INFLUENCE OF ASSISTIVE TECHNOLOGY ON KENYA CERTIFICATE OF SECONDARY EDUCATION (KCSE) PERFORMANCE FOR VISUALLY IMPAIRED STUDENTS AT THIKA HIGH SCHOOL FOR THE BLIND, KENYA

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DECLARATION

This research project is my original work and has not been presented for any award in any other university.

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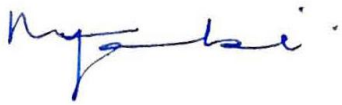
This research project has been submitted for examination with our approval as University Supervisors.



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To all special needs education stakeholders, may they find something valuable in this study.

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LIST OF ABBREVIATIONS AND ACRONYMS

BoM: Board of Management

GOK: Government of Kenya

ICT: Information and Communication Authority

HTML: Hypertext Markup Language

JAWS: Job Access with Speech

OCR: Optical Character Recognition

PDAS: Personal Assistive Technology

UN: United Nations

ABSTRACT

This study aimed at examining the influence of assistive technology on Kenya Certificate of Secondary Education (KCSE) performance for visually impaired students at Thika School for the Blind. The study objectives were to; examine the availability of assistive technology, to examine selection criteria for assistive technology, challenges faced by visually impaired students and teachers when using assistive technology, and the factors influencing use of assistive technology to boost KCES performance in Thika School for the Blind. Case study research design was used in organizing data collection in the research. The target population was 133 students and 10 teachers. The first sample comprised of 40 students was selected from form two and three while the second sample included 10 teachers. Out of the 40 students sampled, only 36 of them filled and returned questionnaires. All teachers accepted to take part in the study. Questionnaires and observation checklists were sent to teachers and student respondents for data collection. A coefficient of 0.7 was established when computing for reliability of instruments. Special Package Statistical Software (SPSS) was used to generate descriptive statistics data and summarised in tables. On the first objective, braille was the primary reading and writing modes used by many students to revise and do assignments. However, most recommended that computer and iPads were the most appropriate assistive that can help visually impaired students to learn and engage in other activities. Students demonstrated the need for assistive technologies that are easy to use and allows them to access various digital content

formats. In the second objective, it was noted that nature of visual impairment, availability of assistive technology tools, and lesson objectives were the major factors considered when selecting assistive technology. The findings in the third objective indicates that inadequate computers and lack of computer literacy skills among students and teachers were the main challenges impending the usage of assistive technology at Thika School for the Blind. The fourth objective demonstrated that appropriate use of assistive technology can significantly improve KCSE performance among visually impaired students. It was concluded that, schools for visually impaired student in Kenya rely mainly on braille, slate & stylus but less on computers and iPads. Also, it was noted that such assistive technology tools are not utilised appropriately. Thus, the following recommendations were made to encourage effective provision and utilisation of assistive technology to boost KCSE performance. Firstly, it was recommended that the Ministry of Education Science and Technology (MoeST) should encourage usage of assistive technology and provide a variety of assistive technologies that enable students with different nature of visual impairment to access content and enjoy learning like their sighted counterparts. However, the assistive technology devices and tools supplied should be portable, easy to use, and faster to enable visually impaired students learn independently. Secondly, the study recommends that schools should consider personal differences among the visually impaired learners when selecting assistive technology. Nature of disabilities and lesson objectives should be considered as the main determinants of assistive technology chosen. Personal differences among students should also guide teachers when selecting assistive technology suitable for each student. Thirdly, MOE should provide enough computers and other forms of assistive technology to schools for visually impaired. Teacher training and development programs were also recommended because they can alleviate challenges impending the use of assistive technology in Thika School for the Blind. Fourthly, the study recommends that schools for visually impaired should focus on appropriate alignment between pedagogical drive and catalytic drive with assistive technology tools and devices to boost academic performance that would improve KCSE results. The researchers made three suggestions for future studies within the area of assistive technology. Firstly, research on strategies that can be implemented to promote quality access to curriculum. Secondly, research on the most appropriate instructional strategies that can be used to teach visually disabled students using assistive technology. Thirdly, study the role of the Kenyan government and the MoeST in the implementation of assistive technology in schools for the blind.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Educational opportunities should be made accessible to all persons, whether sighted or blind. According to the United Nations (2006), every person with visual impairment is entitled to access quality education because it is his or her right. The equality in accessing education by both blind and sighted learners can be facilitated through viable strategies and policies for quality and equality in education for all types of learners. Communication information technology is gaining massive popularity in teaching and learning around the world. Therefore, it is essential for access technology to equalize sighted and blind students by compensating the students with visual disability. Use of access technology enables visually challenged students to perform just like sighted students. It allows them to achieve performances they would not have achieved without any assistive technology.

United Nations suggests that assistive technology should be specially tailored so that it can boost the operations of people who are visually challenged (Borg, Lindstrom & Larsson, 2009). Assistive technology encompasses an extensive concept, including all technologies, techniques, and strategies that can be used to recompense the lack of sight (Reed & Bowser, 2005). It includes all things extending from low-tech like gripping a pen to the more sophisticated technological tools which comprise of hearing aids or visual aids such as glasses.

Also, it can consist of advanced devices such as screen magnification software and computer screen readers which can be used to help students who are visually disabled to access written communication (WHO, 2009; Petty, 2012). Basically, assistive technologies comprise of innovative technical tools that adapt or modify the learning and learning environment for students with special needs in education (Shell, Cashman, Gunter & Gunter, 2006). Assistive technology in learning and teaching activities allows learners to apply technology appropriately to complete critical academic tasks.

Moreover, assistive technology offers teachers with innovative tools that allow students to overcome visual challenges that prevent them from accessing educational materials, thereby impending the process of learning. American Foundation for the Blind (2012) noted that assistive technology could be any technical tool or strategy that allow learners with conditions that challenge their learning process to have a more independent life, learning process, or socialisation by increasing their speed or convenience when doing things. Jonassen et al. (2008), hold similar views that assistive technology is essential in learning because the series of systems, programmes, or tools involved are customised to improve and increase the ability of learners who need special education.

Furthermore, there are several forms of assistive technologies for students with visual disabilities. Some of these technologies include; electronic video magnification, talking dictionaries, mobile note-taking devices, and audio recorders. Also, other categories of assistive technology comprise Scanned Material Access, Braille Output, Braille Access, Large Print Access, and others (Hasselbring& Glaser, 2012). Michaels & McDermott (2003) observed that assistive technology supports visually disabled learners by equalizing them with visually challenges to regular students. Mainly, Braille provides visually challenged students with the ability to produce and present written communication to their teachers, parents, or other students. Also, it offers visually disabled students with a variety of alternatives for excessing electronic and print texts.

Students, however, have to learn the usage of assistive technology first so that they can accomplish learning tasks such as writing, reading or completing assignments. It allows them to participate in the general curriculum independently and with much ease. It shows that computers which are adapted with software systems such as magnifiers, NVDA, or Jaws are ideal for usage by the visually challenged learners. It has also been noted that such computers allow students to engage in a variety of tasks, thereby improving their cognitive and creative thinking abilities. According Jackson (2009), globalization, integration, and inclusion in the

education for visually disabled learners at all levels allow them to get a variety of information which are necessary for boosting their educational performance.

Academic performance for students who are visually impaired encompasses the general idea of education that comprises KCSE performance, autonomy and individual. As such, the primary objective of special education, especially assistive technology, is to bridge the rift between disability and ability in learning. The impact of assistive technology in education can be gauged using KCSE performance and the ability of the learners to search for information by themselves. As such, assistive technology allows learners with visual challenges to perform pretty well like their sighted counterparts in regular school (D'andrea & Presley, 2009). Learners can perform all educational activities and tasks using screen readers, JAWS, digital voice recorders, screen magnification system, talking calculator, Non-Visual Desktop Access (NVDA), speaking dictionary, and window eyes.

Computers that are fitted with the right assistive technology are more accommodative to students who are visually challenged. Students can use it to read or write and produce answers on worksheets or create reports which can enable them to complete assignments and socializing. They can use social media, online libraries, and other digital platforms to get information which is relevant to their growth in personal and academic dimensions. Screen enlargement systems; for example, gives learners who have low vision problems to view and read texts on the computer screen. Likewise, screen reading software can help students who are blind to read text on the computer monitors by listening to it as the software reads it aloud. As such, students can explore a variety of subjects because the system allows them to do so. Additionally, computers and other access technologies are vital in the educational and personal lives of students with sight problems. They can access or read written texts through audio output gadgets or magnification software systems (Tomei, 2003). Visually challenged students can engage in communication and learning independently without having to rely on their teachers, parents, and other students to help them get the information they want (D'Andrea and Presley 2009). Giving visually impaired students a person computer is a

critical step towards making them grows more independent in their lives since they can write, review, edit, proofread, send or receive messages. It will also give them a sense of autonomy because it will act as their PDA (Personal Digital Assistant); thereby making them attend all their duties, lessons, and other functions effectively. Computers also serve as a backup for students' memory because it can store and produce the works required on time. Facilities such as Braille input keyboard, refreshable Braille, notes, calendar, and other files.

According to World Health Organization (WHO), approximately 180 million of the world population have some sort of visual disabilities. People with low vision and the blind use assistive technology to get information which they require in their lives. In the US, visually impaired learners are given greater attention due to the impact of Individuals with the Disability Education Act (IDEA, 1997), the American Public Law (1975). As a result, disabled students are catered for in all types and levels of education in the country through inclusion in the curriculum through proper teaching and assessment that meets the needs of each learner (Taylor, 2000). However, technology is not only used in education for students with disabilities. It goes even beyond the classroom to include socio-economic and extra-curricular activities. Such would help them to meet the demands in the society, job market, and other avenues which require visually disabled students to have abilities that enable them to become responsible members of the society after their school life. According to Tomei (2003), through assistive technology visually disabled students can access augmented communication gadgets which enable such individuals to by-pass the barriers that limit them.

Sensory Solutions Limited (2008), produced a book that outlines strategies which can be used to help visually disabled persons to use assistive technology in South Africa. It explores the rampant usage of Braille in note taking and note making in classrooms to help students during their studies. Likewise, students are provided with magnification gadgets, Scan and Read facilities, and screen reading software. The South African National Council for the Blind (2010), shows that in 2003 about 9 schools for the blind were supplied with assistive technology gadgets thereby increasing the number of schools using such

technologies to 30 with 10000 as total populations. It was an indication that about ten thousand students with visual challenges in South Africa were using assistive technology in schools to learn independently.

In Kenya, visually challenged students comprise 1% of the 45 million people in the national population, which amounts to about 450000 (Web Aim, 2005). Such statistics show that there are a significant number of visually disabled students in Kenya, thereby creating a need for developing policies and technologies that can help such people in their education and work. The Centre for Adaptive Technology, worked together with the Kenya Society for the Blind in 1999 to teach computer skills to people who had visual problems such as blindness or low vision. The first phase of learners was given individualised teaching to enable them to access digital information in their studies or work. About 36 students enrolled on a course that comprised; orientation in computer hardware, embossers, JAWS screen reader, Braille Display (Kenya Society for the blind, 2012). Unfortunately, that was the last time for such kind of training to be organized in Kenya to help students in both primary and secondary schools. It has created inequality in education since such technology is not available in all elementary and secondary schools as a primary subject. Worse still, teachers are computer illiterate, and there are few computers and laboratories in schools. As such, there are insufficient facilities that can provide assistive technology in Kenyan schools.

According to Wachiuri (2015), 21% of the visually impaired students go to school while about 71% of the rest do not have access to educational opportunities. Also, there about 15,500 children who have attained school going age, 1527 attends special schools, about 1637 go to regular schools, while 12336 do not attend school. Wachiuri adds that, schools in Kenya have limited assistive technology that can be used by such students. This case incidence indicates that only 21% (3164) of the visually impaired students are in schools and 79% (12336) learners are out of school.

Development of special education in Kenya has been faced by several challenges because of inaccessibility of academic content. Regardless of existence of institutions

offering special education for the visually impaired students, most of such schools have underdeveloped assistive technology facilities (Chikati, Wachira, & Mwizi, 2019). According to Walker, Mbaari-Kirika, & Miheso-O'Connor (2016), academic performance in the major secondary schools for the blind, such as, St. Lucy, Kibos High School, and Thika School for the Blind, and others have lower academic performance as compared with regular schools. However, Thika School for the Blind has the lowest academic performance among the four schools mentioned above (*See in Table 1).* Cephas, Andrew, & Njambi (2018), noted that inadequate access to information and academic content due to lack of assistive technology.

Table 1.1: KCSE Mean Grade for Four Schools for The Blind Since 2015

Year	Thika School	Kibos School	St Oda School	St. Lucy School
2019	D- (2.3)	D+ (4.1)	D+ (4.5)	D+ (4.2)
2018	C- (5.14)	C (6.2)	B (8.5)	D+ (.4.8)
2017	C- (5.43)	C (6.0)	D+ (4.7)	C+ (7.4)
2016	D (3.32)	C- (5.04)	C (6.2)	D-(2.8)
2015	C (6.2)	C+ (7.2)	C+ (7.0)	B- (8.3)
Mean	D+ (4.48)	C- (5.705)	C (6.18)	C- (5.5)

Source: KNEC Exam Portal, 2020

From the table, Thika School has the lowest mean while St Oda School has the highest mean.

1.2 Problem Statement

Poor KCSE performance by students with visual disability at Thika High School for the blind revealed by the Kenya National Examination council year, is a critical concern to the curriculum planners, tutors, parents, and to the general public (Njoroge, 2011). Thika High School for the Blind had the lower KCSE mean grade than other schools for the visually impaired (Republic of Kenya, 2015; 2014). The Kenya Institute of Special Education recommends use of assistive technology like Braille Note Taker, dolphin pen and JAWS for windows (Ministry of Education, 2012). However, they are overly expensive thus not easily

available in most of the Kenyan schools. It shows that there is a serious problem in the teaching-learning among visual impaired learners because of the unavailability and inadequacy of assistive technology. The Kenya Institute of Special Education has promoted accessibility of assistive technology tools in some schools. Nevertheless, these assistive technology tools have not been utilized effectively to improve teaching and learning of visually impaired learners (Sight savers report, 2015). Mungai & Gender (2011), pointed out that there is poor KCSE performance among visually challenge students at Thika High School for the blind due to unavailability or inadequacy of assistive technology.

Students perform poorly because they cannot access the right educational materials or interact with the curriculum independently. There is also a need to train teachers and students on the current assistive technology, since instructors and learners are still using outdated technology. Thus, there is a need to identify the relative advantage of modern assistive technology tools with those that are being used currently. Lastly, there is a deficit in educational ICT expertise among the teachers, making it challenging to provide visually disabled learners with the digitalized curriculum. Therefore, this research sought to determine the Influence of assistive technology on the KCSE performance among students with visual impairment at Thika High School for the Blind.

1.4 Research Objectives

The study sought to accomplish the following objectives:

1. Examine availability of assistive technology and how it influences KCSE performance among students with visual impairment at Thika High School for the Blind.
2. Examine criteria used to select assistive technology tools and how it influence KCSE performance among students with visual impairment at Thika High School for the Blind.

3. Establish challenges faced by students and teachers while using assistive technology and how it influence KCSE performance among students with visual disabilities at Thika High School for the Blind.
4. Examine factors influencing use of assistive technology among students with visual impairment at Thika High School for the Blind.

1.5 Research Questions

The study was guided by the following research questions:

1. How does availability of assistive technology influence KCSE performance among students with visual impairment at Thika High School for the Blind?
2. How does criteria used to select assistive technology tools influence KCSE performance among students with visual impairment at Thika High School for the Blind?
3. What are the challenges faced by teachers and visually impaired students while using assistive technology at Thika High School for the Blind?
4. What are the factors influencing the use of assistive technology among visually impaired students at Thika High School for the Blind?

1.6 Significance of the Study

The findings of the study would benefit several stakeholders in education. Firstly, it could help the Ministry of Education Science and Technology to develop strategies and policies that will transform the special needs education curriculum in Kenya. Secondly, this study could be useful to teachers of visually challenged students because it will outline and stress the advantages of integrating assistive technology in teaching-learning activities. Thirdly, the study is essential to students because it will inform and describe the usefulness and the influence of assistive technology in improving KCSE performance. Fourthly, it is crucial to parents since it will tell them how assistive technology can help their children to perform better regardless of the visual limitations. The results of study will assist MOE to create programmes and initiatives for assist visual impaired students in improving their

KCSE performance by use of assistive technology. Lastly, the research will develop a basis for future research in assistive technology in developing countries like Kenya.

1.7 Limitations of the Study

Since the researcher is visually impaired, he required a sighted guide who was not readily available. In addition, the research scope was too wide and could not be adequately covered within the stipulated time because it did not focus on KCSE performance in a single subject but all the subjects and the ability to access content independently. The problem of unavailability of the sighted guide was solved by collecting data online. Also, the researcher carefully selected the Respondents to ensure that only the committed ones participated in the exercise. Lastly, online data collection helped in making sure that data in various aspects of topic was gathered. It was also the most appropriate method of data collection for research during the Covid-19 pandemic.

1.8 Delimitations of the Study

The study delimited itself to the influence of assistive technology on KCSE performance of visually impaired students at Thika High School for the Blind. Consequently, all the other forms of disabilities among the learners that affect their education were left out. Finally, the study was conducted at Thika High School for the Blind. Thus, it excluded other schools for visually challenged learners within the geographical area of study or country.

1.9 Basic Assumptions of the Study

This research was based on the following assumption; that student and teacher respondents were acquainted with assistive technology. In other words, the researcher assumed that the respondents; principal, instructors and learners knew what assistive technology is. Therefore, they were expected to know the application and importance of assistive technology in teaching-learning activities.

1.10 Definition of Significant Terms

Assistive Technology: Refers to any form of ICT tools that can be used to help visually disabled students to access curriculum and learn like sighted students.

Braille: Refers to a type of language or writing meant for blind people. It is combination of raised dots, patterns, and lines which can be felt through touch.

Braille Translation Software: Refers to a tool that can translate normal text into Braille or from Braille.

Cognitive Learning: Refers to the type of learning where student uses their memory to cram, internalize, recall, or understands concepts.

Dolphin Pen: Refers to a pen that can talk.

iPad: Refers to a high intelligent tablet made by Apple company and it operates on iOS system.

JAWS: refers to Job Access with Speech which is a screen reader for helping people with low vision or blind to read and write through Braille or text-to-speech tools.

Large Print Access: Refers to a text which are presented in large fonts to be seen by people with low vision.

Megados: Refers to a Braille translation and production tool.

Scanned Material: Refers to printed materials which have been converted into electronic format.

Speech Access: Refers to a tool that changes texts into audio/speech.

Speech Processor: Refers to a gadget that changes sound into vibrations and impulses for people with hearing problem.

Sighted guide: Refers to an assistant who can see and his work is to help visually impaired individuals while traveling

Talking Books: Refers to audio books which a visually challenged student can read through listening to the narrator.

Window Eyes: Refers to a form of screen reader that operates on Windows.

Blind: Cannot see at all.

Totally blind: Blind but has another disability such as hearing impairment.

1.11 Organisation of the study

The research is organised into five chapters. Chapter one comprised of introduction, background of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations of the study, delimitations of the study, assumptions, and definition of terms. The second chapter, literature review, includes introduction, academic performance, and the concept of assistive technology, empirical overview of four research objectives, summary of the literature review, theoretical framework, and conceptual framework. The third chapter, research methodology, covers introduction, research design, target population, sample size and sampling procedures, research instruments, validity of research instruments, reliability of research instruments, data collection procedures, data analysis techniques, and ethical considerations. Chapter four, research findings, covers data presentation, interpretation and discussion of the findings. Lastly, the fifth chapter, conclusion and recommendations, covers summary of the study, recommendations, conclusion and recommendations for further study.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews existing literature on assistive technology in teaching and learning among learners with visual impairment. The chapter discusses academic performance, the concept of assistive technology, assistive technology used in Thika School for the Blind, selection criteria for assistive technology, challenges faced by visually impaired students and teachers, influence of assistive technology on KCSE performance, summary of the literature review, theoretical framework, and conceptual framework.

2.2 Assistive Technology and Academic Performance among Visually Impaired Students

In this study, the KCSE performance for students with visual challenges is the major dependent variable because it usually depends on other factors such as the study behavior, availability of study materials, and the existence of appropriate assistive technology infrastructure. Other dependent variables include the ability to study independently, gaining self-confidence, and socialization. Frankel & Wallen (2009), defines a dependent variable as the variable which is determined or affected by independent variables. In this study, the dependent variable comprised of educational performance, collaboration and social networking, proper exploration of curriculum, independent access to information, confidence, for students with visual impairments. In Kenyan secondary schools, the KCSE performance of visually challenged students relies on their ability to study independently, access the right curriculum content, write, and read like their sighted counterparts (Oranga et al. 2013). As such, effective usage of assistive technology can positively manipulate or improve the academic performance of students in schools for visually blind in Kenya.

2.3 An overview of Assistive Technology and Student Performance among Visually Impaired Students

Koh and Lee (2008), noted that Singapore acknowledges the significance of ICT in the country's economic development growth since the 1970s. As such, it developed a standard type of technology that would be used by all learners from elementary to tertiary level. Investment in educational technology has been a significant priority in Singapore for a long time. Students are equipped with essential skills, knowledge, and study habits that enable them to embrace long-life learning. However, the above literature shows how the nation invested heavily in educational ICT since 1997. Still, it does very little in explaining how assistive technology has been utilized to boost academic performance for visually impaired learners.

The four major categories of assistive technology include braille access, large print access, scanned material access and speech access. Firstly, the large print access comprises of software system meant to enhance magnification functions such as zooming texts, images, CCTV, graphics or magnification scanning systems. Secondly, the speech access category consists of text-to-speech processors such as SAnote. South Africa National Council for the Blind, suggests more speech access technologies which include talking word programme that can respond to students' audio instructions or queries (South Africa National Council for the Blind (2015). Write out loud is system that enables the learners to set the fonts and background colors that assists them to write. Thirdly, the speech synthesizers comprise software and hardware versions that can be either external or internal serialized devices that facilitate speech guidance technique for visually challenged students. Screen reader software consists of the window eyes and the JAWs customized with voice access for windows is also used to assist students. Lastly, Braille access is a translation software that can enable students to used Braille to read or write. Its standard version is the Braille 2000, which is a tool used for editing and that can handle any direct access or completion of Braille tasks. Likewise, Duxbury is a translation and editing software that makes it easy to use because of its

compatibility with braille and speech output. Also, Megados is an intuitive and flexible MS-DOS word processor that has a magic software that can help only the intricacies of printers and braille. Braille embosser is another braille access technology which facilitates Braille printing. It is easily compatible with computer that has Braille version software. Nevertheless, limited literature or research is showing the kind of assistive technology that is or can be used in Kenyan secondary schools. Therefore, this study sought to examine assistive technologies used at Thika School for the Blind.

According to Kieti (2008), some foundations in Kenya usually donate assistive technologies such as Non-visual desktop access, JAWs, embossers, and Dolphin pen to schools for visually challenged students. Kieti added that those are some of the common types of assistive technologies found in some schools for visually impaired students but not all of them. As such students, students have a limited choice because they depend on the slate and stylus, universal Braille kit, or Braille machine that are used by learners at diverse levels of education. They are used in primary school, secondary school, colleges and universities as the essential operation assistive technology for reading and writing. However, these technologies are analogue and less effective as compared to the more progressive assistive technologies that have a higher potential in improving the academic performance and life of visually challenged students.

Mugo (2013), carried out a comparative study between Syracuse University and Kenyan universities such as the University of Nairobi and Kenyatta university regarding the assistive technology available for student usage in each university. The level of technology usage was used to reflect the level of assistive technology usage in Kenyan schools. Mugo noted that visually impaired learners struggled with Braille machines while studying since it was their primary tool for writing and reading. Students have little exposure or no exposure to computers; therefore, they are unwilling or unable to operate or interact with computers while learning efficiently. As such, they require a sighted teacher to guide and orient them individually before assigning them tasks on computers.

Students and teachers in Kenya fear assistive technology since they are computer illiterate and lack the necessary technological skills because they do not have adequate exposure. However, with sufficient interaction and orientation, they can gain technical skills essential in the application of assistive technology, especially when accessing information and knowledge conveniently (Oranga et al 2013). The above literature has shown that assistive technology is essential in improving KCSE performance of visually challenged learners. Unfortunately, no study suggests the best assistive technology suitable for visually disabled students in Kenya. For that reason, this study seeks to provide a comprehensive and conclusive report about the most appropriate access technology for learners with sight impairment in Kenyan high schools.

Individuals with Disabilities Education Act (IDEA, 2004), alongside No Child Left Behind Act (NCLB, 2001) recommends that school and educational organisations need ensure there is equitable access technology devices for all students. Also, they should ensure that instructions are documented according to personalized educational programmes. In Kenya, the National government collaborates with the Ministry of Education, County and sub-county education quality and standards officers, assessment centres, and schools should be encouraged to participate in the planning process. It would ensure that learner with visual challenges access the most appropriate assistive technology relevant for their studies and quality teaching. It can be used during the teaching of students with low vision and blindness problems to specify the right access technology required. It is an essential component in the curriculum for visually impaired students because it ensures that the access technologies are customized to suit the needs of each individual through careful analytical and regular evaluations.

Kavagi (2010) argues that the major factors that determine and justify computer usage among the visually challenged students in Kenya are based on the following;

(i) The Vocational Drive- the need to prepare students with visual disabilities for career as per the industry requirements.

(ii) The Pedagogical Drive- primary purpose is to use computers in teaching to improve teacher and student output using effective content creation and delivery methods.

(iii) The Social Drive-it is based on the need to promote computer literacy and digital learning since due to societal migration from analogue to the digital world.

(iv) The Catalytic Drive- the main purpose is to cultivate independence in learning through innovation and creativity among the students with any form of blindness.

2.4 Empirical Review of Assistive Technology used in Thika School for the Blind

It is the first objective of the study which focuses on examining availability of assistive technology at Thika High School for the blind. It is essential in the study because it will provide information regarding the available supportive resources for visually disabled students in the school (Wachiuri, 2015). As such, it makes it easy to identify the number and quality of technology used and find out if they are effective depending on the number and nature of students' visual impairment.

Studies show that visually impaired students in Kenya rely mostly in braille to write and read because they are commonly available and easy to use as compared to other forms of assistive technologies. As such, students use braille papers, braille textbooks, braille geometrical set, and braille machines (Chikati, Wachira, & Mwinzi, 2019). The second mostly used forms of assistive technologies comprise of large print books, magnifiers, speech synthersisers, and slate & stylus. Likewise, these devices and tools were commonly used in Thika School for the Blind because they were easily available. However, computers, braille translation software, iPads, JAWS, iPads and audio books were least used because of their in availability (Mungai & Gender, 2011). The usage of assistive technology in Thika also matched that of St. Lucy and Kibos because braille was the primary writing and writing tool used by almost all students (Cephas,Andrew, & Njambi, 2018). Generally, usage of assistive

technology devices and tools such as computers, JAWS, window eyes, and others in school for visually impaired students is still demanding.

2.5 Empirical Review of Criteria used to Select Assistive Technology

Second research objective critically examines the selection criteria used by Thika school and teachers to determine the right kind of assistive technology for specific students depending on their learning needs according to the level of visual impairment. Selection criteria is affected mostly by availability of the right technology, infrastructure, financial support, and expertise required (Mugo, 2013). Students in a school have personal differences which affects their ability to learn (Oronga et al. 2013). Likewise, in schools for visually challenged students, learners have different levels of blindness and disabilities. There are students with low vision while others are totally blind. In addition to visual disorders others can have hearing impairment which can reduce their ability to use audio gadgets. As such, this objective attempt to find out how the school selects appropriate assistive technology for each kind of visually impaired students. According to Alpher & Raharinirina (2006), most teachers depend on the nature of students' disability when choosing the suitable assistive technology. It is believed that the nature of disability is the core criteria that should determine the effectiveness in the implementation and usage of various types of assistive technologies.

However, over-reliance on the nature of disability as the main factor influencing the choice of the suitable assistive technology is still ineffective because there are several other factors such as student's interests, availability of the assistive technology, and the lesson objectives (Wachiuri, 2015). Cox & Dykes (2001) suggested that all relevant factors such as personal differences among the students, availability of the assistive technology required, and the desired learning outcomes should not be ignored when choosing the right assistive technology to improve independent learning and KCSE performance. Likewise, during the implementation of assistive technology in schools for the visually impaired various characteristics and learning behavior of visually impaired students should be considered (Abner, & Lahm, 2002). Abner & Lahm adds that teachers should be equipped with the

relevant knowledge through development and training programs to understand the needs of each visually impaired students. This is a suitable suggestion because selection criteria used in Thika School for Visually impaired does not satisfy all the needs suggested in the literature reviewed above.

2.6 Review of Challenges Experienced by Visually Impaired Students and Teachers

Sight impaired students and their teachers usually experience challenges when using assistive technology in the teaching and learning activities. Lack or inadequacy of appropriate assistive technology, inability to access educational materials, and lack needed skills to use the available assistive technology are the problems which teachers and students encounter (Mungai, & Gender, 2011). The third objective focuses on identifying such obstacles in Thika School for the visually challenged. This section of the literature discusses the difficulties experienced by visually impaired students and their teachers when using assistive technology. Such challenges are examined in terms of accessibility, location and number of computers, maintenance, shelving and cataloguing software systems, teacher preparedness, servicing and maintenance, the goals and objectives addressed by teachers.

According to Mugo (2013), several teachers in Kenya are not computer literate because they lack basic skills which hinder full application of appropriate assistive technology in the improvement of KCSE performance of learners with sight impairment. Such a challenge can be avoided through the provision of technological skill training, or orientation and mobility. Proper teacher training in Braille and other assistive technologies is crucial for excellent educational content delivery. It shows that both teachers and sight impaired students usually experience challenges which hinder them from accessing essential technology necessary for curricula delivery.

Kavagi (2010), noted that many schools in Kenya possess few computer laboratories, thereby making accessibility difficult for regular class routines. Therefore, students and teachers cannot fully utilise such computers during lessons. It would be impossible because all students cannot access the computer-based resources. According to the study, it was

evident that several students go to computer laboratory two times per week for their classes. Unfortunately, two lessons are not enough to provide students with quality learning. South Carolina Assistive Technology Program (2015), suggested that speaking software could be used to help student listen and hear words while at the same time seeing them on the monitor or the page where word process system has been used.

Similarly, word prediction and processing can aid students who have limited vocabulary or those who are unable to use the keyboard fully due to disability to write well. Besides, teachers usually benefit from appropriate usage of assistive technology because it offers them options to address and practices a variety of learning approaches for students with different needs. It indicates that the needs of both tutors and students concerning the use of access technology should be balanced by ensuring that the equipment provided and priorities facilitate compelling teaching-learning needs and delivery. Koh& Lee (2008), argue that the quality teaching-learning for any subject should be facilitated through the creation of a constructive environment that allows students' engagement and teachers' delivery mode. Therefore, the study critically addressed how contemporary assistive technology can be applied to allow learners who are visually impaired to study more independently successfully.

Kavagi (2010), noted that appropriate care and maintenance of software and equipment system in ICT is imperative. Provision of the right care and maintenance services requires hiring services or recruiting some well-trained personnel to ensure that repairs and cleaning of computers are done correctly and on time for computers to be operational and effective. In this context, the gap be filled by training teachers so that they can clean, service, or provide maintenance of the assistive technology devices available. At the moment, students and teachers using the access technology only know how to use them, but they do not understand how to service or repair them when necessary. Maintenance and servicing are basic practices meant for the sustainability of assistive technologies. Computer facilities intended for visually impaired students are supposed to be well maintained and serviced for the efficient functioning of speech access, large print, or tactile functions.

American Foundation for the Blind (AFB, 2015), suggested that successful learning of individual students requires each of them to have a personal laptop, desktop, or any other device. Students have different levels or types of impairments. Thus, each of them uses different senses to gather info from the materials around or the environment. As such, some require magnification software, tactile, and audio output. Consequently, this is a good reason for students to own computers individually. Each machine can be programmed or customised according to the nature of the disability or the needs of the hold. This strategy would facilitate active and independent learning for each student.

2.7Review of Influence of Assistive Technology on KCSE Performance of Visually Impaired Students

The fourth objective attempts to determine factors influencing the use of assistive technology in the KCSE performance of visually challenged students in Thika School. Assistive technology application in education is meant to improve the performance of the visually disabled students so that they can match the success of their sighted counterparts. It is an enabler for visually challenged learners to access the curriculum, read, and write independently (Oronga et al. 2013). Likewise, appropriate usage of assistive technologies boost academic performance among visually students through improved teaching and learning (Sight Savers Report, 2015). Students are able to use favourite assistive technology tools to access content and learn on their own even without or without the intervention of sighted guides. For instance, magnification software, audio input and output gadgets, screen readers allow students to access written texts (Tomei, 2003). Access to the content gives them more time and freedom to do interact with the curriculum through reading, writing, doing assignments, and revising for exams. These activities have positive implications on academic performance which can be translated into improved results in KCSE.

According to Edyburn (2006), assistive technology is a significant tool that helps disabled students to overcome their limitations, learn, and perform just like their regular counterparts. Elimination of visual disabilities through application of assistive technology can significantly

elevate visually impaired students by putting them on the same level with the sighted students in the teaching learning activities or process (Jackson, 2009). A study conducted by Kiperman, Sticken, & Heinze (2002) demonstrates that effective implementation and application of assistive technology among visually impaired students in Illinois improved their independence in learning and their academic performance.

World Health Organization (WHO) observed that provision of hi-tech devices such as computers, hearing aids, specialized software, and other innovative technologies give students a chance not only to be included in the learning but to participate in it like regular students (Ahmed, 2015). Assistive technology is vital in the education of the visually impaired students since it gives them ability and opportunity to contribute in the teaching-learning process. This demonstrates that, increased participation of visually impaired students in the learning process can increase their ability to interact with the curriculum content, revise, and pass their exams.

2.8 Summary of Literature Review

The reviewed literature has identified some benefits and applications of assistive technology, generally in education. It has also pointed out how educational technology can fix the gap in the quality of learning for various students. The literature explored was inclined to the usage of assistive technology on students with various kinds of disabilities. As such, it could not bring out a comprehensive report about how such techniques are used in developing countries like Kenya. The previous studies do not explore the contribution of assistive technology on improving academic performance, socialisation, confidence, and independent learning among the visually impaired students.

The little study that has been carried out in Kenyan secondary schools and universities shows that learner with visual challenges still uses the old and ineffective kind of technology. The old technology is inefficient because it is slow, too analogue, bulky, time-consuming, and disturbing because unpleasant sounds are prevalent. In other words, this type of assistive technology can only be used by students or teachers who are sighted to guide the rest. For

example, the sighted student has to read as the other one listens. Therefore, there is a necessity to study how assistive technology is used in Thika school for the Blind, the method used to select the ICT resources and gadgets used, challenges encountered, and the overall influence of assistive technology on KCSE performance of visually disabled learners.

Vik (2008) in Norway, Kelly (2008) and Kiperman, Sticker and Heinze (2002) in USA, Specht, Howell and Young, 2007 in Canada, are some of the studies on the usage of assistive technology in education conducted in the developed economy countries. Nevertheless, literature on assistive technology in developing economy countries is inadequate. Countries such as Kenya experience critical problems such as unavailability of appropriate assistive technology devices. Also in the few schools with such assistive technology, their full utilisation to boost KCSE performance is another big problem mainly in secondary schools for the blind. Studies such as Jwaifell and Gasaymeh (2013) in Jordan, Askar, Usluel and Mumcu (2006), Kelly (2008), Kiperman, Sticker and Heinze (2002), Specht, Howell and Young, 2007, Vik (2008) and Hussin (2013) have not acknowledged the influence of assistive technology in academic performance. This research focuses on addressing the knowledge gaps by defining the influence of assistive technology on KCSE performance of visually impaired learner at Thika High School for the Blind.

2.9 Theoretical Framework

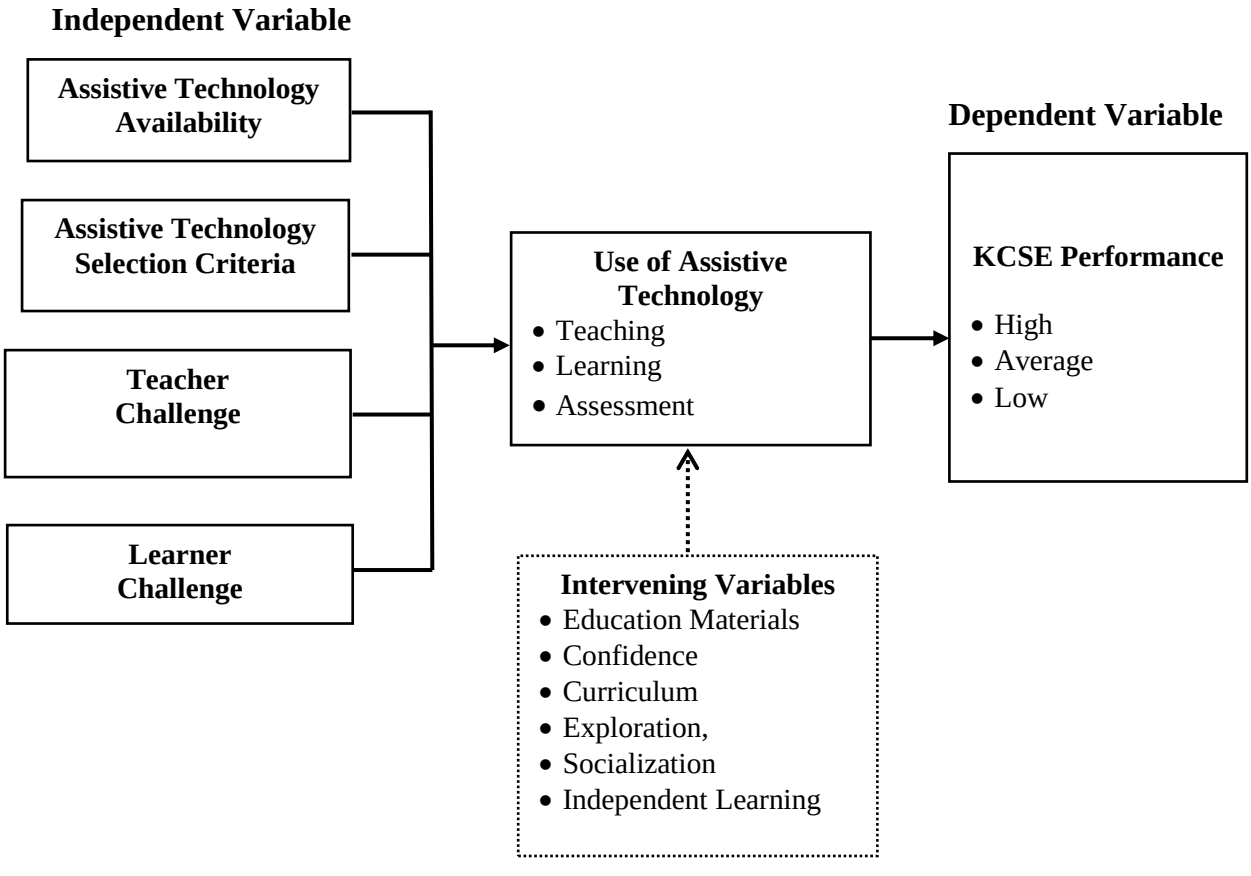
This research is anchored on the foundations of the constructivist theory, which was proposed in 1933 and revised in 1998 all by John Dewey. Later, in 1972, Jean Piaget introduced the concept of cognitive learning in Dewey's theory, and it was advanced to cognitive constructivism. John Dewey posit that education be effective only when children have learning opportunities that make them to link new knowledge to pre-existing experiences and knowledge calling for learners to participate in real-world learning based on practical activities that would develop their creativity, knowledge and collaboration. He advocated for 'direct living' learning, whereby students are given opportunities to construct meanings for themselves and articulate their thoughts. As such, Dewey stressed that

education should be founded on real experience derived from everyday life. People should, therefore, learn through research, proper inquiry, ponder, and then consider the possibilities for each alternative then develop their knowledge or concepts based on the evidence to solve their doubts. For learning to be effective among the visually impaired students, they should be provided with appropriate assistive technology for them to use and experience learning.

Notably, this study was based on constructivism theory because it explains how visually disabled learners, experience learning using assistive technology which helps them to infer from the pre-existing knowledge by reconciling it with the previous learning experiences. Likewise, the establishment of assistive technology can make learning more meaningful and interactive for visually challenged students, especially when they can quickly and conveniently access electronic information. It can be facilitated through the usage of ICT tools such as Accessible PDAs, Screen Magnification, Refreshable Braille Displays, Screen Reading Software, and Optical Character Recognition (OCR) (Presley & D' Andrea, 2009).

2.10 Conceptual Framework

Conceptual framework regarding the influence of assistive technology on KCSE performance of learners with visual impairments indicates how the independent variables, intervening variable and dependent variable correlate in the study.



CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methods which were used in conducting data collection and analysis of the study. The chapter explores elements of research methodology such as target population, study locale, sample size, design and sampling procedures to be used in the proposed research. It will also focus on the research instruments used in this study, describing how each will be used, and the reliability and rationality of each element. Lastly, this chapter will concentrate on the description of collection of data processes, data analysis methods, and ethical considerations

3.2 Research Design

The study used case study design. McBurney & White (2007), noted that a case study involves archival and observation methods. Likewise, Stakes (2008), suggested that case studies involve an investigation of a single phenomenon or case. Stakes also suggested that case study methods are most effective when analysing or examining an event that occurs in real life situations. Also, a case study is effective in situations which require the investigator to conduct a comprehensive investigation of a limited system which can include an event, activity, individual, or process depending on the extensive data collection (Creswell, 2008). Creswell added that the choice of this research design is motivated by its unique features and the ability to provide accurate and valid response.

In this research, case studies design was used to gather data. State also added that a case study allows the investigator to get a full understanding of the theme, issue, or entity of concern. Thus, case study was the most suitable research design for the study since it allows the researcher to have full view of the theme.

3.3 Target Population

Kombo and Tromp (2006) defines target population as major or general group from which a sample is extracted. This study target population was 133 students. They all had different levels of visual disabilities. The recruitment criteria also considered the performance

of such students in KCPE. In this study target population, male students were 73 while females were 60, and 10 teachers.

Table 2.1: Study Population

School Population

Class	Streams	Male	Female	Total
Form I	1	31	27	58
Form 2	1	12	08	20
Form 3	1	11	09	20
Form 4	1	19	16	35
Total	4	73	60	133

This study target population comprised of 133 learners. The school teachers were ten.

3.4 Sample Size and Sampling Procedures

Sample size is the quantity or number of units, objects, subjects, items, objects comprising a quantifiable section of the target group to be used for the study (Mugenda & Mugenda, 2003). It outlines the specific parameters of the population which were used to represent the whole. It is essential when making estimates or inferences from the larger population that are more accurate. This study sample size was forty students, ten instructors, one librarian, and transcriber. The sample consisted of twenty-three males (n=23) and seventeen females (n=17) from form three and two. This sample was more manageable during the study. In addition, it conformed to the individual needs requirements because all students were visually impaired. Table 3.2 demonstrates the sampling structure and respondents' distribution.

Table 3.1: Sampling Frame

Respondents	Target Population (N)	Sample Size	Sample (%)
Students	133	40	30
Teachers	10	10	100
Total	143	50	

The study employed purposive sampling technique, and the sample comprised of all students in form three and two. Mugenda and Mugenda (2003), defines purposeful sampling as a non-probability strategy of sampling which requires the investigator to select individuals, subjects, objects, or other units of a population dependent on the nature of data needed for the study. Therefore, the researcher purposely picked groups or subjects that contained the desired characteristics. In this case, the sample characteristics was visual impairment among students. This technique allowed the researcher to generalise the findings that were obtained from similar educational institutions or other similar learners.

Purposive sampling strategy was appropriate in this research because it allowed the researcher to pick a small group from a population with same features to represent and describe the entire visually impaired students in a particular environment. Wallen & Fraenkel (2012), and Kombo & Tromp (2006) suggests that ideal sample size should be at least 10 percent of the target population. The researcher used purposive sampling because of its ability to allow for an in-depth examination of fundamental issues in access technology among the visually disabled students. Likewise, the participation of all form two and three students was crucial for the study because they were few, and they had the target population characteristics required in the study.

3.5 Research Instruments

Online questionnaires for 10 teachers and 40 sampled students was developed systematically, strategically, and thematically to allow direct collection of various sets of data

from respondents' interviewee responses. Questionnaires were suitable for this study because they enabled the researcher to collect a wide range of data about the different kinds of variables targeted in the study (Knapp & Mueller, 2010). As such, it was possible to gather information about the access technology and its influence on the KCSE performance of learners who are visually challenged. Mugenda & Mugenda (2003), noted that methodically organized questions in questionnaires facilitates systematic data collection thereby hindering ambiguity or confusion.

Additionally, the researcher designed a checklist for the study that comprised of the assistive technologies available in the school that allow visually challenged students to learn independently. The researcher used the checklist to involve teachers and students in listing the assistive technology tools and devices available in school for teaching and learning process. Frels et al. (2011) suggest that checklists are essential instruments in research because they serve as a rubric used in collection of data regarding an item or variable in the study.

3.5.1Validity of Research instruments

According to Mugenda & Mugenda (2003), validity of instruments measures are expected to authenticate and correct ambiguities within the data collected. Validation of data is carried out before the actual data is collected, especially during the piloting stage. Cooper & Schindler (2008,) argues that validity is an accuracy test or instruments used in research according to results. Also, Cooper & Schindler (2004) suggests that questionnaires help researchers to gather vast amounts of data through a short time. This is the primary reason why the researcher selected questionnaires as research instruments in this study. Using questionnaires, it is possible to collect a variety of data sets during the study thereby ensuring there is a comprehensive data collection (Knapp & Mueller, 2010). Observation checklist was used in this research because it enabled the researcher to establish the number and efficacy of the assistive technology present at Thika High School for the Blind.

3.5.2Reliability of Research Instrument

According to Cooper and Schindler (2008,) reliability is the measure of extent at which a research instrument provides consistent results. Questionnaires were emailed to St. Lucy's High School for the visually disable, and the students' feedback was collected. Using test re-test approach, similar questionnaires were e-mailed back to the same respondents within 14 days to measure for reliability. Pearson Product-Moment Correlation Coefficient is suitable for testing reliability of the instruments to measure the association between variables used in the study instruments (Scholar, Boer, & Schwarte, 2018). Product moment correlation coefficient or *R*-value was computed using the following formula;

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

The instruments had a higher level of internal consistency because reliability coefficient of 0.7 was established. The reliability coefficient plays a significant role in determining the reliability of scales used in the designing data collection instruments and how effective such instruments can distinguish individual respondents. According to Nunnally, 0.7 is the lowest acceptable reliability coefficient required in basic studies in the 21st century but anything above 0.8 is adequate. In 1990s, research experts such as Cicchetti suggested that 0.4 to 0.59 is fair, 0.6 to 0.74 is good, and 0.75 and above as excellent (Matheson, 2019). As such, the reliability coefficient established in this study falls within the acceptable threshold of reliability.

3.6 Data Collection Procedures

Firstly, the researcher cleared with the Department of Educational Administration and Planning. He was then given a research license from National Commission for Science, Technology and Innovation (NACOSTI) before proceeding to collect data. After getting authorisation letter, the researcher went ahead and sought permission from the administration of the school. Next, arrangements was made regarding the date and time for conducting the

actual research. During the real study, the researcher administered online questionnaires to students, and other respondents in which they were expected to email them back within a week. During the same week, the researcher collected data through online interviews. To initiate teamwork and collaboration from the respondents, the researcher e-mailed a letter of introduction to each respondent specifying the intent of the research.

3. 7 Data Analysis Techniques

Data analysis refers to the process of refining, classifying, examining, modelling, and transforming the collected data to make it more meaningful for drawing conclusions and answering research questions (Sgier, 2012). In this study, data was classified and organised into themes based on the research questions and the objectives. The responses were then coded before it was analyzed using Statistical Package for Social Sciences (SPSS). This software package generated some descriptive statistics and established the association between the independent variables and dependent variables of the study. Later, the findings were refined, organised, presented using percentages in tables. Also, qualitative analysis of data was carried out using a thematic approach by putting the results from the interviewees into particular themes based on the objectives.

3.8 Ethical Considerations

According to (Israel & Hay, 2006), research ethics serves to guard the rights of the respondents and protect the truthfulness of the study. The following strategies were implemented to enhance ethics in this study. The research respondents were recruited, and their participation was voluntary. It is imperative for the research respondents to be informed before they are involved in the data collection process. To observe this, the respondents were informed before data collection through phone calls, SMS, and e-mail to ensure that there was informed consent. To protect the privacy of the respondents, the respondents' names in the whole study were made anonymous. Lastly, the researcher assured all the respondents that the data they provided was solely meant for educational purpose and would not be shared with third parties without their consent.

CHAPTER FOUR: PRESENTATION, ANALYSIS, AND DISCUSSION OF RESULTS

4. Introduction

Chapter four explores the analysis and the discussion of the research outcomes. It has been subdivided into various categories and subcategories. Demographic details of the respondents, such as age, disability nature, and reading modes for students, are presented before the rest. Likewise, demographic information for teachers includes teaching experience, professional and academic qualifications. The discussion section of the study findings is arranged based on the esearch questions and the objectives. Inferential and descriptive statistics was used to analyse quantitative data. Using descriptive statistics, data were described and summarised into tables, percentages, and frequencies. Finally, the thematic analysis technique was used to interpret qualitative data.

4.1 Response Rate

Questionnaires and observation checklists were sent to 40 visually impaired students and 10 teachers through email. All respondents filled and returned their questionnaires except 4 students who never e-mailed their back, and refused to answer neither calls nor SMS. Response rate indicating questionnaire return rate is shown on table 4.1.

Table 4.1: Response Rate for Students and Teachers

Respondent Category	Sampled	Returned	Response Rate
Students	40	36	90%
Teachers	10	10	100%
Total	50	46	92%

It is evident that response rate from teachers was 100% whereas that students' response rate was 90%. The overall response rate for both student and teacher respondents was 92%. According to Fincham (2008), the average response rate in the 21st century is about 60% in most studies. This indicates that average non-response bias is about 40% of the sample size.

Questionnaire return rate in this study was far much above the acceptable return rate of about 60% because it was 90% for students, 100% for teachers, and 92% for both students and teachers. Also, the non-response bias was 10% for students, 0% for teachers, and 8% for the general sample. It was much less than the acceptable level of 40%.

4.2 Respondents' Demographic Information

The demographic characteristics of the students and teachers usually have a significant role in determining the effectiveness of teaching learning. Therefore, demographic characteristics such as the nature of student's impairment, the age at which the student acquired such impairments, teacher educational and professional qualification, teaching experience are the key demographic data used in this section.

4.2.1 Age of Students

Age distribution among the students was considered because age affects the learning process. Navarro, Garcia-Rubio, & Olivares, (2015), discovered that the differences in maturation and experiences among the students or relative age effect (RAE) has a significant influence on academic performance. School policies in various regions recommends that learners within the same birth year be included under the same academic level to reduce disparities in academic performance. In Spain students born between Jan 1st to December 31st same years are put under the same class or category to minimize the impact of RAE. In Wales, Britain, and Wales, students born from August 31st to September 1st of next year are put in the same category. Therefore, the age of the student respondents were summarised in the table 4.2, along with percentage distribution.

Table 4.2: Percentage Distribution of the Student Respondents' age

Age in Years	Number (N=36)	Percentage (%)
Below 14	1	2.7
15 to 16	10	27.8
17 to 18	14	38.9
19 and above	11	30.6
Sum	**36**	**100**

Exploratory analysis of the Respondents ages indicates that most of the respondents, about 38.9% were aged between 17 to 18, respondents aged 19 years and more were 30.6%, followed by 27.8% who were between 15 to 16 years, and 2.7% of the rests were 14 years or younger. As such, the mean age of the respondents was 17.3 years, rounded-off as 17 years, whereas the modal age of all the Respondents was also 17 years. It can be noted that most respondents, more than 50%, are 17 years and above. They are old because they either joined school late or have not been moving across the academic levels successfully because of the disability. Notably, students with such age range are supposed to have joined tertiary education institutions such as colleges and universities.

4.2.2 Form and Age of Students

Age distribution and learners' class were also explored in the study and summarised in table 4.3. A majority of the learners (55.6%) were form threes while the rest (44.6%) were form twos. The researcher chose form twos and three because they had the ideal population characteristics required for this study. There were a mixture of low vision, blind, totally, blind, and sighted.

Table 4.3: Learners form and age

Class	Less than 14	15 to 16 years	17 to 18 years	19 and more
	% (students)	*% (students)*	*%(students)*	*%(students)*
Form 3	0% (0)	40% (4)	64.2% (9)	64% (7)
Form 2	100% (1)	60% (6)	35.8% (5)	36% (4)
Sum	**2.7% (1)**	**27.8% (10)**	**38.9% (14)**	**30.6 (11)**

The data in Table 4.3 shows that the most of form three learners (64%) are between 17 to 18, and 64% of the rest are above 19 years. Only 35.7% of students aged 19 years and 36% of others aged 17 to 18 were in form two. They were generally older than form twos because a majority of form twos (60%) were 16 years and below. Such a trend is normal because older students are expected to in a higher academic level as compared to their younger counterparts. In the attempt to actualise vision 2030, the Ministry of Education developed early child hold policy that requires children aged 0 to 3 years to join preschool or nursery school while those aged 4 to 5 years to enroll in class one (MOE, 2012). As such, a form two student is supposed to be 14 to15 years old while a form three one should be 15 to 16 assuming that they joined class one at the age of 4 or 5. It is thus normal to have a form 2 aged 14 years.

However, having form two and form three students aged between 17 years to 19 years and above is abnormal. This reflects a large wastage rate among the visually impaired learners at Thika School for the Blind. It can be attributed to various factors which cause marginalization of students with disabilities. For instance, the substantial expenses involved in medical care costs associated with disabilities divert resources from education (Moyi, 2017). This makes visually impaired students to enroll on schools later than 5 years, or drop out of school due to financial constrains and then go back. Moyi also noted that low academic performance due to difficulty in accessing the content or participate in learning could have

contributed to high repeat rate among the visually impaired students thereby making them to spend more time than expected in secondary school.

4.2.3 Visual Impairment Distribution

Respondents' visual disability distribution was also taken into consideration, as shown in table 4.4. Sighted category comprised of students who can see but have occasional visual impairment attacks. Low vision comprises of students who could only see things such as texts and pictures when they are magnified. The blind category included students who could not see anything even when it is magnified. Finally, totally blind groups included students who were blind but had hearing impairment that hindered them from using speech output or input devices to read or write.

Table 4.4: Visual impairment distribution among the student respondents

Nature of Impairment	Number (N)	Percentage
Totally blind	13	36%
Blind	1	3%
Low Vision	23	64.1%
Sighted	35	97%

Notably, 97% of the student Respondents said that they acquired visual disability because they were born with good sight but lost it as they grow up. It was also noted that 64.1% had low vision, 36% had total blindness, and 3% of the rest had total blindness. Upon further inquiry, it was discovered that 1 respondent was born blind, 26 others lost their sight before 10 years, 7 lost theirs after 10 years, but the rest could not remember when they lost their sight.

4.2.4 Favorite Reading Mode

Responses regarding the favorite reading mode for students were organized, analyzed, and summarized in table 4.5. Favourite reading mode refers to the kind of assistive technology

which a student prefers to use when doing personal studies without recommendation from the teacher or colleagues.

Table 4.5: Favorite Reading Mode

Favorite Reading Tool	Number (N)	Percentage
Braille	18	50%
JAWS	10	27.8%
Audiobooks	5	13.9%
Window eyes	2	5.6%
Large print access	1	2.7%
Sum	**36**	**100%**

Students' responses indicate that Braille was the most favorite reading mode for about 50% mentions while JAWS was mentioned by 27.8% of the student respondents, audiobook was stated by 13.9%, window eyes by 5.6, and large print by 2.7%. Most students chose braille as their favorite mode because it as commonly used in the school and most of the instructional resources were available in braille format. It was a favourite mode for the blind and totally blind students. JAWS was relatively favorite but it was selected by few students simply because not most students had mastered the computer skills required to use it. According to Kavagi (2010), slack of technical skills among students is a major impediment against the usage of assistive technology. Audio books and window eyes popularity was affected by their scarcity. On this, Smith et al. (2011) pointed out that scarcity in the assistive technology tools and devices in schools for visually impaired results to unequal access to education. Large print access was chosen by students who hard low vision problem. The findings demonstrate that over-reliance on Braille hinders students from accessing other forms of assistive technology such as JAWS which can make them operate a computer, access and read all types of files either in the computer or over the internet. Inadequate audio books make students to rely o braille thereby limiting their options to read. As such, overdependence on braille limits the options of students to access curriculum content especially in the period

when most academic materials are presented in digital format (Presnsky, 2001). Finally, large print access could only be used by students who have partial visual impairment.

4.3 Teacher Respondents

The teaching process and application of assistive technology is affected by the teachers' age. As such, the age distribution of teacher respondents was explored.

4.3.1 Age of Teacher Respondents

Age distribution among the teacher respondents is shown in table 4.6.

Table 4.6: Age distribution of teacher Respondents

Age in Years	Number (N)	Percentage %
40 to 49 years	3	30%
30 to 39 years	2	20%
20 to 29 years	5	50%
Sum	**10**	**100%**

The exploration indicated that 50% of the teachers were aged between 20 to 29 years, 30% were 40-49 years old, while 20% were between 30-39 years old. The study outcomes indicate that majority of teachers at Thika School for the Blind are young; thus, they are either on BOM terms and have limited teaching experience since some of them are fresh graduates. Most of the fresh graduate teachers do not have adequate assistive technology competences required to teach visually impaired students (Smith et al. 2009). As such, the school has an inadequate human resource to teach visually impaired learners since a majority of the teaching force is employed on contract terms. This hinders teachers from utilizing the available assistive technology appropriately. Failure to use the available technology to allow students access content and learn independently results to poor academic performance.

4.3.2 Qualification of Teachers

The researcher acknowledges that teacher qualification plays a critical role in the teaching-learning process of visually impaired learners. As such, academic and professional qualification was considered in this study, as shown on the table 4.7.

Table 4.7: Professional qualifications of the teacher Respondents

Accreditation	Number (N)	Percentage %
Master's Degree (MSC/MA/MED)	1	10
Bachelor's Degree (BED)	7	70%
Diploma (Dip Edu)	2	20
B-A	0	0%
KISE	0	0%
P1	0	0%
KCPE/CAPE/CPE	0	0%
P2	0	0%
S1	0	0%
UT	0	0%
Others	0	0%
TOTAL	**10**	**100%**

Teachers with a diploma in education were 20%; those holding bachelor's degrees in education were 70%, while holders of master's in education were only 10% of the total teaching force sampled. There were no teachers with B-A, S1, P1, P2, KCPE/CAPE/CPE, UT, KISE, or other academic or professional qualifications. This shows that teachers at Thika School for the Blind have adequate academic and professional qualifications to teach. However, Thurlow et al. (2007) suggests that teaching visually impaired students requires more than just a degree and a diploma, because one has to have knowledge in special education to help identify and satisfy the needs of such students. Also, teachers needs technical skills they can use to guide visually impaired students during teaching and learning

process (Leibs, 1999). Lack of such factors is the major contributor to low academic performance among visually impaired students in Thika despite having academically qualified teachers.

4.2.3 Teaching Experience for Teachers in Thika School

Teaching experience was considered important determiner in the usage of assistive technology in the teaching of visually impaired students. For that reason, teachers were requested to indicate how long they have been teaching to assess their teaching experience. Results are summarised in table 4.8.

Table 4.8: Teaching experience of teachers

Experience	Number (N)	Percentage %
Less than a year	5	50%
2 to 5 years	2	20%
10 to 20 years	2	30%
Sum	**10**	**100%**

It was noted that about 50% of the teacher respondents got teaching experience of less than one year. This can be attributed to frequent teacher transfer from Thika School for the Blind to regular schools upon realizing the teaching of visually impaired students without adequate training on teaching visually disabled students (Croenewegen, 2006). A significant number of them (30%) had teaching experience of 10 to 20 years, while the rest had teaching experience of between 2 to 5 years. As such, most teachers at Thika School for the Blind have low teaching experience. Also, there are few teachers employed by TSC in the school. Thus, due to less permanent teachers, the school has employed more BOM teachers. Like in any other job, increase in experience increases job performance and professionalism. Therefore, teaching experience has a significant impact on the usage of assistive technology. Griffin-Shirley (2009), observed that teaching experience determines the level of competence among teachers of visually impaired learners in using assistive technology to teach. Lack of

experience is associated with low assistive technology competence thus low academic performance among visually challenged students.

4.3.4 Teacher Training for Special Education

The questionnaires also focused on investigating if teachers at Thika School for the Blind had special training on how to teach students with visual impairment. Table 4.9 shows that 50% of tutors responded that they had trained on teaching visually impaired students while 50% had not trained on the same.

Table 4.9: Special education training distribution

Training Status	Number (N)	Percentage %
Trained	5	50%
Not Trained	5	50%
Sum	**10**	**100%**

The results indicate that 50% teachers at Thika School for the Blind are not trained adequately to use assistive technology in teaching visually impaired students. This requires the integration of theory and practice to facilitate good teaching-learning outcomes. Visually impaired students see through touch and hearing. They also learn through doing things practically as justified by the constructivist theory of learning.

4.4 Assistive Technology for Teaching Visually Impaired Learners

Objective number one in this research was to study the availability of assistive technology and how it influences KCSE performance among visually impaired students in Thika School for the Blind. This objective was aligned with the following research question; “how does the availability of assistive technology influence KCSE performance among students with visual impairment at Thika School for the Blind?” As such, two questionnaires were designed and e-mailed to the Respondents to gather their views and perceptions about assistive technology presence and usage in the school. The items or questions in the questionnaire were designed to use opinions and facts about the usage of assistive technology

in teaching-learning activities in the school. The respondents were required to fill in the questionnaires online by choosing the answers or responses that described a situation at school, about themselves, or facts about the assistive technology usage in the school. The questions in the questionnaire were customised to conform to facts and respondents' perceptions regarding the assistive technology in the school. The Respondents were requested to fill the questionnaire by choosing the answers or responses that described the academic environment, teaching, and learning at Thika School for the Blind. The percentage frequencies were calculated for the teachers' and students' responses. The analyses and summaries were presented in three tables shown below.

4.4.1 Assistive Technology Usage in Thika School for the Blind

The research revealed that there were various forms of assistive technologies being used at Thika School for the Blind by both students and teachers. All the 10 teachers (100%) and about 66.9% of the students responded that there was a computer laboratory in the school. Also, 61.11% confirmed that they attended computer lessons two times every week. The study outcomes also show that about 90% of teachers think that the computer lab had all the necessary assistive technology tools to cater to the needs of visually impaired learners. The 10% maintained that the school's computer lab does not have the essential assistive technology customised to meet the needs of the visually impaired students.

4.4.2 Reading and Writing Tools and Devices

The study also explored the items that were used by the students to write or read. Students mentioned that they use a variety of tools and devices to read and write. Such tools includes, but not limited to; computers, iPads, Braille, Text-to speech machine, braille translation software, and slate & stylus. For more precise results, the usage of four tools and devices such as iPad, Computer, Braille Machine, and were summarized and expressed in terms of percentage, as shown in Table 4.10.

Table 4.10: Writing and Tools and Devices

Tool(s)	Percentage %
Braille	33.3%
Computers	28%
Slates & stylus	25%
iPad	11.2%
Others	5.6%

A third of the students (33.5%) used a braille machine for writing and reading. It can be deduced that teachers suggested that students should use braille machines because they are the primary writing and reading mediums used by visually impaired people. Using braille, blind, and low vision, learners can access information and do assignments faster than when using other forms of assistive technologies. Some students (66%) confessed that braille was their favorite reading mode because it enables them to read or take notes without being assisted by a sighted guide. D'Andrea (2010) also noted that a considerable number of visually impaired students prepared braille because it was simple to use and readily available.

(i) "Braille enables me to write, read, do my assignments, and prepare notes without much struggle," one student said.

(ii) Another one added that, "Braille is the most student friendly assistive technology tool for the visually impaired."

(iii) "Using Braille, I can write and read without a need for a sighted guide." The third respondent confessed.

Moreover, about a quarter (28%) of the student respondent said computer was their favorite reading mode and they used computers to read or write. Such students preferred to use computers because they have braille printers, OCR, refreshable braille screen readers, and speech output that enable blind and low vision students to socialise with peers online, access

content, and complete assignments. Also, the webpages used by such students supported screen readers and braille, thereby making it possible for students to conduct online research independently. The number of students using stylus & slate was almost equal to that of computer users (25%). They argued that stylus & slate are usable in many academic contexts because of their flexibility and portability. Unlike braille and computers, stylus & slate require little to no maintenance since they only require occasional sharpening. Some students observed that stylus & slate could help them do several things they could not do using computers or braille.

The usage of iPads at Thika School for the Blind was significantly low, with only 11.2% of students. Most learners did not recommend iPads to be used in the learning and teaching process. However, the few who encouraged the use of iPads pointed out that they have in-built accessibility features and apps that facilitate vision, hearing, learning, and mobility among the disabled students. For example, iPads for the blind are fitted with screen readers, which offer immediate access to the internet, apps, and other significant information to help the blind to execute some tasks on their own. Spector et al. (2010) suggests that learning and instruction in the digital age require devices such as computers or micro-computers that can access digital content in the internet. Finally, other items and tools used for learning were only used by 5.6% of the student respondents who used different materials such as laptops, large prints, and other forms of assistive technology.

Students were also requested to recommend the tools and devices they believe were appropriate in improving reading and writing experiences of students. The responses were analyzed and summarized in the table 4.11. Most students (44.4%) recommended that computers should be used for reading and writing by visually impaired students. Additionally, iPads were recommended by 33.3%, Braille by 16.7% and Slate & Stylus.

Table 4.11: Recommendations

Tool(s)	Percentage %
Computers	44.4%
IPads	33.3%
Braille	16.7%
Slate & Stylus	5.6%

Students who recommended computers justified their commendations by saying that computers are versatile and can be used for multiple purposes. One student responded that, " a computer can be fitted with JAWS, Window eyes, PDA, text-audio input and input, internet, and other forms assistive technology tools. It can thus, enable students to read, write, and perform other tasks using a computer. Likewise, those who chose iPads said that, they are like mini-computers that can be used for various functions and fitted with reading and writing software such as JAWS, OCR, PDA, Window eyes, and they can be carried almost everywhere. A student confessed that, "iPads can perform most functions of a computers because reading and writing software systems can be installed. They can also be help students access content stored in the device or online. Also, one can carry an iPad everywhere in church, bus, class, or field thereby making it possible to read or write at ones convenience. Student who supported Braille hinted that they are easy to use and almost all students are familiar with it, thus no difficult in writing and writing will be witnessed if they are implemented. Finally, those who chose slate & stylus argued that it is easy to use and allows students to write and read manually.

According to the questionnaire responses, about 80% of teachers in the school confirmed that JAWS was the most prevalent assistive technology in the school. Deputy principle responded that, "JAWS is the most prevalent assistive technology after braille because it allows students to access contents on screen, internet, and any other location within

a computers." It is a screen reader for visually impaired students, which enables them to navigate through the screen through the help of a virtual audio guide (Cullen, 2006). The responses also demonstrated that NVDA technology had a prevalence of 60% in the school. It is an open-source and free screen readers operational with Windows OS. The tool allows visually impaired people to use computers effectively and at a relatively lower cost. Newby et al. (2011), noted that JAWS and other screen reader technologies facilitates successful teaching and learning of visually impaired students because they allow them to navigate through the computer screen with a lot of ease. Braile output and input, braille translation, and speech synthesiser were moderately used in the school at a frequency of 40%. It indicates that their usage in the school is less than a half in all the teaching-learning sessions. Also, Mega dots, Windows-Eyes-Intellitalk, and Braille 2000 usage during lessons was less than 10%, or once out of ten cases. Low usage of such assistive technologies can be attributed to their high prices making it impossible for schools to buy them. Sometimes, they are provided by donors to support special education in schools for the blind. Unfortunately, students and teachers at Thika School for the Blind never used Dolphin pen and talking books because the two were mostly used for commercial purpose.

To determine the usage of computers in Thika School for the Blind, the views of the learners gathered through online questionnaires were considered. The results of this study confirm with another study by ICEVI (2009) that computers are the primary and frequently used forms of assistive technologies in most schools, including Thika. About 25 students (69.5%) of the student Respondents accepted that the attended computer classes. Notably, 72.2% of them indicated that they attend lessons at least 2 lessons per week while the other 27.8 said that they attend 5 to 7 lessons every week. However, 20 students (55.6%) responded that the school had a computer laboratory where they attended lessons at least twice per week. The other 45.6% including a few who attended lessons did not know whether the school had a computer laboratory. The results also show that 41.6% of the respondents knew that computer lessons took place in the computer lab, but the majority 58.4% were not

sure about the venue for computer lessons. Likewise, 16.7% of students responded that the school had 21 to 30 computers, 25% others said that the school had 11 to 20 computers, while the majority 58.3% indicated that there were about 11 to 20 computers in the school. Regardless of the different responses regarding the number of computers in the school, it can be observed that the learners were aware that there were less than 30 of them in the school. It shows that the number of computers in the school is still limited. The inconsistencies in students' responses can be attributed to visual impairment limitations which hinders them from identifying venue or the actual number of computers in computer lab. McCuspie (2002) noted that visually impaired students have less access to instruction or information regarding issues surrounding them. They rely heavily on the sighted guides to inform them what they can seen in the environment. As such, it was challenging for visually impaired students to count. Their responses relied on the information they have overheard from teachers, sighted students, librarian, transcriber, and other individuals within the school.

Table 4.12: Computer classes attendance, Venue, Computer lab, Number of Computers and Lessons per Week

Item	Percentage %
Attend computer classes	69.5%
Don't attend computer classes	40.5%
Computer lab as venue	41.6%
Not sure about venue	58.4%
Computer lab present	55.6%
Computer lab absent	45.6%
5-7 lessons per week	27.8%
2 to 4 lessons per week	72.2%
1 to 10 computers present	25%
11 to 20 computers present	58.3%
21 to 30 computers	16.7%

According to the students' views, learners were motivated by features such as large print access, megadots, speech input, and output, write out loud, JAWS, Interllitalk, and others, as shown on the table 4.13.

Table 4.13: Tools that inspire usage of assistive technology

Programme	% Prevalence
JAWS	88%
Large print access	78%
Write-out-loud	13%
Intellitalk	12%
Window-eyes	10%
Megadots	0.0%

Based on the responses on the questionnaire, it can be noted that JAWS was deemed as the most effective programme that motivates a majority of visually impaired students (88%) in Thika School for the Blind to use assistive technology. Large-print-access was the second motivating feature that motivates about 78% of the visually impaired students to use computers. Intellitalk, write-out-loud, and Window-eyes motivates about 13%,12%, and 10% of students, respectively. Megadots and other programmes did not encourage any of the student respondents because they are somewhat complicated. Most students recommended that JAWS should be implemented in the school to ensure every student can access content easily.

"I would recommend JAWS to be implemented in the whole school because it allows students to access the curriculum, navigate the computer, navigate web-pages over the internet without the need for a transcriber to help," a student confessed.

4.4.3 Forms of Assistive Technologies Used in Teaching-Learning

Teachers also responded to the questionnaire indicating the kind of assistive technology they use to teach their students. The results are analysed and summarized in table 4.14 shown.

Table 4.14: Assistive Technologies used by Teachers at Thika School

Assistive Technology Tools	Yes	No
Braille	80%	20%
Talking books	10%	90%
NVDA daisy book	0%	100%
Windows Eyes	30%	70%
JAWS	60%	10%
Microcomputers with braille output and input	80%	20%
Speech synthesiser	30%	70%
Speech processor	30%	70%
Megadots	20%	80%
Dolphin pen	10%	90%
Braille translation software	0%	100%
IPad	20%	80%

Form the teachers' responses displayed in the questionnaire indicated that Braille (80%), microcomputers fixed with Braille Output and uput (80%), JAWS (60%), were mostly used by teachers in the school to teach visually impaired students. However, it is clear that other assistive technologies such as window eyes (30%), braille translation software (0%), iPads (20%), and speech processors' (30), and others were the least used by teachers.

4.4.4 Instructional Media used in Classroom

The study also explored the forms of instructional media used in Thika School for the Blind and summarised in table 4.15. According to the responses given, it was evident that teachers in the school used a variety of instructional technologies to teach visually challenged students.

Table 4.15: Instructional media Available for teaching-learning

Instructional Media	Present (%)	Absent (%)
Large Print Books	90%	10%
Braille Machines	90%	10%
Magnifier	80%	20%
Talking calculators	80%	20%
Braille Papers	80%	20%
Braille Textbooks	80%	20%
Braille Geometrical Set	70%	30%
Cubelinthm Slate & Cubes	50%	50%
Binocular and Telescope	50%	50%
Reading and makers windows	40%	60%
Tactual figures and diagrams	40%	60%
3-D objects	30%	70&
Tylor frame & types	30%	70%
Tactual globes and maps	20%	80%
Writing guides and templates	20%	80%
Optacon	10%	90%
Sound balls	10%	90%

Instructional media includes all the gadgets or materials available in school to be used by a teacher to facilitate teaching-learning (Margolis, & Goodman, 1999). Large print books and braille machines were the most abundantly available instructional media with a frequency of 90% or marked as present by 9 out of 10 teachers at Thika School for the Blind. In the same school, slate & stylus, braille paper, magnifiers, braille textbooks, talking clock, and calculators were also abundantly available with a frequency of 80%. Likewise, braille geometrical sets, including items such as set squares, rulers, dividers, and protractors, were the third most with a frequency of 70% in all lessons. Binoculars, telescopes, microscopes, and cubelithm boards were also available in Thika School for the Blind with a frequency of

50%. The rest of the instructional medium found in the school had a frequency of 40% to 10%. Sound balls and Optacon are used in co-curricular activities like games, but learners with disabilities hardly participate in sports and games.

4.4.6 How Visually Impaired Learners Use Computers

Students with visual impairment engage in diverse activities while using computers. In most cases, learners used computers to access news and connect with other people through social media.

Table 4.16: Uses of Computers by visually impaired students

Use	Prevalence (%)
Playing games	58%
Reading News	42%
Emails	33%
Facebook chat	25%
YouTube streaming	20%
Tweeting	13%

The findings reveal that most students used computers for leisure activities in leisure activities. The table shows clearly that 58% of students use a computer to play computer games, 42% read the news, 33% sending and received emails, 25% chatting Facebook, 20% streaming YouTube videos, and 13% used it to tweet. It can be noted that computer usage can enable visually impaired students to be independent, confident, socially connected, and enjoy life just like other regular students.

Some of the common assistive technologies in the instructional media used today include software, whiteboards, blackboards, tape recorders, real-objects, pictures, videos, cartoons, charts, teacher-made figures, maps, projectors, television, and models (Kavagi, 2010; Jackson, 2009; Creswell, 2002). This study, however, has shown that instructional media for visually impaired students is dependent on the nature of their visual impairment and learner or teacher preferences.

According to South Africa National Council for the Blind (2015), common forms of assistive technologies utilised in most school for visually impaired learners include braille access, screen readers such as JAWS, speech access, large print, and text-to-speech devices or software systems. Therefore, visually impaired students need magnification devices that can zoom images, texts, and other graphics to increase students' interaction with the content and the curriculum (Kieti, 2008). They also need talking word programs or devices with software that can respond to the students' audio instructions. However, Mugo (2013) noted that visually impaired students are limited to braille because it is their primary tool for writing and reading.

Mugo (2013) is justified to argue that most schools for the visually impaired students depend on braille as the primary tool for teaching and learning. The most challenging issue with overdependence on braille is that students' access to content is limited because most of the online materials are hardly presented in braille. Also, converting them into braille would be a lot of work. The most appropriate technology that deserves to be implemented in this case are computers and iPads because they can be connected with countless devices to access unlimited content in diverse formats. This could significantly improve KCSE performance among the visually impaired students.

4.5 Selection of Best Assistive Technology

The study also sought to explore the criteria used to select assistive technology tools and how it influences KCSE performance among students with visual impairment at Thika School for the Blind. This objective was also aligned with the research question; "how do criteria used to select assistive technology tools influence KCSE performance among visually impaired learners at Thika School for the Blind?" The responses of teachers regarding the criteria they use when choosing the right technology for visually impaired students are summarised in the following table 4.17.

Table 4.17: Selection Criteria for Suitable Assistive Technology

Criteria	Percentage
Nature of visual impairment	100%
Available instructional media	90%
Lesson objectives	80%
Learner experience	60%
Level of impairment	50%
Topic covered	50%
Age of disability onset	30%
Other	30%

Assistive technology, in this case, means the equipment, gadgets, or products that are meant to boost or maintain the functionality level of visually impaired learners. Such devices include computers, iPads, braille, laptops, and other technologies suitable for visually impaired students. As per the findings, all the tutors indicated that their choice of assistive technology is significantly influenced by the type or nature of students' visual impairment. About 9 teachers (90%) said that their choice of assistive technology for students depends on its availability. Also, 8 teachers (80) felt that the lesson objectives significantly contribute their selection of instructional media or assistive technology while 6 others (60%) confirmed that learner experience in using such technologies affects their choice. It was noted that 5 teachers (50%) indicated that the level of impairment and the nature of the topic covered play a significant role in identfying the assistive technology to be used. Lastly, 3 others (30%) of the teacher respondents indicated that the age at which the student lost sight is also crucial in selectin the tools, material, and gadgets to use during teaching and learning activities.

Generally, students have personal differences that contribute to different learning speed and ability to learn. This applies to all learners including the visually challenged ones. As a result, it calls for recognition of personal differences and nature of disability among the visually impaired learners to help in choosing the most suitable form of assistive technology for each (Cox, & Dykes, 2001). According to American Foundation for the Blind, successful

learning requires provision of assistive technologies that conform or match to the unique needs of each visually impaired students (AFB, 2015). As a result of different levels or nature of impairment, each student uses different sense to gather information which makes it necessary to provide each one of them with a personal computer installed with software systems or attached to devices that enable the student to learn like other students. Each computer or laptop could be programmed with technology that meets the needs of the student who uses or owns such computers.

Assistive technology criteria selection is very crucial in promoting equal access to content and curriculum among visually impaired students. It is helps in reducing disparity in the access to content and academic performance between visually impaired students and sighted ones. Also, it would also help enable learners with different levels of visual disability to access content easily and conveniently without struggling. This puts them on a level ground with the regular students thereby increasing the possibility of improved performance in KCSE.

4.6 Challenges Faced by Visually Impaired Students and their Teachers

The study also sought to establish the challenges faced by students and teachers while using assistive technology and how it influences KCSE performance among visually impaired students at Thika School for the Blind. Challenges faced by visually impaired students and their teachers at Thika School for the Blind when using assistive technology was the fourth objective of this study. This objective was aligned with the following research question; “what are the challenges faced by teachers and visually impaired students when using assistive technology at Thika School for the Blind?” Information and data about such challenges were gathered from the students' and teachers’ responses. It was evident that both respondents faced various challenges that prevented them from using assistive technology appropriately, and that would negatively impact their KCSE performance.

4.6.1 Teachers' Challenges

Lack of adequate teaching-learning materials appears to the major challenges faced by teachers of visually impaired students who want to execute the use of assistive technology during their lessons. Like in other Kenyan special schools, Thika School for the Blind had few computers in the laboratory and was not enough for students. As such, they could not be accessed regularly because they cannot be used by several students or various classes at a go. Inadequate technical knowledge and skills was another major impediment towards the usage or implementation of assistive technology in schools. As such, most teachers do not possess enough computer skills to help them operate or run computer programmes for teaching visually impaired students or even teaching students how to use computers. This interferes with curriculum delivery because computers are not put into good use by both students and teachers at Thika School for the Blind.

Maintenance, servicing, and repair of the available assistive technology tools are other major challenges among the teachers because teachers are unable to ensure software and equipment are working correctly. Some equipment needs frequent servicing, which teachers are unable to give. Software systems also need to be constantly updated and reviewed to ensure that they are working properly. As such, schools are forced to hire trained personnel to frequently service or repair the equipment whenever they get damaged.

A teacher confessed that "Most computers in the school are not functioning properly sue to lack of proper maintenance and servicing such as updating software systems."

Difficulty in identifying the learning needs of visually challenged students was another challenge preventing the practical application of assistive technology in Thika School for the Blind. Notably, not all forms of assistive technologies are suitable for every visually impaired student. Different students need different assistive technology tools and programmes because of the nature and severity of their disabilities. For example, each student needs a specific assistive technology that meets their learning and visual needs. A learner may use speech access, large print, window eyes, JAWs, or a combination of all such

technologies. The teacher respondents demonstrated that most teachers in Thika School for the Blind do not have appropriate skills and knowledge for identifying and determining the needs of visually impaired students they teach.

For example, one teacher responded that "Most of us lack essential computer literacy skills and knowledge which hinder us from accurately and effectively helping students to use these tools."

4.6.2 Students' Challenges

Likewise, students experience various problems when using assistive technologies in their studies or other activities. It was clear that some students did not use assistive technology regardless of their desire to do so when accessing content or interacting with the curriculum. For instance, 13 students or 36.1% of students did not use assistive technology when doing assignments or revising. This shows that students who used assistive technology (63.4%) were less than 75% or three quarters. It is a significant problem because it denies more than 25% of visually impaired students access to the content or the curriculum. Most of the students who did not use assistive technology said that some were inadequate, problematic to use, lack of computer literacy skills, and lack of adequate personalized teaching by teachers.

(i) One student said, "I do not use assistive technology to revise because I lack computer skills that can help me navigate properly through a computer."

(ii) "Most of the assistive technologies are difficult to use. As such, I am limited to using assistive technology because I am unable to assistive technology tools and devices when doing my assignments."

(iii) "The available assistive technology tools and devices in the school, especially computers, are not enough for everyone. Sometimes, I am forced to wait for our classmates or other students to use them so that we can get access. Worse, I sometimes wait, and finally fail to get one...thereby making me to copy or request other students to do the assignment for me."

(iv) "Teachers do not give me personalized teaching-learning environment. I learn slowly and therefore; I need a lot of attention to capture and understand how to use various forms of assistive technology."

However, all the students (100%) acknowledged that assistive technology can improve their academic performance even though they did not use it while doing assignments or revising. This is a clear indication that students are ready to embrace assistive technology to boost their academic performance, mainly in the KCSE.

Such challenges were explored using questionnaires that were designed using a 4-item Linkert scale format with responses such as "strongly agree," "agree," "disagree," and "strongly disagree," as shown in the table 4.18. The first response tries to examine if lack of access to assistive technology prevents students from enjoying or getting equal opportunities while learning. The second response examines whether there any pedagogical challenge surrounding usage of assistive technology.

Table 4.18: Students' responses regarding the challenges

Response	Strongly Disagree (%)	Disagree (%)	Strongly Agree (%)	Agree (%)
Assistive technology allows visually impaired students to enjoy equal opportunities with other students	5.6	5.2	40.6	48.5
Teachers do not attend to my personal needs and does not give me adequate time to internalise computer	16.4	16	46	21.5

The study indicates that a majority of students responded agree and strongly agreed (89.1%) that assistive technology allows them to exercise human rights and enjoy learning just like the regular or sighted counterparts. However, inadequate computers in the laboratory might limit this opportunity since they waste a lot of time waiting for others to finish so that they can use them as well. The response of the other students who disagreed and strongly disagreed can be attributed to the limited number of computers, the inability of teachers to identify the needs of visually challenged students, and the difficulty in using some features in

the computers. This impedes the adequate application of assistive technology for teaching and learning activities in Thika School for the Blind to boost KCSE performance. A low number of computers in the school is a critical challenge because it hinders optimisation of teachers' needs for instruction and the students' needs to access the curriculum using the available teaching-learning resources or assistive technology. The school checklist indicated that there were less than 40 functional computers at Thika School for the Blind. effective teaching and learning can only happen when students have adequate access to computers.

Notably, speech synthesisers are challenging to use since it makes students unable to use them while talking. This prevents them from benefiting fully by using the computers since such attached devices can interfere with the functionality of the computer. As such, other gadgets attached to computers or installed software systems seem to be another significant challenge that prevents students from entirely using assistive technologies in their learning process. For example, attached gadgets such as speakers, speech synthesisers, mouse, or keyboard might be complicated or defective, thereby making it impossible for a visually impaired student.

Finally, it was noted that teachers hardly attend or respond appropriately to the problems experienced by students during computer lessons. For example, 67.5% of students agreed and strongly agreed that teachers fail to give them personalised teaching and time for internalizing the content they have learnt or mastering how to use various tools or concepts on the computer. Only a small portion of 32.4% disagreed and strongly that teachers do not give them adequate time to learn and masters content and computer usage. This small portion believed that teachers attend them as is required. According to Abner & Lahm (2002), teacher readiness in the implementation of assistive technology plays a critical role in ensuring that all the learning needs of disabled students are identified and accommodated. However, this teacher readiness seems to be inexistence in Thika School for the Blind.

Also, 30 student Respondents or 83.3% respondent that the computer lab has inadequate computers. This makes them to wait for long when other students or classes are

using them. Sometimes computer lessons would be postponed or even missed when computer lab is fully occupied by another class. “There is a time, we missed computer lessons three weeks because computer lab as always occupied by another class whenever we had a lesson…thus missing the lesson completely, “ a student wrote. Another one added, “inadequate of computers in the computer lab hinders equal access to content and curriculum thereby making it impossible for students to write notes, revise, or do assignments using assistive technology.”

According to the study, schools for the visually impaired in Kenya have teachers and students who do not have technical skills for using assistive technology gadgets or software. In Thika School for the Blind, for example, there was only one teacher (the deputy principle) who had all the know-how to use assistive technology. He taught visually impaired students on how to operate computers and run assistive technology programs. The deputy principle used coach teachers who had little or no skills in the usage of assistive technology. However, this requires a lot of patience since it takes more time for that teacher to managing coaching students and fellow teachers on how to use various tools, software, and programmes for assistive technology skill mastery.

Research shows that visually impaired students at Kenyatta University lack assistive technology usage skills (Groenewegen 2005). Such students came from different secondary schools. This means that they were not taught or exposed appropriately to assistive technology. It can be attributed to inadequate computers, unskilled teachers, and lack of time to attend each student at personal level. As such, Thika School for the Blind has challenges when it comes to allocating time to students and resources to allow students to interact with computers adequately. However, the school copes with this by organising in-service training sessions to boost the assistive technology knowledge among the teachers.

Generally, students and teachers in Thika School for the Blind face various forms of challeges which prevent successful teaching and learning. This is critical problem that should be addressed appropriately to ensure there is adequate assistive technology tools, computer

literacy skills, and other necessary resources. Lack of personalized teaching or enough support from teachers can also be attributed to this problem.

According to Mungai & Gender (2011), inadequate assistive technology tools, inability to access educational materials, and lack of the necessary expertise are the most critical challenges preventing full implementation of assistive technology in Thika and several other schools for the Blind. This leads to poor academic performance which is demonstrated in the KCSE results of the subsequent years. Mugo (2013) also acknowledged that teachers in Kenya are computer illiterate and this hinders application of assistive technology and inculcation of computer skills into students so that they can use computers without having to dependent on a sighted guide. Mugo also added that students with limited or no exposure to computers experience challenges when using assistive technologies because they are unable or unwilling to interact with or operate computers to access the content they want, write, read, revise, or maybe do assignments.

Additionally, shortage of computers in most Schools for the Blind is the most critical problem. Most schools rely heavily on braille machines and very little on computers and iPads. Braille machines can hardly access internet or read digital format materials. This calls for implementation of iPads and computers which allow students to access the internet, access digital files, and interact with the world. These devices will expose such students to various forms of content that further boosts their learning process thus improving KCSE performance for individuals and the school at large. This aligns with the recommendations by Individuals with Disabilities Act (IDEA, 2004) that visually impaired students can perform better if they are given equitable access to technology devices that enable them to access academic materials just like their sighted counterparts.

4.7 Influence of Assistive Technology on KCSE performance among learners with visual impairment

The final research objective attempted to find out how assistive technology impacts on the visually impaired students' KCSE performance at Thika School for the Blind.

Responses in questionnaires were designed to allow the researchers to gather adequate data regarding this research objective to determine how assistive technology would impact the KCSE performance of the visually impaired students. A 4-item Linkert scale was used to rate the responses of teacher respondents regarding assistive technology. The responses included "Agree," "Strong Agree," "Disagree," and "Strongly Disagree," as shown in the table 4.19.

Table 4.19: Influence of assistive technology in the visually challenged students education

Response	Strongly Disagree (%)	Disagree (%)	Strongly Agree (%)	Agree (%)
Technology is the only way to improve academic performance of visually impaired students	10	0	70	20
Assistive technology allows visually challenged students to collect information independently regarding the curriculum	0	10	50	40
It increases performance in practical subjects such as Chem, Geo, Maths, e.t.c	10	0	30	60
Assistive technology increases the rate of interaction among the students, the students and curriculum, between the teacher	10	0	40	50
Usage of technology helps covering a lot of work	10	30	40	20

According to the findings, it was noted that assistive technology usage in Thika School for the Blind contributes significantly to curriculum completion and syllabus coverage. As such, it has a constructive implication on the KCSE performance of visually impaired learners. About 60% of teachers agree and strongly agree that assistive technology enables them and students to learn a lot of content in class. The proponents of the constructivist theory of learning observed that student involvement in practical activities boots their learning capacity. Thus, assistive technology provides a pleasant learning experience that enables

students to learn practically. Student participation is critical in importance but passiveness discourages learning.

The findings also reveal that assistive technology promotes a higher interaction between students, the curriculum, and the teachers, as manifested in the 90% of teachers who agreed and strongly agreed. This boosts performance, especially in subjects such as physics, mathematics, chemistry, and geography, which require participation. Most of respondents (90% who agreed and strongly agreed) supported that assistive technology enables visually impaired students to select science courses of students. It enables visually disabled students to access content and handle assignments on their own. Cephas, Andrew, & Njambi (2018) observed that usage of assistive technology enabled students to interact with content with easy while reading, writing, or doing assignments. Such students can draw, paint, write, or do calculations using computers and other assistive technology tools. Also, increased academic performance among visually impaired students can be attributed to the ability of students to access notes, revision materials, drawings, and mathematical formulas that help them when doing assignments.

Teachers recommended that, challenges preventing the full implementation of assistive technology in schools for the blind could be eliminated through multiple stakeholder corporations. The ministry of education in collaboration with the government and non-governmental institutions should work together to determine the learning needs of the visually challenged students, provide necessary resources, and then effectively implement relevant programmes to help various students. The school principal said that, “proper identification of the learning needs and provision of the necessary assistive technologies can significantly improve the efficiency of assistive technology in promoting improved academic performance.”

Students who accessed assistive technology indicated that assistive technology enables them to gain skills, gain self-confident, and improve in academic performance. The responses were analyzed and summarised in the table 4.20, below.

Table 4.20: Effects of accessing assistive technology

Item	Percentage
Improved performance in many subjects	77.8%
Dropped performance in majority of subjects	22.2%
Acquired self-confidence	69.4%
Able to connect with the outside world	61.1%
Known how to revise for exams	88.9%
Gained social skill	66.7%

Most students (77.8%) indicated that having access to utilize assistive technology enabled them to improve academic performance in several subjects. However, another group (22.2%) indicated that assistive technology made them to drop in majority of subjects. The failure can be attributed to either difficulty in the usage of assistive technology or spending too much time on social media platforms. Also, 88.9% of students indicated that assistive technology enabled them to learn how they can revise for their exams. Such contributions of assistive technology seem to promote or elevate the standards of learning for visually impaired students.

Students also mentioned the subjects in which the assistive technology has helped them to improve. The results and summarized in the table 4.21.

Table 4.21: Subjects Improved because of Independence Developed by Computers

Subject	Percentage
Mathematics	63.9%
Physics	66.6%
Chemistry	72.3%
Biology	75%
Geography	83.3%
Religion	80.5%
History	86.1%

English	55.5%
Swahili	33.3
Business	80.5%
Computer	66.6%

The results indicate that assistive technology enabled at 63.9% of students to improve in maths, 66.6% in physics, 72.3% chemistry, 75% biology, 83.3% geography, 80.5% religion, 86.1% history, 33.3% Swahili, 55.5% English, and 66.6% in computer. The data indicates the potential of assistive technology in improving KCSE performance if well implemented and utilized. The improvement captured in this data includes even addition of a single mark. So, it is expected that proper implementation of assistive technology can make learners shift from a lower grade to a higher one, for example, from D to C, C to B, or B to A.

Students however, reported that, appropriate application of computer could be facilitated by increasing the number of computer in the school, training teachers on computer skills, and ensuring that such computers have up to date software systems. A student suggested that, “Since the number of computers available is inadequate, I think adding more of them would make every student to have access to computers whenever they want to learn.”

Notably, assistive technology has a high potential of improving KCSE performance for visually impaired students. Koh & Lee (2008) suggested that creation of a constructive learning environment that encourages all students to actively participate in the teaching - learning process encourages improved performance in academic performance. It improves student participation and improve the quality of the teachers’ delivery mode. Provision of the appropriate assistive technology enables students to read, revise, and do assignments without depending on their fellow students, teachers, or a sighted guide to instruct them. It also allows teachers to deliver specialized teaching to ensure that no student is left behind or misses a concept because they are blind or cannot see. Such form of independence has a significant contribution in the performance of such students.

Notably, assistive technology removes differences that are caused by disabilities between sighted and visually impaired students. Oronga et al. (2013) argued that assistive technology is an enabler that enables visually challenged students to learn independently and successfully just like their regular counterparts. Thus, implementation of assistive technology that promotes equal access to the curriculum and content would reduce performance disparity in KCSE between sighted and visually impaired students. It would enable Thika School for the Blind to improve KCSE mean grade in the coming years.

CHAPTER FIVE: SUMMARY, RECOMMENDATION, AND CONCLUSION

5.1 Introduction

Chapter five is the last chapter in this research, which summarises the results, provides recommendations and conclusion, and then proposed opportunities for future research. The summary of the findings sections offers a recap of the four major objectives of the study based on the findings. Recommendation section provides possible solutions that can be implemented to help improve the effectiveness of assistive technology in boosting KCSE performance among the visually impaired students.

5.2 The Summary of the Research Findings

Based on the findings, various forms of assistive technology were used in school where there are computers and computer labs. However, inadequate computers in the computer labs were the major challenge impending use of assistive technology to help the visually challenged learners. Likewise, teacher respondents in Thika School for the Blind indicated that assistive technology plays a significant role in boosting KCSE performance for visually impaired students. The results are as summarised in the subsequent sections:

5.2. 1 Assistive Technologies Used in Thika School

Among the types of assistive technologies used at Thika School for the Blind, Braille machines were used mostly followed closely by computer. Large print devices, OCR, window eyes, speech synthesisers, talking calculators, and iPad were also used in the teaching-learning process. A majority of students preferred computers to other forms of assistive technology. They argued that computers are packed with other assistive technology tools such as speech output, braille output, screen readers, braille printers, and JAWS. These enable the visually impaired students to access content, socialise with peers, play games online and do assignments independently. Such build-in technologies and programmes in a computer improve hearing, vision, touch, and vision, thereby making students overcome visual impairment limitations. The teachers also used instructional media tools such as braille papers, slate & stylus, optical vision enhancers, and talking books.

Students confessed that Braille was the highly used assistive technology in school, computers and iPads could make lessons to be more engaging and fun because they are versatile and can be used in various ways. They provided learners with opportunities to access various types of content. This made it easy for visually impaired students to enjoy leisure time activities such as sending and receiving emails, tweeting, chatting on Facebook, and watching videos on YouTube. In the research, more than 70% of the student respondents showed that the internet and computers could significantly improve their KCSE performance. All students indicated that they were aware that assistive technology could significantly transform their academic performance, however, about 25% of them could not access assistive technology because of inability to use or access them. It can be adduced that assistive technology has a critical role in elevating the KCSE performance of visually impaired students at Thika School for the Blind.

5.2. 2 The Criteria Used to Select Assistive Technology

According to the study findings, the selection of suitable assistive technology that satisfies diverse needs of visually challenged students depended mostly on the level and nature of visual impairment of each student. Teachers considered such factors when aligning the best instructional media that fits the needs of the visually impaired students at hand. The availability of instructional media was another major factor that affected the selection criteria of assistive technology. Finally, lesson objectives, the topic, the onset of the visual impairment, and the experience of the student also played a significant role in choosing the most appropriate assistive technology for students at Thika School for the Blind. Lesson objectives, availability of the target assistive technology, and nature of the visual impairment are the main factors considered when teachers or the school is choosing the appropriate assistive technology for the students.

5.2. 3 Challenges experienced by Students and Teachers

Both teachers and students experience various problems while using assistive technology. The respondents revealed that computers are less in the computer lab, thereby

making it difficult for the students to learn regularly as per class schedules. As a result, teachers had to restrict the number of computer lessons to two lessons per week. It was also discovered that a majority of teachers in Thika School for the Blind lacked the technical skills required to implement the most appropriate assistive technologies since they were still held up analogue technologies such as braille. For that reason, they could not repair, service, or maintain the assistive technology devices and software whenever they breakdown or have technical issues. As such, school management usually consults experts or manufacturers who might not be readily available for help, repairs, maintenance, or consultation. In such a context, most teachers could not troubleshoot a program or system whenever there was a technical problem. Teachers are also not able to identify the needs of visually disabled students correctly to determine the kind of assistive technology is required to support such students.

5.2. 4 Influencing of Assistive Technology on KCSE Performance among Visually Impaired Students

It was discovered that assistive technology plays a important role in boosting the KCSE performance of visually impaired students. JAWS, note-takers, large print, smartphones, braille machines, speech output, iPads, and computers are the most impactful assistive technologies that can help improve the KCSE performance and learning independently among the visually disabled students at Thika School for the Blind. Such assistive technology tools and programs enable students to perform well in academic and access content, just like their sighted counterparts. Assistive technology facilitates adequate coverage of curriculum and syllabus since students can access lots of content and instructional information even outside the classroom notes. This boosts their level of independence as well as their KCSE performance. It can thus be confirmed that assistive technology is crucial in all academic institutions, including schools for the blind, because it improves the quality of education.

5.3 Conclusion

The study has demonstrated that schools for the visually impaired in Kenya use brailles, slate & stylus, braille machines, talking calculators, and other forms of assistive technologies to support students' learning. The contemporary technology being used in schools for the blind include iPads, computers, and other smart technology equipment that are less bulky, time-saving, and convenient for multiple needs of visually impaired students to boost their potential performance in KCSE. However, such items and tools are not well utilised because of their scarcity and lack of adequate skills by teachers and students to operate or service them. There are also not developed policy framework from the ministry of education that clearly stipulates how such kinds of assistive technology should be used to boost learning outcomes among the visually impaired students. Notably, the advent and widespread technology globally has made part of our daily life, and we cannot live without it. As such, it should be appropriately implemented in education to help students. Technology seems like the most appropriate strategy to improve the KCSE performance of visually impaired students, boost their confidence, and make them more independent in their daily lives. Form such a perspective, this research emphasises the need to use technology to allow visually impaired students to perform well in school and life, just like their sighted counterparts. This would prepare them even for jobs in the future after completing their education.

5.4 Recommendations

The study recommends the following;

(i) The Ministry of Education Science and Technology (MoeEST) should encourage schools for the visually impaired students to embrace assistive technology to improve their performance in KCSE. MOE acknowledges that learners with disabilities deserve to be supplied with the right assistive technology so that they can enjoy education right like other students (MOE, 2012). This could reduce the problem encountered by students who cannot access computers because they are

limited. MOE can also organize in-service training programmes for teachers to elevate the usage of assistive technology to ensure that they provide students with relevant computer literacy skills thereby making it easy for students to use various tools and devices to read and write (Oronga et al. 2013). MoeEST should Achools for the blind with suitable assistive technology that is easier and motivating to use, portable, and faster to ensure that visually impaired students enable them to become fully independent in the learning process to improve their KCSE performance

(ii) Selection of the assistive technologies should focus on the students' personal differences in terms of disability (Oronga et al. 2013). This means the nature of disability should be the main criteria for selecting suitable assistive technology for each student. Lesson objectives should also be significant role in assessing whether the chosen assistive technology has the capacity to deliver. Therefore, the most appropriate assistive technology is the one that enables students with specific visual disabilities to access curriculum and content undependably, just like a regular student. However, this is highly dependent on the implementation of the first objectives because availability of infrastructure, expertise, and financial support matters a lot in the implementation of the proposed assistive technology (Mugo, 2013). Teachers and students can only have various alternatives or options for choosing during learning-teaching when there is enough computers, well maintained devices, and other assistive technology tools. It will also enable students to have personal computers that are customized with programmes and software systems that help minimize the limitations experienced by the students because of various forms of visual disabilities.

(iii) Challenges facing teachers and students in Thika school for the Blind could be alleviated through in-service teacher training and development programmes to ensure that teachers are continuously provided with skills to use assistive

technology when teaching visually impaired students to boost KCSE performance (Kavagi, 2010). When teachers are well trained, they are able to handle visually impaired students appropriately and teach them how to utilize various forms of assistive technologies.

(iv). Assistive technology usage in Thika School for the Blind should be aligned with the pedagogical drive and the catalytic drive to actualize the potential of students in academic performance thereby putting them in a better position to further improve in the KCSE. Pedagogical drive focuses on improving teacher and student output through efficient content creation and delivery methods (Kavagi, 2010). Likewise, catalytic drive strives to cultivate independence among the visually impaired students to develop creativity, innovation, ability to learn, revise, and do assignments on their own.

5.5 Suggestions for Further Study

(i) Research should be conducted to determine the strategies that can be implemented to enhance quality access to curriculum content for students with visual disabilities to improve their academic performance.

(ii) A study should be conducted to determine the most appropriate instructional strategies to ensure there is improved academic performance among visually impaired students using assistive technology.

(iii) Research is required to define the role of the Ministry of Education Science and Technology and the Government of Kenya ion the implementation of assistive technology in schools for the visually impaired.

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

Moses Johnson Gitari

University of Nairobi,

Date 17th October 2020

Dear Sir/Madam,

RE: INTRODUCTION LETTER TO COLLECT DATA

I am a final year Master of Arts student at the University of Nairobi. As part of the requirement for the award of the degree of Master of Arts in Curriculum Planning, I'm taking a research project on **"Influence of Assistive Technology on performance of visually impaired students at Thika High School for the Blind in Thika Town"**.

The purpose of this letter is to kindly ask you to fill the questionnaire to allow me gather the data required for the study. The information provided is purely for research work and to improve knowledge in the Assistive Technology usage and Special Education in Kenya. All information provided will be used only for research purpose and your privacy will be safeguarded.

Thank you very much.

Yours faithfully,

Johnson Gitari Moses

APPENDIX II: QUESTIONNAIRE FOR STUDENTS WITH VISUAL CHALLENGES

Please, put a tick or a dot in the brackets []. Also, when required, you can write your comment on the space provided. Your name is not required so do not write.

1. (a) Indicate your age and class/form

(i) Age [Less than 14 years] [15-16 years] [17 -18 years] [19 years and above]

(ii) Form [One] [Two] [Three] [Four]

(b) Select the nature of your visual disability

(i) Low Vision [ ]

(ii) Total Blindness [ ]

(iii) Sighted [ ]

(iv) Blind [ ]

(c) What is your favourite reading mode? _____

(d) Mention a variety of tools and devices you use to write and read

_____

2.(a) Which tools do you use to write and read during your free time? Tick in the box.

(i) iPad [ ]

(ii) Slate and stylus [ ]

(iii) Computer [ ]

(iv) Braille machine [ ]

(vi) Others [ ]

(b) In the items you ticked above in 5 (1), which one do you suggest should be used mostly in your education system? Explain why.

_____

(c) Do you attend computer classes? No [ ] Yes [ ]

(d) If yes, indicate the venue _____

(e) Does your school have any computer laboratory

No[] Yes[]

(f) If yes, indicate the number of computers available _____

(g). How many times per week do you go to computer lab?

(h) What inspires your regular usage of assistive technology? Select and mark where appropriate.

(i)Write-out-loud

(ii) Large print access (lunar and large) [ ]

(iii) Mega dots [ ]

(iv) JAWS [ ]

(v) Window eyes [ ]

(vi) Intellitalk [ ]

4. (a)Do you do assignments or revise using assistive technology? If yes, which subjects has it helped you?

5. Do you think assistive technology can improve your academic performance? No [] Yes []

If no, indicate why _____

6. Problems Experienced by Students in the application of ICT (4-Item Likert Scale)

(a). Assistive technology Allows visually challenged students to enjoy equal opportunities with other individuals.

(i) Strongly Disagree [ ]

(ii) Disagree [ ]

(iii) Agree [ ]

(iv) Strongly Agree [ ]

(b) Teachers do not attend to my personal needs and does not give me adequate time to internalize with computer.

(i) Strongly Disagree [ ]

(ii) Agree [ ]

(iii) Disagree [ ]

(iv) Strongly Agree [ ]

7. Are there enough computers in the computer lab? If not, what inconvenience do they bring?

8.List other challenges you experience while using assistive technology.

Influence of Assistive Technology on the Academic Performance of Visually Impaired Students Student/Learner

1. After knowing how to access information using assistive technology I have____

(I) Improved performance in many subjects [ ]

(ii) Dropped performance in a majority of subjects [ ]

(iii) Acquired self confidence [ ]

(iv) Been able to connect with the outside world [ ]

(v) Known how to revise for exams by my own [ ]

(vi) Gained social skills [ ]

2. (a) In what subjects have you improved due to independent using computers?

_____

(b) What do you think should be done to allow you utilise computers appropriately?

_____

APPENDIX III: QUESTIONNAIRE FOR TUTORS OF VISUALLY CHALLENGED STUDENTS

Part A: Assistive technology used and level of teacher qualification

1. (a) Kindly select your age from the options below.

(i) 40-49 years

(ii) 30-39 years

(iii) 20-29 years

(b) What is your professional or educational attainment?

Educational			Professional	
MSC/MA/MED	[	]		
BED	[	]	DIP EDU	[ ]
B-A	[	]	S1	[ ]
KCSE/AECE/ KCE			P1	[ ]
KISE	[	]	P2	[ ]
KCPE/CAPE/CPE	[	]	UT	[ ]

Others _____

(b) How long have you been teaching visually disabled students?

(i) [Less than 1 year]

(ii) [2-5 years]

(iii) [10-20 years]

(c) Did you train as a teacher of visually challenged students?

(i) No [] (ii) Yes []

Part B: Indicate the forms of assistive technology you use to teach

Assistive Technology Tools	**Yes**	**No**
Braille		

Talking books		
NVDA daisy book		
Windows Eyes		
JAWS		
Microcomputers with braille output and input		
Speech synthesiser		
Speech processor		
Megadots		
Dolphin pen		
Braille translation software		
IPad		

(a) Which selection criteria do you use to ensure you pick the appropriate technology for students with various types of visual impairment?

Mark where appropriate (√)

(i) Nature of the content [ ]

(ii) Lesson objectives [ ]

(iii) Nature of impairment [ ]

(iv) Learner's experience [ ]

(v) Age when impairment begun [ ]

(vi) Technology tools available [ ]

(vii) The level of vision [ ]

Part C: Difficulties experienced by students and teachers

Provide a list of challenges you experience while trying to get assistive technology for your students

_____

Which problems do you encounter while teaching using assistive technology?

_____

Provide a list of how you think such problems or challenges can be solved_____

Part D: Effect of assistive technology in the visually challenged student's education

1. Assistive technology is the only way to improve academic performance of visually disabled students. Mark (√) where appropriate

(i) Strongly Disagree [ ]

(ii) Disagree [ ]

(iii) Agree [ ]

(iv) Strongly Agree [ ]

2. Usage of assistive technology helps in covering a lot of work.

(i) Strongly Disagree [ ]

(ii) Disagree [ ]

(iii) Agree [ ]

(iv) Strongly Agree [ ]

3. Assistive technology increases the rate of interaction among the students, between students and the curriculum, between the teacher and students thereby increasing performance in practical subjects like chemistry, geography, computer, mathematics, physics, and others.

(i) Strongly Disagree [ ]

(ii) Disagree [ ]

(iii) Agree [ ]

(iv) Strongly Agree [ ]

4. Assistive technology allows visually challenged students to collect more information independently regarding the curriculum.

(i) Strongly Disagree [ ]

(ii) Disagree [ ]

(iii) Agree [ ]

(iv) Strongly Agree [ ]

APPENDIX III: OBSERVATION CHECKLIST

Instructional media available

Instructional media	Number Present	Not Present
Slate and stylus		
Tactual globes and maps		
Cramnier abacus		
Cubelithm slate and cubes		
Tylor frame and types		
Braille papers		
Markers and reading windows		
Binocular, Telescope, and Microscope		
Braille books		
Templates and writing guides		
Brailled compass, protractor set squares, rulers etc.		
Optical-tactual – connector		
Sound balls		
Talking clocks and calculators		
Braille writers		
Tactual diagrams		
Large print books		
Magnifying glasses		
3-D materials		
Tactile graphic kits		

APPENDIX IV: RESEARCH LICENSE

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **258554**

Date of Issue: **26/August/2020**

RESEARCH LICENSE

This is to Certify that Mr.. Moses Gitari Johnson of University of Nairobi, has been licensed to conduct research in Kiambu on the topic: INFLUENCE OF ASSISTIVE TECHNOLOGY ON THE KCSE PERFORMANCE OF VISUALLY IMPAIRED STUDENTS AT THIKA HIGH SCHOOL FOR THE BLIND for the period ending : 26/August/2021.

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