, 2022 introducing **Mr. Bahati Karusha John,** students of Kyambogo University pursuing Master of Special Needs Education and who is at the moment required to conduct research with title **"The Use of assistive Technology in the Education of learners with Visual Impairment in Primary School: Case Study Kasulu District"**

3.   Kindly assist him with necessary requirements to enable data collection in your administration area. The period of the research is from 01 December, 2022, to 31 January, 2023. No time extension will be added.

4.   Thank you for your cooperation.

Elisante M. Mbwilo
For: <u>REGIONAL ADMINISTATIVE SECRETARY</u>
<u>KIGOMA</u>

Copy: Head of Department,
Kyambogo University,
P.O. Box 1,
KAMPALA

FOR: REGIONAL ADMINISTRATIVE SECRETARY
KIGOMA

"   **Mr. Bahati Karusha John**

Appendix ix: Research clearance from the District Commissioner's Office.

<div align="center">

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

</div>

Telegrams: "ADMIN"

telephone:(+225) 028 2810 092
Email:
Fax: (0255) 028 2810 092
In reply please quote:
Ref. No. AB.172/299/01/92

District Commissioner's Office,
P.O Box 1,
KASULU.

1st Desember, 2022

Town Director,
Kasulu Town Council,
P.O Box 475,
KASULU.

<div align="center">

RE: RESEARCH CLEARANCE

</div>

The heading above refers.

2.0 I am introducing **Mr. Bahati Karusha John** a Student from Kyambogo University in Kampala Uganda that has been permitted to conduct his research on **"The Use of Assistive Technology in the Education of Learners with Visual Impairment in Primary Schools". Case study: Kasulu District.** His Research period starts from 1st Desember, 2022 to 31st January, 2023.

Please accord him necessarily.

Muguha T. Muguha
District Administrative Secretary
KASULU

Copy: Mr. Bahati Karusha John,
Kyambogo University in Uganda,
KAMPALA.

Appendix x: Introductory letter from the District Director.

HALMASHAURI YA MJI KASULU
(Barua zote ziandikwe kwa Mkurugenzi wa Mji)

Simu: +255282810335
Tovuti: www.kasulutc.go.tz
Baruapepe: td@kasulutc.go.tz

Ofisi ya Mkurugenzi wa Mji
Halmashauri ya Mji Kasulu
S. L. P. 475
KASULU

Unapojibu tafadhali taja

KUMB NA.KSTC/D.1/2/61   **02/12/2022**

Mwalimu Mkuu,
Shule ya Msingi Kabanga Mazoezi,
Halmashauri ya Mji,
KASULU.

YAH: UTAMBULISHO WA KUFANYA UTAFITI (RESEARCH) BW.BAHATI KARUSHA JOHN.

Tafadhali husika na mada tajwa hapo juu.

2. Nimepokea barua kutoka Ofisi ya Katibu Tawala wa Wilaya yenye Kumb Na. **AB.172/299/01/92** ya tarehe **01/12/2022** iliyohusu kibali cha kufanya utafiti.

Kwa barua hii, Namleta kwako **Bw.** Bahati Karusha John ili aweze kufanya utafiti unaohusu **"THE USE OF ASSISTIVE TECHNOLOGY IN THE EDUCATION OF LEARNERS WITH VISUAL IMPAIREMENT IN PRIMARY SCHOOLS".** Hivyo naomba umpokee na umpatie ushirikiano wa kutosha .
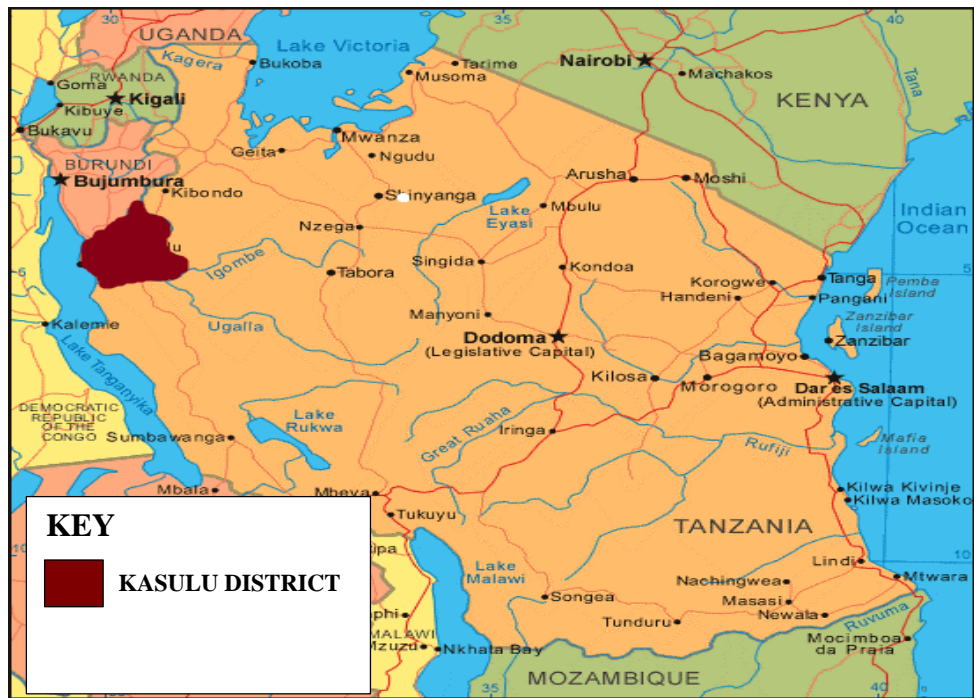
Wako katika Utumishi wa Umma.

Pascalina A. Mabena
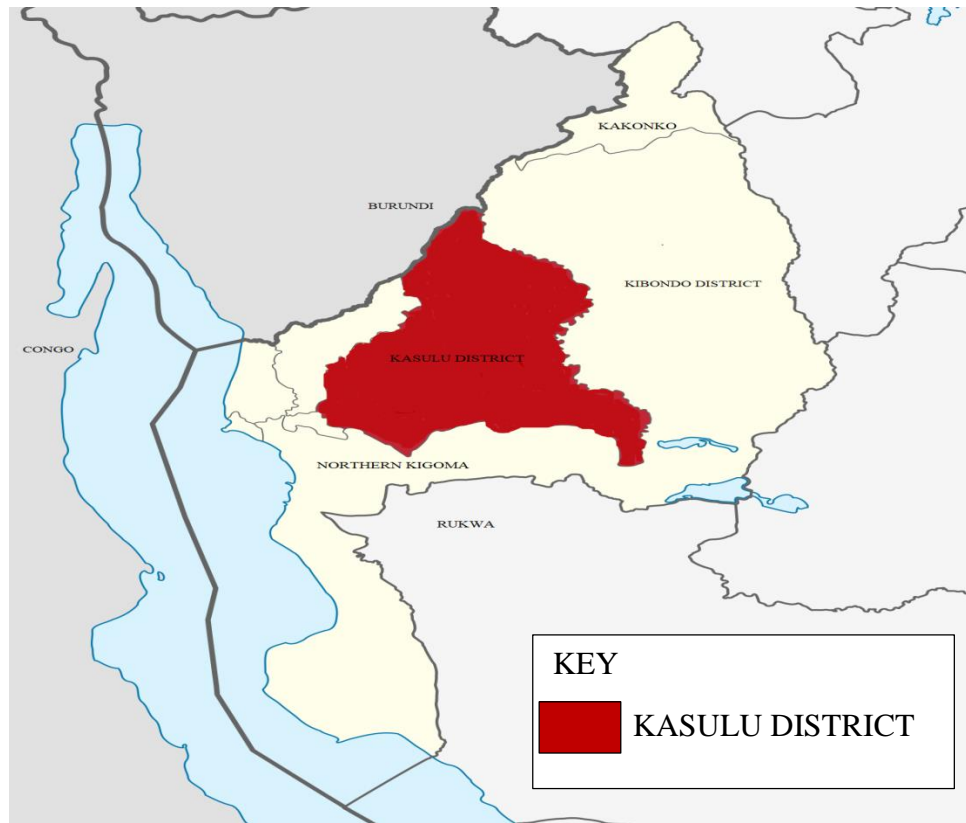Kny: MKURUGENZI WA MJI
HALMASHAURI YA MJI
KASULU

Nakala: Bw. Bahati Karusha John (Mtafiti)

Figure 1: Map of Tanzania showing Kasulu District

Source: *Retrieved from the National Bureau of Statistics (URT, 2016)*

Figure 2: Map of Kasulu District showing a Study Area Location

Source: *United Republic of Tanzania (URT; Kasulu DC, 2019)*