ACCESS TO INFORMATION COMMUNICATION TECHNOLOGY AND ITS INFLUENCE ON EDUCATION FOR LEARNERS WITH VISUAL IMPAIRMENT IN SELECTED SPECIAL PRIMARY SCHOOLS, KENYA

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DECLARATION

I declare that this research thesis is my original work and has not been presented in any other university/institution for consideration of any certification. This research thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited using current APA system and in accordance with anti-plagiarism regulations.

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DEDICATION

To my parents, the late Isaiah Miningwo and Paulina Chebii, you laid the foundation upon which I build. To my dear husband, Obadiah Keitany, you held my hand in my darkest moments. To my children, Billy Kipchirchir, Karen Jepchumba, and Laura Jerop, you are the source of my inspiration.

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LIST OF ABBREVIATIONS AND ACRONYMS

CCTV	Close circuit Television
CRPD	Convention on the Rights of Person with Disabilities
EFA	Education for All
GoK	Government of Kenya
HR	Human Resource
ICT	Information Communication Technology
IITE	Institute of Information Technologies in Education
IT	Information Technology
KICD	Kenya Institute of Curriculum Development
MGDs	Millennium Development Goals
MoEST	Ministry of Education Science and Technology
NVDA	Non-Visual Desktop Access
ODL	Open and Distance Learning
PC	Personalized Computers
PDAs	Personal Digital Assistants
SNE	Special Needs Education
SPSS	Statistical Package for Social Sciences
SWD	Students with Disabilities
TSC	Teachers Service Commission
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
VI	Visual Impairment

ABSTRACT

Information Communication and Technology has become the most suitable tool for learners with special needs for it meets their different learning demands. Access to this tool by these learners is hence vital. Learners with visual challenges require this technological tool for their education and personal support. This study therefore investigated access and use of ICT by learners in primary schools for visually challenge. The study was guided by the following objectives: To identify ICT resources available in the special primary schools for visually challenged in Kenya; to determine the level and nature of use of ICTs in teaching and learning in the special primary schools; to find out the learner- related factors that influence the access to and use of ICT in teaching and learning in the special primary schools; to establish the teacher- related factors that influence access to and use of ICT in the special schools; to explore the challenges encountered by the special schools in accessing and using ICTs for teaching and learning; to suggest a model for provision of learning support to learners with visual challenges in the special primary schools. The study was guided by Bruner's Constructivist theory and was also supported by the Social Model of Disability and the philosophy of Universal Design for Learning. The study adopted descriptive survey design and used both qualitative and quantitative methods of data collection. It targeted the seven special primary schools for the visually challenged in the country. Purposive sampling method was used to select the schools, head teachers, teachers and ministry of education officials. Stratified random sampling method was used to sample the learners. The sample size consisted of 3 MoE officials, 3 headteachers, 3 computer teachers, 18 class teachers and 168 learners with visual challenges. The students were selected randomly. Data collection instruments included questionnaires for the teachers and for the learners, classroom observation schedule, interview schedules for head teachers and officials from the ministry of Education. Inventory document analysis was used to collect the data. Validity and reliability of the instruments was tested through piloting in one school which was not included in the main study. The questionnaires were tested and accepted at r=0.785. Data was analysed through descriptive statistics that included frequencies, percentages, means, ratios and inferential statistics. The Statistical Package for Social Sciences (SPSS) was used to analyse the data. The study found out that the learners did not effectively access ICT in their learning. Use of ICT in teaching and learning was not effective. Both the teachers and the learner's ICT skills were low and the schools were not well equipped with quality ICT resources. The study concluded that there is minimal use of ICT in teaching and learning in the schools. The study recommended that schools be equipped with modern technologies and more rigorous training of teachers on the use of ICTs in teaching learners with visual challenges be emphasized.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Education is crucial for gaining gainful employment, creating opportunities for career advancement, and improving overall quality of life (Duta, Scguri-Geist, & Kundu, 2009; Getzel, Stodden, & Brief, 2001). Worldwide, students with visual impairments must have special access to high-quality education (Mugo, 2013; Dorwick, Anderson, Heyer & Acosta, 2005; Rimmerman & Araten-Bergman, 2005; Inbar, 2003; Drake, Gray, Yoder, Pramuka & Llewellyn, 2000; Inbar, 1991). Nevertheless, students with visual impairments continue to lag behind their sighted peers in education despite the revolution in social and legislative policies regarding the provision of equal opportunities for quality education and good employment for these persons (United Nations Conventions on the Rights of Persons with Disabilities; UNCRPD, 2018).

Global research has demonstrated that integrating Information, Communication, And Technology (ICT) into pedagogy is one of the best ways to address the issue of these students' lack of access to high-quality education. According to UNESCO (2006), for example, ICT has emerged as the most effective tool for assisting individuals with varying learning needs in exercising their rights to education, work, social life, leisure, and democratic channels. Newhouse's (2002) study on the effects of ICT in Western Australia also shown that ICT has an impact on the quantity and quality of education worldwide. ICT literacy has, in essence, improved teaching and learning by offering genuine opportunities for tailored instruction through its dynamic, interactive, and engaging material. Worth (2001) stipulates that there is enough evidence of the impact of

ICT on intermediate outcomes such as motivation and engagement with independence in learning, which is greater and more persuasive. Indeed, the benefits of using ICT in teaching include increased collaboration and confidence in pedagogy.

The term "information and communications technology" (ICT) is broad and encompasses all forms of communication, such as satellite systems, cellular phones, radio, television, networking, computer hardware, and software, as well as the many applications that are related to them, such as teleconferencing and distance learning (Dos Santos et al., 2022). In order to accomplish learning objectives, using computers and technology-based tools offers exceptional chances for cooperation, development, and meaningful engagement with one another across a wide geographic distance (Orogbemi et al., 2022).

The incorporation of ICT into education has the potential to transform society's approach to learning and modify the characteristics and methods of the classroom (Montenegro-Rueda et al., 2022). Convenience, adaptability, and intuition are now requirements in the ICT world. ICT lays the groundwork for a new learning culture by enabling learners to develop, change, and exchange ideas and information globally (Arslantas & Gul, 2022). In order to improve analytical, creative, and problem-solving skills, it supports learner-centered, constructivist teaching methods (Akbar et al., 2022).

Special education requires that learners accomplish tasks at their own pace and decently (Trut, 1999). This could be made possible by the use of adaptive and/or assistive ICT. According to Castro, Sanchez, and Aleman (2011), learners are more frequently engaged in meaningful use of computers by building new knowledge through accessing, selecting,

organizing, and interpreting information and data. Further, Koc (2005) found out that ICT enables students to communicate, share, and work collaboratively anywhere, anytime, and allows them to have the opportunity to analyze problems, explore ideas, and develop concepts. Research has further shown that the use of ICT makes learners develop greater pride in their work and complete tasks on time. UNESCO (2006) attested that ICT offers potential support for lifelong learning for all types of learners, including those who have special educational needs, including the visually impaired. Listenic (2010) further affirmed that ICTs have the potential to reduce discrimination and provide more opportunities to engage people with disabilities in all aspects of life, including teaching and learning. The application of ICTs in teaching and learning enhances independence, integration, and equal opportunities for learners with visual impairments, and in this way, it facilitates their inclusion in society as valued, respected, and contributing members.

ICT is now a reliable source of knowledge for transforming and reforming education. Contrarily, numerous studies demonstrate that effective ICT use can improve educational quality and link classroom instruction to real-world contexts (Kapote & Srikanth, 2021). ICT tends to open up more opportunities for visually impaired students to attend education anytime, anywhere. ICT helps visually impaired learners gain new knowledge by facilitating their access to, selection of, organization of, and interpretation of high-quality resources (Hood & Littlejohn, 2017). Additionally, ICT makes it possible for people who are blind or visually impaired to collaborate, explore ideas, develop concepts, learn, and share a variety of learning experiences (Tatut, 2022).

Those who are visually impaired are among those who are typically categorized as disabled. These individuals also include those who suffer from numerous disorders or impairments of the mind, body, or ears (Hall et al., 2022). Those who are impaired are a small minority whose condition prevents them from competing favorably with those who are sighted in society. Therefore, their needs are not clearly stated (Campisi et al., 2021). At all stages of human activity, it is now widely accepted that having information readily available is a requirement for enlightenment and meaningful progress (Jebril & Chen, 2021). In this contemporary society, which is largely governed and propelled by computer technology, any aspect of society that prevents a sector from benefiting from the advantages associated with access to knowledge is likely to suffer from marginalization and decadence (Kong & Loi, 2017).

The integration of ICT in education has been compulsory in developed countries since the 1980s. Most developing countries currently emphasize new dimensions, pedagogical approaches, teaching, and learning that would enhance knowledge in interactive and self-directed ways. The countries acknowledge that ICT can play a great role in preparing learners to acquire skills and competencies that are fundamental for competing in the emerging global 'knowledge' economy (UNESCO, 2017).

Studies conducted in developing countries have demonstrated the importance of using ICT in education, especially for learners with special needs. However, the question of how ICT ought to be used effectively for the education of learners with disabilities is currently the main concern in all countries, particularly those that have ratified the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD, 2006). Some

scholars have even questioned the potential of ICTs, arguing that digital tools are inherently disabling for people with disabilities (Goggin & Newell, 2003). Most digital tools are unable to meet the specific needs of the learners, such as supporting independent functioning, working as intended, or helping them to address the demands of the curriculum (Mull & Sitlington, 2003).

Research has also demonstrated several other factors that could bring about the abandonment of the use of ICT in the educational support of learners with special needs, including those who are visually impaired. In Taiwan, for instance, Shiue (2007) used path analysis to study factors that influenced teachers' use of technology among 242 secondary Taiwanese teachers, and she found that teachers' ICT integration in the teaching-learning process was largely determined by teachers' skills in using the technology. A study by Buabeng (2012) in Ghana revealed that effective adoption and integration of ICT into teaching in schools depends mainly on the availability and accessibility of ICT infrastructure and resources, such as hardware and software. On the other hand, the study by Ngwu (2014) in Nigeria found that there were enough ICT resources, but the use of them in teaching and learning was below expectations. Research conducted by the Namibia Training Authority (2006) in Namibia indicated that there are barriers to the integration of ICT in inclusive settings. These barriers included attitudinal, administrative, architectural, programmatic, and training facilitators. The studies that have been reviewed have indicated administrative and teaching-related obstacles to the efficient use of ICT in the classroom. Nevertheless, the investigations were conducted outside of Kenya in other nations with distinct environments, and the findings may not

apply in the Kenyan context. Therefore, it was imperative to conduct a study in Kenya to see whether the same obstacles might be influencing the use of ICT in classrooms.

East African countries also suffer from ineffective use of ICT for learners with disabilities. In Rwanda, the study by Sabomana (2017) revealed that the level of integration of ICT in teaching and learning science in lower public primary schools was low. It was found that the minimal use of ICT was influenced by inadequate ICT abilities among the majority of science teachers and inadequate resources in most primary schools. The studies conducted about the use of ICT in pedagogy, as described herein, clearly demonstrate that countries the world over have embraced the use of ICT in the teaching and learning process. However, there are numerous barriers to the effective use of technology in pedagogy. Although the existing studies were informative for the current investigation, their methods and settings differed with the context in Kenya, as such, the findings may not be applicable in Kenyan schools. Thus, research in Kenya was required to determine whether comparable obstacles encountered in other nations have an impact on the integration of ICT in Kenyan schools.

In Kenya, the government has put in place a national ICT policy and e-government strategy that provide guidelines for the transformation of the Kenyan population into a digital society. The government recognizes that an ICT-literate workforce is the foundation on which the nation becomes a knowledge-based economy. For this, the government made education a platform for equipping the nation with ICT skills to create dynamic and sustainable economic growth. To achieve this vision, every educational institute, teacher, learner, and respective community ought to have been equipped with

appropriate ICT infrastructure competencies and policies for usage and progress. The Ministry of Education Science and Technology (MOEST) calls for the transformation of teaching and learning with ICT to incorporate new pedagogies that are appropriate for the 21st century (Kenya Institute of Curriculum Development, 2017).

Moreover, the government's new constitution (2010) and Vision 2030 (2007) place education at the centre of unlocking Kenya's future. Vision 2030 is grounded on economic, political, and social pillars, where education is the centre of social growth. The government is committed to the provision of quality education, training, and research as a human right for all Kenyans, following the law and international conventions. The use of ICT in pedagogy was therefore emphasized to achieve this mission. Therefore, ICT should be able to offer tools for enhancing how people do their daily activities without restrictions or boundaries (Keitany et al., 2020).

Unfortunately, Kenya has equally suffered from ineffective use of ICT, especially for learners with disabilities. A study by Makanda (2015) on the use of ICT in teaching found that teachers had a positive attitude towards the use of ICT, but barriers such as inadequate skills to integrate the technology into their teaching were a problem. Moreover, Alma (2014), in his study, concluded that ICT integration in classroom instruction in Kenya is constrained due to a lack of adequate training and refresher courses for teachers, inadequate resources, and inadequate support from technicians and administration. Another study by Biwot (2012) cited determinants of ICT access in schools as the capability of the implementers, that is, teachers, headteachers, and education officers; availability of materials and resources; positive attitudes of teachers

and learners; existing school setup; and supportive school management. The aforementioned studies are informative on factors affecting the use of ICT in teaching and learning; however, the studies focused on regular learners without special needs. Therefore, it was imperative to establish if the listed barriers to effective use of ICT in schools exist for learners with visual impairments.

Lack of sight places certain restrictions on students with visual impairments access to information, which prevents them from reaching their full potential and wastes the brainpower that could have been used to boost the nation's economy (Barbareschi et al., 2020). Researchers in Kenya have demonstrated that the performance of learners with visual impairments has lagged far behind that of their sighted peers at all levels of education (Munyi, 2017; Wanjau, 2016; Mugo, 2013; & Nzoka, 2011). Given the role that ICT plays in instruction, the performance of learners with visual challenges in Kenya should meet international standards. A pertinent question one would ask at this point is: are the schools for visually impaired learners in the country accessing and using ICT effectively in their teaching and learning? There are no answers to the pertinent questions because of a lack of empirical studies on the use of ICT for learners with visual impairments. Based on this, it was therefore viable to conduct a study to investigate the access and effective use of ICT for the education of learners with visual impairments in special primary schools in Kenya.

1.2 Statement of the Problem

It is evident that ICT has a positive impact on the education sector the world over and that many countries in the world have embraced the use of this technology in pedagogy. Kenya has made considerable efforts to make ICT accessible to all groups of learners, including those with visual impairments. To ensure quality education for all, the government has given support and put emphasis on the use of ICT in all schools at all levels, including special schools. Moreover, in 2018, the government introduced the Competent-Based Curriculum (CBC) in primary schools. In this curriculum, one of the core competencies is digital skills, meaning that ICT use in schools is inevitable.

Moreover, legislation such as the Kenya Constitution (2010), the Persons with Disabilities Act (2003), and the Special Needs Education Policy (2009) has resolved a number of important issues affecting the quality of education for learners with visual impairments. However, research has shown that these learners still lag behind their sighted peers in the access to ICT. This has generated numerous questions with respect to what could be done to help the learners compete equally with their peers. Scholars have demonstrated that ICT has the potential to reduce discrimination and provide more opportunities to engage people with disabilities in all aspects of life, including teaching and learning. Further, research has shown that the use of ICT in learning enhances independence, integration, and equal opportunities for learners with visual impairments, and in this way, it facilitates their inclusion in society as valued, respected, and contributing members. Given the role that ICT plays in instruction, the performance of learners with visual impairments in Kenya should meet international standards.

Researchers in Kenya have shown that, across all educational levels, the performance of learners with visual impairments has fallen well short of that of their sighted counterparts. Special schools for the visually impaired in Kenya have a legal obligation to provide learning support and substantive accommodations for the learners that afford them quality education and equal opportunities in their future lives. However, the current practice of providing this essential support to the learners in special primary schools lacks sufficient research. There is a lack of empirical research on ICT use for learners with visual impairments. Therefore, this was an opportunity for this research to investigate in a profound manner the access to ICT in pedagogy in special primary schools for learners with visual impairments in Kenya.

1.3 Purpose of the Study

The purpose of the study was to investigate the access of ICT and its influence on the education for learners with visual impairment in special primary schools, Kenya.

1.4 Objectives of the Study

The following specific objectives guided the study.

(i) To identify ICT resources available in the special primary schools for learners with visual impairment in Kenya,

(ii) To determine level of integration of ICTs in teaching and learning in the special primary schools for learners with VI

(iii) To find out factors that influence learners access and use of ICT in learning in special primary schools for learners with VI

(iv) To identify factors that influence teachers access to and use of ICT in teaching and learning in special primary schools for learners with VI

(v) To establish the administrative support that influence access to and use of ICT in the special primary schools for learners with VI

(vi) To propose a model for access of ICT and provision of the learning support for the learners with visual impairments in the special primary schools in Kenya.

1.5 Research Questions

The study sought to answer the following research questions:

(i) Which ICTs resources are available in the special schools for learners with visual impairments in Kenya?

(ii) What is the level of integration of ICTs in teaching and learning in the special primary schools for learners with VI

(iii) What are the factors that influence learners access to and use of ICT in learning in special primary schools for learners with VI

(iv) What are the factors that influence teachers access to and use of ICTs in teaching and learning in special primary schools for learners with VI

(v) What are the administrative support factors that influence the access and use of ICT in the special primary schools for learners with VI

(vi) What model would offer access to ICT and quality provision of the learning support to learners in the special primary schools in Kenya?

1.6 Significance of the Study

The findings of the study may be useful in the following ways:

The results of the study may assist the Ministry of Education in developing strategies to supply ICT resources and raise awareness among pupils, instructors, and head teachers of the value of utilizing ICTs in the instruction of pupils with visual impairments.

Policymakers may benefit from the findings of the study as they may be able to come up with effective policies that may aid in the provision, planning, and use of ICTs in schools for learners with visual impairments.

Additionally, the findings and recommendations of the study may be helpful to the management of the school since they would be informed on factors that hinder pupils with visual impairments from accessing and utilizing ICT and how it affects their education. Further, the research would assist the school administration in developing a school ICT policy that could comply with both the national and ministry ICT policies. In addition, the study's findings may help teachers since it may provide them with more knowledge on how to use ICTs and suitable pedagogical approaches in their lessons.

Additionally, the results of this study add to the existing literature in the field of teaching and learning for learners with special needs. The findings added to the body of knowledge in the area of ICT and school administration and laid the groundwork for further investigation. Furthermore, this study's recommendations, findings, and proposals would identify research gaps that could guide the execution of additional investigations.

1.7 Assumptions of the Study

This study was conducted under the following assumptions, that:

i. Teachers of learners who are visually impaired were trained on use of ICT in teaching their learners.
ii. Learners living with visual impairments face certain challenges in accessing and using ICT in their learning process.
iii. Special primary schools had integrated ICT in teaching-learning of learners with visual impairments
iv. There were factors that affected the access and use of ICT by both the teachers and the learners in the special primary schools for the visually challenged.
v. Teachers and learners used ICT in the teaching and learning process.
vi. A model of access and provision of services to learners with VI could support a great deal in accessing ICT in the special schools in Kenya.

1.8 Limitations and Delimitations of the Study

1.8.1Limitations

The study collected data from three primary schools for learners with VI, which can compromise the generalizability of the data. For exhaustive results and for the purpose of generalization, this study would have covered all the schools of learners with VI in Kenya. However, due to the distance between the schools, the researcher conducted the research in the three schools. The researcher further experienced the challenges of accessing some of the schools since they are situated in areas with poor transport networks. The researcher therefore set the study period with a sufficient time allowance in case of any delays. The study adapted a descriptive survey design and used research

tools with items that sought respondent opinion. As a result, the findings generated from opinion only applied to the three selected schools.

1.8.2 Delimitation of the Study

ICT encompasses a broad spectrum of hardware and software; however, this study concentrated on ICT as a teaching tool for learners who are visually impaired in special primary schools in Kenya. The study could have explored ICT access and use in teaching and learning for learners with other types of disabilities, but doing so would have increased the study's scope. Nonetheless, the researcher recommended further research on the same in other special schools that serve students with various kinds of disabilities.

1.10 Theoretical Framework

Bruner's constructivism theory (1990) served as the main theoretical foundation for the research. According to this view, the basis for innovation, creativity, or the process of generating new information, is the learner's past experiences. The student makes use of the knowledge they already possess in order to learn new information from a teacher or facilitator. These encounters arise from the surroundings and from the learner's interactions with their classmates.

The process of learning environmental creativity requires the learner to apply what they have learned and experienced to generate fresh insights related to their area of emphasis. A teacher serves as both a facilitator and an advisor in this kind of scenario. Giving instructions allows learners to attribute and generate their own knowledge, which is the

teacher's job. This results in education. Ensuring that what is taught is relevant to the learner's prior experience is therefore the primary goal of the instructor (Jonassen, 1997).

Additionally, the teacher must ensure that all of the material he teaches is applicable to the real world or its surroundings. This could aid in the learners' acquisition of more knowledge that would allow them to resolve problems in their surroundings. The constructivism approach places a strong emphasis on the responsibility teachers have to effectively and actively involve students in the teaching and learning process. The use of ICTs in conjunction with learner-centred approaches gives students a broad knowledge base that enables them to become self-reliant and lifelong learners. Constructivism theory was considered significant for this investigation since it provided insights into the efficient ways in which humans learn.

In terms of life milestones and overall experience, learners with special needs, especially those who face visual impairments, typically lag behind their classmates (Mugo, 2013). This necessitates better ICT adoption and usage for them. Learners who experience visual problems may find it more difficult to adopt new behaviours than their sighted counterparts. It is largely up to their teachers and other stakeholders who supply the technology for them to be able to access and use ICTs that have been tailored or adapted for them. When teachers are given technology, for example, there are several elements that affect their choice of how and when to use it. Likewise, other education stakeholders may choose to supply technology to students or not, based on how highly they regard and regard the learners. For this study to effectively scrutinize the challenge these learners

face in terms of access and use of ICTs in their learning process, the Social Model of Disability philosophy was also used to inform the study.

1.10.1 Goffman's theory of stigma, the Social Model of Disability (Oliver, 1990)

The social model of disability can be traced back to the 1960s (Hunt, 1966), and in the 1970s, the Union of the Physically Handicapped Against Segregation (UPIAS, 1977) questioned the dominance of a section of the staff in the medical field and those in social work over people with disabilities. UPIAS resisted the status quo and strived for a change in the social order in society. The social model of disability is a comprehensive perspective originated by PWDs to define their place in society. It is endeavouring to bring together PWDs into one group by defining who they are and explaining disability as a political issue.

The social model illuminates the areas in society where PWDs encounter discrimination and offers a chance for this group of individuals to act as a united group to counter discriminative practices (Campbell and Oliver, 1996). By exposing the areas of discrimination, the social model seeks to acquire for PWDs the same citizenship rights that people without disabilities possess. The benefit of adopting this perspective on disability in this study was that it would help to recognize the impediments that learners with visual impairments encounter within their educational environment. This helped in identifying ways in which these learners were unnecessarily isolated from full participation in their education.

The social model of disability is anchored on the philosophy of inclusive instruction. From the social model perspective, learners in the classroom continuously engage in cooperative activities, including discussions. The manner in which the involvement of learners is organized, the sort of discourse and standards of performance set for each student, and the manner in which learners relate to one another and other individuals in the classroom could make the learners feel welcome or isolated (Allan, 1999; Collins, 2003). In other words, teachers are in a position to demonstrate positive regard, recognize differences amongst the class members, and require certain levels of behavior to exhibit these virtues (Shapiro, 1999; Hehir, 2003). They can structure the learning environment in such a way that the learners feel like part of the class (Tomlinson, 1999). Also, teachers can demonstrate the disability as being abled differently by incorporating learning materials that enable them to academically perform better and depict disability positively (Ben-Moshe, 2006; Gallagher, 2006).

The social model theory was relevant to this study because access and use of ICTs by learners with visual impairments depend on how school administrators and teachers in education take and support the learning through the provision of ICTs and quality instruction, respectively. In other words, how well the special primary schools are adapted to the needs of these learners depends on how the teachers, school administration, and society in general perceive the learners with visual impairments.

Learners with visual impairments, just like their sighted peers, differ in terms of cognitive abilities, learning styles, and, uniquely, in terms of the extent to which the disability affects their learning. This calls for specialized pedagogical practices to enable access to

quality education. The study therefore considered the theory of universal design for learning to help in analyzing how well the learners with visual impairments access ICT and how well the teachers use the technology to teach the learners.

1.10.2 Universal Design for Learning Theory (Aslaksen *et. al*, 1997)

Universal design for learning theory provides an educational structure that is considered to make the best of learning opportunities for all learners to acquire knowledge, skills, and values in learning (Rose & Meyer, 2002; Rose & Meyer, 2006; Rose, Meyer, & Hitchcock, 2005). According to Scott, McGuire, and Embry (2002), the theory of universal design was implemented as a form of instruction comprising practical design and the use of inclusive instructional strategies that benefit a wide range of learners, including those with disabilities. Learners with visual impairments at all levels of education should access quality learning just like their sighted peers.

The three principles of universal design comprise multiple methods of presentation where the teacher uses various and flexible ways to present content to the learners. In the principles, multiple methods of expression where learners are given opportunities to interact with the learning material in a flexible manner are emphasized, and engagement where learners are allowed to express their understanding of the learned material in multiple and flexible ways is paramount. Adopting this educational design was important in this study, for it helped to analyse how the teachers used ICTs with instructional methods to teach learners with visual impairments in the classroom. The theoretical base of this study helped in conceptualizing the study and aided in understanding how the

variables interacted in this study, as graphically presented in the following conceptual framework.

1.11 Conceptual Framework

Learners with visual impairments deserve quality education just like their sighted peers. Various factors come into play to enable them to access this kind of education. In order to have a comprehensive picture and make an in-depth analysis of these factors, this study was guided by the theories and the various international and national policies previously described in this study for learners with disabilities. From these, the research variables interacted as shown in the following conceptual framework.

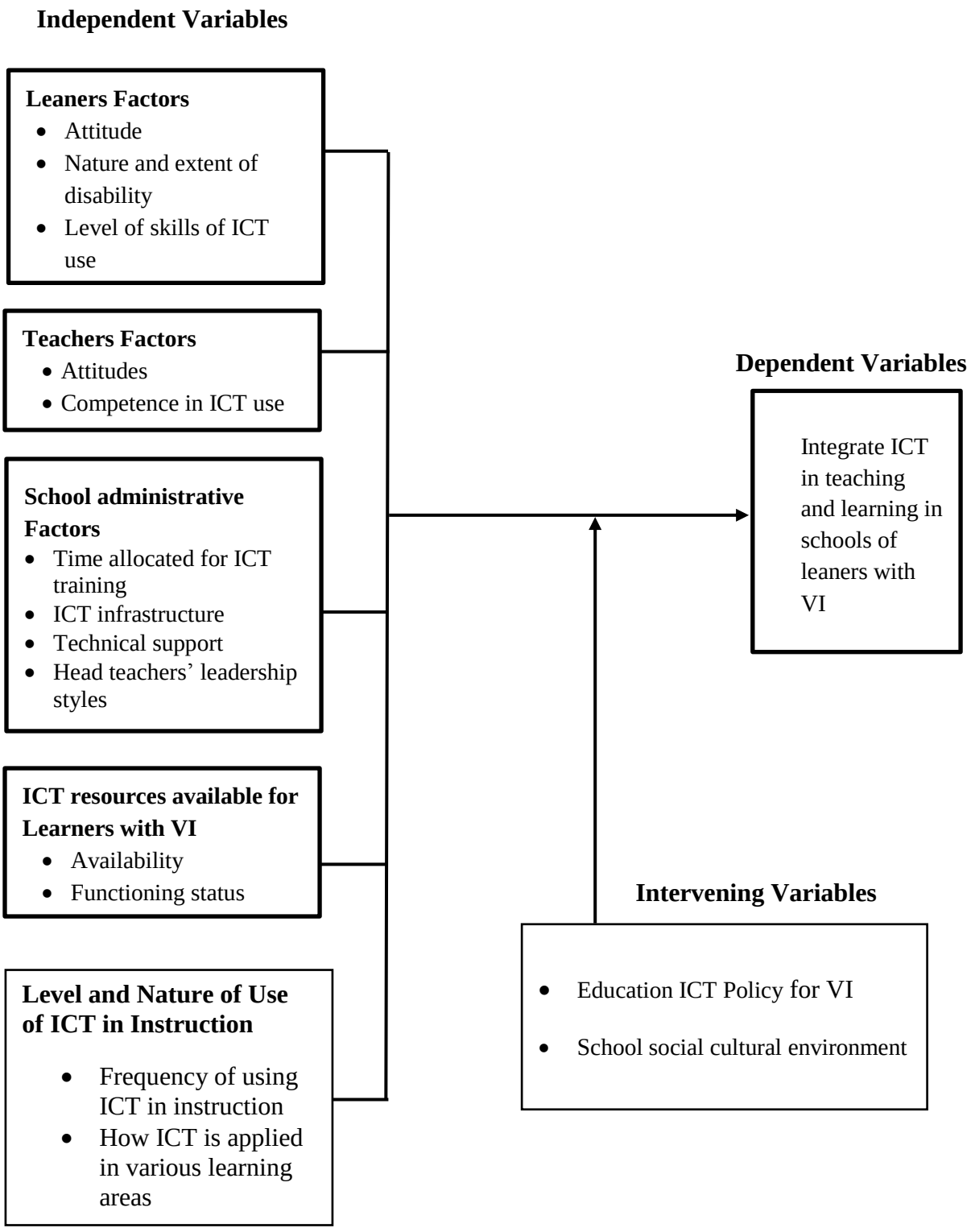


Figure 1.1: Conceptual Framework Illustrating the Relationship between Access and Use of ICT in Education for Learners with VI

Source: Researcher designed framework

Figure 1.1 illustrates that learner factors, teacher factors, school administrative factors, level and nature of use of ICT and ICT resources available constitute the independent variables that create a conducive learning environment. The ICT policy, if well implemented in a well-managed social-cultural environment (intervening variable), would lead to access to ICTs and consequently integration of ICT for learners who are visually impaired in teaching and learning (dependent variable).

Access to ICT will depend on learners, teachers, school environment factors, and head teachers' beliefs about ICT. For instance, if learners have access to ICT, have the knowledge and skills to manipulate the new technologies, and have a have a positive attitude, then they will be willing to use them during learning and during their free time to acquire knowledge. On the other hand, if the teachers have access to ICT and have acquired the necessary skills and knowledge on how to integrate ICT in pedagogical practice, then they will be willing to try out this innovation, and with that, they will be confident and competent in using ICT in teaching.

If the school supports the teachers by allowing them to attend in-service training to acquire the necessary knowledge and avail ICT resources to teachers and learners to access anytime, then they will be encouraged to integrate ICT in learning and teaching. The school should also allocate more time to computer lessons and give teachers ample time during preparation and teaching using ICTs. The head teachers, on the other hand, play a key role in the implementation of ICT integration in schools. If they believe in the benefits of ICT in teaching and learning, they will avail and technically maintain the ICT facilities for teachers and learners to access and use them. If the ministry of education

implements government policies on ICT integration, then learners with VI will access ICTs in their schools.

1.12 Operational Definition of Terms

Availability of ICT resources refers to the accessibility of a variety of functional ICT resources for the teaching and learning of learners with VI in special public primary schools.

Leaners Factors: Refers to learners' characteristics that affect the use of ICT in the teaching and learning of learners with IV. These include learners' attitude, nature and extent of disability, and learners' level of skills in ICT use.

Level of ICT integration: refers to the frequency, approach, and ability to use ICTs for the learning benefit of learners with visual impairments.

Model: refers to a visual representation that identifies and describes various parts of the process of utilizing ICT in the teaching and learning of learners with visual impairments.

School administrative factors: refers to factors related to the school administration of special primary schools that influence access and use of ICT in the teaching and learning of learners with IV. These factors include time allocated for ICT training, the availability of ICT infrastructure, the availability of technical support, and the leadership styles of the head teachers.

Schools for Learners with VI: These schools educate and invest in many children that, due to blindness, low vision, and additional handicapping conditions, other schools cannot or have difficulty serving.

Social-cultural environment: This refers to the school environment being physically and emotionally safe and conducive to learning. This will set the stage for external factors that affect the learners.

Teachers Factors: refers to teachers' characteristics that influence the use of ICT in teaching learners with IV. These include teachers' attitudes and their competence in ICT use.

Visual Impairment: This is when a person has eyesight loss that cannot be corrected through medical intervention, for instance, surgery, or with eyesight-correcting devices, including glasses or contact lenses. In this study, this term is used for the learners who are blind and those who have low vision.

CHAPTER TWO

REVIEW OF THE RELATED LITERATURE

2.1 Introduction

Based on the goals of this investigation, relevant literature is covered in this chapter. The focus of the literature review was on the factors that affect visually impaired learners' access to and usage of ICT. As such, the following topics are used to present the literature in this chapter. Availability of ICT resources for learners with VI: The level and nature of access to ICT: Learner factors that influence their access and use of ICT include: Teacher factors that influence pupils use of ICT in pedagogy: School administration factors that influence pupils' use of ICT and school environment factors that influence pupils' use of ICT.

2.2 ICT Resources Available for Learners with Visual Impairment

There is a growing awareness that people with disabilities have the right to expect the same service and access as every other member of society. However, disabled people must overcome additional obstacles before they can fully enjoy the information services, entertainment, and social interactions offered by ICTs. People without vision need appropriate hardware and software to be created, for example, a text as an alternative to an image. The text can be translated into an audible format by specially designed screen-reading devices or made accessible by means of printed braille text (UNICEF, 2007). Information has become a social necessity and a fundamental aspect of human rights, and all groups of people must be included. Therefore, ways to integrate these people into the current information and technological space must be looked into.

The specific applications of ICT for learners with disabilities are extremely diverse and varied. Technological aids for learners with VI include Perkins braille, Braille note takers, speech access, technologies (software-screen access and hardware-synthesizers), closed circuit television (CCTV), magnifying technology with or without a personal computer (PC) using magnifying soft and hardware, optical character recognition, audio tape recorders, radios, and touch-screen computers, among others. (UNESCO, 2006); others include.

ICT is now employed as a tool to raise the quality of life through increased efficacy and efficiency. Various ICT tools help the disabled by enhancing their learning opportunities, capabilities, and potential in various spheres of life (Singhal *et al.*, 2019). ICT equips them with skills by enabling access to knowledge with appropriate digital media and software (Okonji & Ogwezzy, 2019). It accomplishes this by playing a crucial role in peer communication and fostering a collaborative and social learning environment. ICT supports children with disabilities in a variety of ways, including the reading, writing, hearing, and visual processes (Amponsah & Bekele, 2022).

The new digital ICT for visually impaired students combines a variety of technological tools and equipment, including hardware, software, and multimedia, to provide a variety of services (Kuma & Sanaman, 2013). The term "ICT in education" today refers to a wide variety of quickly developing technologies, including desktop, laptop, and handheld computers, digital cameras, local area networking, Bluetooth, the Internet, cloud computing, the World Wide Web, streaming, DVDs, word processors, spread sheets, tutorials, simulations, email, digital libraries, computer-mediated conferencing, video-

conferencing, virtual environments, simulators, emulators, and many other technologies (Kaur *et al.,* 2022). The following specialized ICT tools were thought to provide better services to visually impaired pupils, making them unique to the study (Omolara *et al.*, 2022).

Window-Eyes: - One of the most well-known and potent screen reader tools accessible right now is this one. With this technology, you have complete control over what and how you hear. Additionally, it has improved Braille support. The vision impaired can unlock doors to an infinite amount of information with the help of Window-Eyes. The program translates parts of the Windows operating system into synthesized speech, giving visually impaired users full and unrestricted access to Windows-based computer systems. When Windows-Eyes is incorporated into Windows, it offers fast access to the operating system without the need to memorize a complex sequence of keystrokes (Liu *et al.,* 2022).

Access with Speech is a potent accessibility tool for people who are blind or visually impaired that reads text on a computer screen using synthesized speech. It offers a variety of helpful instructions that simplify using programs, editing documents, and browsing the Web. In addition to or instead of voice output, JAWS may produce Braille on a refreshable Braille display. It offers options that can be tailored to each user's needs and interests.

Text-to-Speech Assistive Tools: The purpose of text-to-speech (TTS) software is to aid youngsters who have trouble reading regular print (Park *et al.,* 2017). Blindness,

dyslexia, other visual impairments, learning difficulties, and other physical conditions that make it difficult to read are examples of common print disabilities. TTS, however, can also help other pupils, including those with intellectual disabilities, autism, or attention deficit hyperactivity disorder (ADHD). Using a variety of speech sounds that are used to make up words in any given situation, the technology reads the words to the pupil after scanning them in a synthesized voice. The accuracy and lifelikeness of TTS technologies have improved because of advancements in voice synthesis.

Draft- Builder: Outlining, taking notes, and producing drafts are all integrated into the writing tool known as Draft Builder, which divides the writing process into three parts (Meeks & Geither, 2014). The tool uses a graphical organizer to assist the learner in adding information where it belongs without having to conceptualize the entire procedure. The process of making the paper is then automated, allowing the learner to simply drag and drop each note's contents onto the first draft.

Assistive Listening Systems: Students who are hard of hearing or deaf, as well as those with visual impairments, might benefit from a range of assistive listening technologies. Children who do not require hearing aids or cochlear implants but still need hearing assistance can use assistive listening systems to extend the range and effectiveness of those devices (Schles & McCarthy, 2022). A microphone, a form of transmission technology, and a device for capturing and conveying the sound to the ear are all used in assistive listening devices. One sort of assistive listening system is often distinguished from another by the particular transmission technology utilized in the system.

Sound-Field Systems: For schools where all of the students' listening needs need to be met, sound-field systems are a good option (Farhan & Razmak, 2022). Children with various disabilities also benefit from these devices, according to ASHA. Additionally, students studying English as a second language might use sound-field systems. A microphone in sound-field systems transmits sound through speakers set around the classroom. Sound is possible to spread uniformly around the room in classrooms with strong acoustics, solving the issue of distance between the speaker and each listener.

Sip-and-Puff Systems: - Students with movement issues, such as paralysis and deficiencies in fine motor skills, employ sip-and-puff devices. With the use of these solutions, a youngster can move a computer, smartphone, or other technical application by moving the device with his or her mouth (Dos Santos *et al.,* 2022). The youngster can move the controller, which functions like a joystick, in any direction and use either a sip or a puff to select different navigational tools. The youngster can type with the same motions using an on-screen keyboard. Sip-and-puff systems are an example of a switch device, which is a term for gadgetry used in place of a keyboard or mouse in a computer. Other switch devices include buttons or other things that a pupil can touch, push, pull, kick, or do any other straightforward action to operate.

Proofreading Software: A type of assistive technology called proofreading software goes beyond the standard functions of a word processing program for proofreading, such as fixing terms that the visually impaired regularly misspell (Amponsah & Bekele, 2022). Other features in this area can assist pupils in honing their English language proficiency and improving their writing quality. Proofreading software can be useful for anyone with

any form of learning disorder that makes writing and reading difficult, even though it is primarily designed for those with dyslexia.

Math Tools:- Students who struggle with math, most frequently due to a learning condition termed dyscalculia, might benefit from a variety of technologies and resources. Dyscalculia is defined by a broad lack of understanding in the area of math, which makes it challenging to comprehend numbers. Mathematical assistive technology is not simply for people who have dyscalculia. It can also benefit kids who struggle to complete math-related tasks due to limitations including eyesight, problems with their fine motor skills, or other conditions (Shefketi, 2020).

MathTalk: A math speech recognition tool called MathTalk can assist kids with a variety of difficulties. Students can solve arithmetic problems by speaking into a computer microphone, from prealgebra through Ph.D.-level mathematics. For voice-to-text functionality, the program integrates with Dragon NaturallySpeaking software, making it perfect for students with fine motor skill impairments. The built-in braille translator is available to students who are blind or have vision impairments. Students with dyscalculia are another group that MathTalk appeals to in addition to these others. For pupils who have trouble doing math problems on paper, the program serves as an electronic math worksheet by allowing the child to arrange, align, and work through issues on the computer (Arslantas & Gul, 2022).

Math Simulations:- Math simulations can aid dyscalculic students in visualizing mathematical concepts and issues. Since many students have trouble with the conceptual

components of arithmetic, this enables them to better understand how a specific type of problem is applied (Wadlington & Wadlington, 2008). Teachers and students may see clearly how a math idea or problem would work through video and animation simulations. Students can work through a problem and then watch the outcome play out in the simulation with various math simulators.

Information and communication technology (ICT) are today acknowledged as the major tool and the force behind nearly all forward-thinking knowledge-based and skills-oriented development projects and activities across all fields of human endeavor (Kamaghe et al., 2020). Therefore, a lot of individuals acknowledge ICTs as change agents for things like working circumstances, information management and exchange, instructional methodologies, learning strategies, scientific research, and information access. Visually impaired people have the same right to expect the same standard of education as other sections of society (Eligi & Mwantimwa, 2017). They do, in fact, also have the right to use and access technologies used in traditional education, such as those based on ICT (Fred, 2020).

Technology is a tool for promoting equality since it provides persons with disabilities with assistive, adaptive, and rehabilitative equipment through proper selection, location, and use of these tools depending on their disability (Mutia, 2020). Blind and partially sighted people have made use of assistive technology to raise their social inclusion and increase their level of independence when it comes to access to education. For instance, Zaid (2018) lists the Kurzweil Reading Machine, Computer, Video Conferencing, Internet, and World Wide Web as the top ICT facilities that help learn for the visually

impaired. Also crucial is the use of various AT tools for visually challenged pupils, including screen readers, Braille translation software, Braille writing instruments, closed-circuit television (CCTV), Braille embossers, and scanners (Nahar *et al*., 2022).

According to Simui *et al.* (2017), assistive technologies can help visually impaired students all over the world learn by facilitating information access and retrieval, contacting friends, and knowledge sharing just like sighted individuals do. ICT is essential for promoting the participation of the blind, especially in educational activities. ICTs can aid in exceptional ways to reduce and even eliminate the feeling of prejudice and open access to knowledge. ICT is typically utilized as a tool to enhance efficacy and efficiency in several socio-economic spheres, including education, hence raising the quality of life.

People with visual impairments' abilities have improved thanks to assistive technologies in the US, the UK, and other European nations (Tomet *et al.*, 2018). Both developed and developing nations now use AT in the classroom as a vital component of the learning environment since it actively promotes the learning process. In North America, assistive technology (AT) has emerged as a "tool of choice" for increasing both the general student population and the educational experience of those with visual and learning challenges (Kisanga & Kisanga). The use of assistive technologies promotes improved communication and self-expression skills, as well as learning. Many people with disabilities wish to communicate but are unable to do so successfully. This communication can be made possible by many of these so-called "e-inclusion" technologies (Dalton & Sarah, 2020).

Additionally, assistive technologies benefit people with visual impairments by making electronic resources and tests more accessible, improving the reliability of students' work, expanding employment options, and decreasing overdependence (Kisanga and Kisanga, 2020). Additionally, assistive technology helps people with vision impairments manage their academic and social obligations as well as direct their career paths. In the field of education, AT provides instructors with cutting-edge resources to assist students with VI and other special needs in overcoming obstacles to their teaching and learning. Students with visual impairments and those with special education needs do need AT in this era of inclusion to interact with their teachers, peers, and educational resources (Tom *et al*., 2018). The significance of incorporating technology into the teaching and learning process for students with special needs has been emphasized by the evaluated studies. Nevertheless, no empirical research has been done in Kenya to determine whether or not ICT is beneficial to learners with VI. Therefore, the study purposed to address the gap by determining the kind of ICT resources available and used by learners with VI in Kenyan special schools.

2.3 Access of ICT by Learners with Visual Impairment

Access often refers to the ability or privilege to own or make use of anything that will be advantageous to oneself. Regarding the use of ICT in pedagogy, this indicates that technology can facilitate a learner's access to high-quality education or assist them achieve in a variety of ways. This may also imply that ICT is essential in assisting a learner in developing a new attitude. This phrase can also refer to the method and capacity of using ICT to support students who have visual impairments. This suggests that a person's aptitude and learning style for navigating and exploring ICT are essential

for reaping the benefits of ICT's involvement in education. Therefore, there are two ways to interpret the term "access" in this context: first, as the opportunity or right to own these instruments; and second, as the capacity or method of using them. It may be necessary to briefly discuss the nature of blindness and the cognitive difficulties these learners encounter when acquiring new dispositions in order to fully comprehend this.

Numerous studies have reported that there are several reasons why certain people do not have access to technology. Teachers in the Rasheed et al. (2020) study complained about how difficult it was to always have access to computers. The author listed a number of contributing issues, including the fact that "teachers would forget to reserve computers in advance or that they could not reserve them for multiple periods in a row when they wanted to work on multiple projects with the kids." Stated differently, a teacher would not have access to the majority of ICT resources because instructors shared them. According to Eligi and Mwantimwa (2017), ICT resources are not always inaccessible because the school lacks the required hardware, software, or other ICT supplies. There are several possible causes for this, such as insufficient personal access for educators, disorganized resources, subpar technology, inappropriate software, or broken hardware.

Providing teachers with access to new technologies presents a variety of challenges that differ from country to country. There are infrastructure limitations in schools, such as a lack of broadband connectivity, according to Almanthari *et al.* (2020). Only one-third of European schools have access to broadband Internet, per their research. Ghavifekr *et al.* (2016) state that a number of issues, such as a dearth of computers, antiquated or sluggish

ICT systems, and a shortage of instructional software, impede the effective implementation of ICT in Turkish schools.

In a study on the factors influencing the effective use of ICT in education and learning, Renukadevi *et al.* (2018) found that poor connectivity, self-enthusiasm, required extra time, incentive to integrate ICT tools in teaching, and certain ICT software that is difficult to learn and use are the most significant factors. In their case study from 2021, Nameetha and Srihari explored how ICT may help women who are visually impaired access inclusive education. It was shown that gender disparity in communities, society, and the workplace impedes economic and social development, while women in underdeveloped nations suffer major challenges to obtaining an education. Women's empowerment through education has the potential to influence society in social, economic, and political ways.

Women with visual impairments continue to receive less education, are rejected by society, and now face additional challenges due to a lack of informational resources. Perhaps ICT has altered the lives of visually impaired women by allowing them to participate in society and work toward financial and social independence. Additionally, ICT has made it possible for blind women to use assistive technology and programs to read braille, operate assistive equipment, and express themselves freely.

Eligi and Mwantimwa (2017) conducted a study at the University of Dar es Salaam to evaluate the usability and accessibility of information and communication technology resources to support learning for visually impaired students (UDSM). In order to collect,

handle, and analyze both quantitative and qualitative data, the study used a mixed-methods approach. ICTs assist creative learning, support independent learning, and support participatory and collaborative learning, according to the study. On the other side, the units assessed at the UDSM faced issues like a lack of special ICTs to meet the needs of students who are blind or visually impaired, poor training on how to use special ICTs, and a lack of ICT experts. In order to foster effective learning, it is also essential to satisfy the educational needs and preferences of visually impaired students.

In fact, there may be significant challenges for students with disabilities in "accessing and using" electronic learning resources, and these challenges might differ greatly depending on the type of impairment. This issue emerges because many different educational institutions cannot brag about having enough professionals or equipment to maximize the potential of students with visual impairments (Burzagli *et al.,* 2004; Anderson, 2006). Furthermore, despite the fact that there are numerous gadgets created electronically to fulfill the demands of such users, they are not aware of how to utilize information technology devices in many high education institutions for visually impaired students (Luck and Achebe, 2012).

For example, despite both groups simply being referred to as "visually handicapped," blind and low-vision students typically present very different visual issues, encounter very different challenges, and want very different types of assistance and support (Bacconni *et al.,* 2007). Many of these issues stem from the challenges of using the tools effectively, and they might be detrimental to learning in general. Wyclife and Nyambura (n.d.) list a number of additional limitations. These include: lack of specialized training

for teachers who work with disabled students; limited flexibility of training options for students with disabilities; limited availability of specialized disabled-friendly hardware and software due to financial concerns; lack of formal involvement of governmental organizations; ICT support structures for the disabled; stigmas associated with people with disabilities; and absence of accessible technology.

Evidently, Tanzania and Bangladesh, two poor nations, were the subjects of a study by Gronlund *et al*. (2010). The purpose of the study was to provide an answer to the question of how assistive technology might best be utilized to support inclusive education in developing nations. According to the study's findings, Tanzania had no formal inclusive education policies. As a result, the study discovered that while several policy documents, such as the disability policy and the education and training policy, mention inclusive education, they do not specify how it should be implemented, much less monitored and assessed. The paucity of teaching and learning resources for students with special needs was another finding of the study.

Despite the growing demand for ICT, the educational infrastructure seems to have overlooked its accessibility, leaving only a small number of students with access to it. According to estimates from the World Health Organization, just 10% of the world's population has access to ICT (WHO, 2016). In both industrialized and developing countries, literature has shown that persons with impairments, especially students, have limited access to ICT (Ampratwum, Offei, & Ntoaduro, 2016; WHO, 2016). Less than 40% of US elementary and middle school students, according to Kelly (2011), have access to assistive technology.

Assistive technology and digital libraries are examples of the limited accessible infrastructure that many countries have, according to 2017 research by G3ICT. This implies that Tanzania's condition is worse than that of industrialized countries due to low levels of technology and unstable power supplies. ICT accessibility issues are caused by a variety of causes, such as inadequate funding, excessive costs, a lack of expertise and technical employees, restricted availability of assistive devices, and a lack of assistive technology policies (Ampratwum *et al.,* 2016; UNESCO, 2019; WHO, 2016).

Some students with VI were reportedly uninformed about using computer assistive technology, suggesting that they frequently are not aware of the potential of ICTs to improve education (Ampratwum et al., 2016). According to statistics, 95% of students had trouble using the computer keyboard and the screen reader Job Access with Speech (JAWS) (ibid.). Because the order of the alphabet did not follow the typical arrangement of the alphabet from A to Z, some keyboard keys were difficult for students to recognize. The pupils also had trouble using JAWS because the school only allowed access to certain applications because it used unlicensed software (Ampratwum *et al.,* 2016). Additionally, some students mentioned having trouble with voice recognition because the pronunciation was foreign to them.

Kisanga and Kisanga (2021) carried out research on the availability of assistive technology for students with visual impairments at higher education institutions in Tanzania and revealed that the availability of assistive technology (AT) and the user's technical proficiency are key factors in a student's ability to use it. In Tanzania's higher education institutions, this study details the difficulties visual impaired students have in

gaining access to assistive technology and their coping strategies. Descriptive and theme analyses were performed on the resulting qualitative data. According to the survey, the biggest obstacles for students with visual impairments to using assistive technologies at higher education institutions are a lack of understanding on how to use them, a lack of ICT infrastructures, and a lack of assistive technology tools. Social support networks and individual efforts emerged as the two main problem-focused coping types. The former includes assistance from knowledgeable, sighted peers and organizations in terms of assistive technology training.

Mugo (2013) points out that, by its nature, blindness presents obstacles that might greatly affect access to quality education. For instance, understanding information and applying the lessons derived from it require a fully developed cognitive ability. Unfortunately, learners with VI are faced with major cognitive problems. One of the problems is related to the difference between the concurrent character of visual perception and the successive character of tactile perception. Another problem stems from the process of concept formation in learners who are visually challenged, which is dominated by two extremes: (i) extremely abstract verbal notions that have minimal support in the learners' experience, and (ii) extremely concrete tactile images of everyday life objects that hold little potential for generalization (Gauzman and Kozulin, 1998). This clearly shows that the way learners with visual challenges access and benefit from ICT is different from their sighted peers' access, use, and benefit from the technology.

Another cognitive problem facing these learners is related to the primary methods of instruction that extensively exclude two-dimensional schematic representations of objects

and processes such as diagrams, charts, plans, and maps (tactile graphics). This problem could be blamed on three main factors: the procurement or provision of ICT resources, a lack of teachers' kills to use the technology, and poor learners' skills to use the technology. Hence, Mugo (ibid.) construes that many of the cognitive tools used by sighted students remain underdeveloped in learners with visual impairments.

To help these learners overcome the aforementioned challenges, there are four major benefits of using ICT in special pedagogy for learners with visual challenges. First, it does not only attenuate the learners' impairments (Roulstone, 1998) but also increases functional independence (Stumbo, Martin, & Hedrick, 2009). ICT tools such as assistive technologies, defined as "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized,' are used to increase, maintain, or improve the personal capabilities of individuals related to environmental orientation, mobility, and reading" (Wisniewski & Sedlak, 1992). The technologies range from personal digital assistants with speech and Braille output to screen magnification systems, speech synthesizers, and more recently, mobility-aid solutions for mobile phones. These allow the learners to participate actively in the teaching and learning process (Kelly & Smith, 2011; Krishna, Colbry, Black, Balasubramanian, & Panchanathan, 2008).

The role ICT plays is that of providing access to information. There are different types of technological tools that are used to play this role. (Presley & D'Andrea, 2009) give examples of these tools: closed-circuit television systems (CCTV), which use a video camera connected to a monitor. This can enlarge the size of text and images from books and other course-related material and adjust their background and color. Another example

is computers, including desktops and laptops, especially where they are connected to the internet. This provides access to information available online (Ritchie & Blanck, 2003). A study conducted by Van der Geest, van der Meij, and Van Puffelen (2014) showed that currently, most learners with visual challenges regard the Internet as the main means to access information. It is also worth mentioning at this point that the possibilities for information access through the internet are not limited to the content of websites but also other sources such as digital text eBooks, PDFs, and files, which can be manipulated with the support of assistive technologies.

The third role that ICT plays in education for learners with visual challenges is that of supporting or enhancing communication. According to Cook & Polgar (2014) and Seymour and Lupton (2004), writing by learners with visual challenges poses a barrier to effective communication because it is tedious and time-consuming. Presley and D'Andrea (2009), however, observe that the barriers against writing communication can be reduced with the use of ICT and that learners with visual challenges can accomplish writing tasks by using laptops with Braille capability. Sometime they could use dedicated electronic word processors for taking classes, producing files that can be saved electronically and later transferred to a desktop or laptop. Research has also shown that in developed countries, learners with visual challenges use a combination of assistive technologies to enhance their communication. For instance, they combine the built-in accessibility features of portable devices (smartphones and tablets) for short and quick written messages (Scott, 2013; Presley & Dandria, 2009). Of course, internet tools complement oral and face-to-face communication for these learners, and in addition, phone calls, video chats (Skype, Google Meet), and even tools used in social media

(Facebook, Twitter, WhatsApp) are tools that the learners with visual challenges could use to support communication (Kelly & Wolffe, 2012; Pfeiffer & Pinquart, 2013).

The fourth role of ICTs in the support of learners with visual challenges is ease and effective learning in school and other settings (Hutchinson, Atkinson, & Orpwood, 1998; Nochajski, Oddo, & Beaver, 1999; Sutcliffe, 1999). ICTs generally help learners to have control over their learning by promoting independence and enhancing their academic performance (Smith & Kelly, 2014; Sutcliffe, 1999). An example is that ICT can be used to make course material accessible via electronic formats and even provide alternative ways to support writing needs.

ICT allows students with vision challenges to manage themselves and their learning demands, including supporting their study experience and helping them develop academic skills (Kim-Rupnow & Burgstahler, 2004). However, an important condition is that the technology must be accessible. It is not obvious that learners with special needs need access to ICT. Mull and Sitlington (2003) point out that technology abandonment can occur if ICTs are unable to meet the specific needs of the learners, such as supporting independent functioning, working as intended, or helping to address the demands of the curriculum. Indeed, some scholars have questioned the potential of ICTs, arguing that digital tools are inherently disabling for people with disabilities (Goggin & Newell, 2003). Adam and Kreps (2006) posit that this reflects society's structural inequalities. The literature reviewed here does not clearly demonstrate the issue of access to and use of ICT in developing countries, especially in Kenya. This study will bridge this gap by

investigating how special schools for the visually impaired in Kenya access and use technology.

2.4 Teachers Factors that Influence Access to ICT

The primary agents of curriculum implementation are teachers. They must therefore possess the necessary competence to carry out their responsibilities well. According to Fullan (1982), having a qualified instructor has a major impact on the caliber of education and learning. In this study, Law and Chow (2008) discovered that self-reported pedagogical digital competence was the best positive predictor of a teacher's adoption of ICT in the classroom out of all their personal traits. Additionally, research revealed that instructors with a greater traditional orientation were less likely to incorporate ICT into their lessons in most systems, whereas teachers with a stronger 21st century orientation were more likely to do so.

Technology may help with autonomous, self-paced learning, but without a change in the way that education is delivered, its full potential may not be realized (Bangok, 2004). In actuality, educators have a significant impact on the paradigm shift in teaching and learning. To effectively employ technology in the classroom, educators—especially those who work with students who have special needs—need to be aware of the possible applications of technology in education. The transition from instructive to constructivist pedagogies is linked to the incorporation of ICT (Barker, 1999). In this regard, educators must use constructivist teaching methods, which heavily rely on ICT. The unfortunate thing is that teachers, especially those teaching learners with special needs, are still struggling to learn how to use ICT resources (Anderson & Dexter, 2000).

A study carried out by Ghavifekr *et al.* (2016) assessed how ICT tools were used for teaching and learning in Malasyia, taking into consideration issues and challenges from the instructors' point of view. The study reported that in today's digital environment, using ICT in the classroom is essential to providing students with the opportunity to acquire and employ the skills they need for the twenty-first century. Teachers can overcome these obstacles and develop their technological proficiency by having a thorough awareness of the issues and challenges related to ICT use in teaching and learning. Thus, this study's main objective was to investigate the teacher-related challenges that affect the use of ICT in the classroom.

The information was randomly collected using a quantitative study design from a sample of 100 secondary school teachers in the Malaysian state of Melaka. Overall, it was determined that the following critical concerns and challenges prevented instructors from effectively using ICT tools: limited accessibility and network connection, limited technical support, inadequate training, time constraints, and a lack of teacher competency. Additionally, the outcomes of an independent t-test reveal that male instructors (M = 2.08, SD =.997) use ICT tools in the classroom more frequently than female teachers (M = 2.04, SD =.992).

Teachers' capacity to incorporate ICT into pedagogical practice presents another difficulty that is closely tied to teacher confidence (Sepulveda-Escobar & Morrison, 2020). Falloon (2020) discovered that many instructors lacked the knowledge and abilities necessary to use computers and that they were unenthusiastic about the adjustments and integration of supplemental learning that came along with incorporating

computers into their teaching practices. According to studies, teachers' lack of technological proficiency in underdeveloped nations is a major obstacle to their acceptance and implementation of ICT (Al Buabeng-Andoh, 2012).

One issue in Syria, for instance, is teachers' lack of technological proficiency (Albirini, 2006). Similar to Saudi Arabia, where a key barrier to integrating technology into science education is a lack of ICT capabilities (Al Mulhim, 2014), According to the research, teachers who don't use computers in the classroom often cite "lack of skills" as a barrier to their ability to use ICT for instruction. Chin et al. (2022) discovered that adopting ICT in primary and secondary schools is seriously hampered by teachers' lack of knowledge and abilities in another global study of nationally representative samples of schools from 26 nations.

In Denmark, many teachers still choose not to use ICT and media in teaching situations due to a lack of ICT skills rather than for pedagogical or didactic reasons, according to the findings of a study by Motzfeldt and Naesborg-Andersen (2018). In contrast, in the Netherlands, teachers' ICT knowledge and skills are no longer seen as the main barrier to ICT use. Therefore, one of the major obstacles to integrating technology into education may be a lack of teacher competency. It could also be a contributing element to the reluctance to change.

Since computers are the foundation of every innovative curriculum, the level of ICT integration in school management in developed and developing nations depends on how teachers are prepared to use them (Malik, 2018). Through in-service training and capacity

development workshops, knowledge and skills are gained, and it helps the principal feel confident using ICT technologies in regular school administration activities. The availability of ICT technical support, according to Ogachi (2015), quoted in Mutisya et al. (2017), has a substantial impact on how the principals integrate ICT into their administrative work areas. This suggests that even though the principals' offices would have benefited from sound advice regarding the purchase of ICT facilities, the principals were becoming increasingly frugal with their ICT spending, to the point where they hired computer instructors rather than technicians to maintain and fix computers in their workplaces.

According to Nang'unda (2019), a number of issues, including poor pre-service training for teachers in ICT and a dearth of instructors with ICT diplomas, hamper the integration of ICTs in secondary schools. It was noted that 20.5% of instructors had a diploma in ICT and 70.5% of teachers had certificates in computer application packages, while 6% did not disclose their level of ICT training. This shows that even though many instructors' ICT abilities are not very advanced, they are able to use computers.

Further, Unal and Ozturk (2012), in their study on “Barriers to ICT integration into teachers’ practice: A case study on social studies teachers in Turkey,” analyzed the difficulties and obstacles faced by teachers of social studies education while using ICT-based teaching equipment and methods in the classroom. Eighteen teachers of social studies education participated in the study, where classroom observation and semi-structured interviews were used as research instruments to collect data. The results of the study indicated that the main barriers to the use of ICT-based methods and equipment in

teachers' instructional practices were a lack of ICT equipment in the classrooms, a lack of ICT-based teaching resources, the effect of traditional approaches on teachers' practices, inadequate in-service teacher training, and a lack of time. The above studies indicated that the provision of ICT equipment, teaching resources, adequate in-service training for teachers, more time, and a change in traditional approaches to teachers` practices are the main determinants of teachers` use of ICT-based teaching equipment and methods.

Langat (2020) looked into how teacher-related factors affected the use of ICT in Nandi North Sub-County public secondary schools. The study made use of Everett Rogers' Diffusion of Innovation concept. Using the descriptive survey method, a target group of 20 public secondary schools, including 20 administrators and 174 instructors, was selected. While inferential statistics used Pearson correlation to show the link between the independent and dependent variables, descriptive statistics required the computation of frequencies and percentages. There was a substantial correlation found between training and technology literacy, knowledge generation and development, and ICT integration for teaching and learning.

Studies by Stronge, Tucker, and Hindman (2004) found that when teachers participate in professional development that relates to their content area, it enhances their effectiveness, resulting in higher levels of student success. The teachers' central role in the implementation of the curriculum has been further exposed by Katz (1989), who emphasized that there is a general agreement among specialists in the field that the competence of the teacher is a central determinant of the quality and effectiveness of a

program. The implementation of new technologies in teaching depends on the knowledge, skills, and attitudes fostered during initial training. Indeed, teachers and teaching pedagogies must be close and constant. A study by Schoepp (2005) indicates that the act of integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties or barriers. The barriers could be extrinsic or intrinsic. Ertmer (1999), as cited by Bingimlas (2009), referred to extrinsic barriers as first-order and cited access, time, support, resource training, and intrinsic barriers as second-order and cited attitudes, beliefs, practices, and resistance. To overcome these barriers, a teacher needs to be confident. Perhaps it would be important to look in a deeper way at the teacher's confidence.

2.4.1 Teacher Confidence

Research has indicated that one barrier that prevents teachers from using ICT in their teaching is a lack of confidence. According to Becta (2004), this is the major barrier to the uptake of ICT by teachers in the classroom. Some studies have investigated the reasons for teachers' lack of confidence in the use of ICT. Beggs (2000) asserted that teachers' fear of failure caused a lack of confidence. Balanskat, Blamire, and Kefala (2006) found that limitations in teachers' ICT knowledge make them feel anxious about using ICT in the classroom, and thus they are not confident enough to use it in their teaching.

Similarly, Becta (2004), as cited in Bingimlas (2009), concluded their study by agreeing that many teachers who do not consider themselves to be well-skilled in using ICT feel anxious about using it in front of a class of children who perhaps know more than they

do. In the same survey, many of the teacher respondents who identified their lack of confidence as a barrier reported being particularly afraid of entering the classroom with limited knowledge in the area of ICT, with their learners knowing that this was the case. On the other hand, teachers who are confident use ICT effectively to support learning. Cox, Preston, and Cox (1999) found that teachers who have confidence in using ICT identify those technologies as helpful in their teaching and personal work and those they feel they need to extend their use further. One of the greatest fuels for self-confidence is competency. It would be important to look at this concept a bit more critically.

2.4.2 Teacher Competence

Competence is directly related to teachers' confidence. In Australia, Newhouse (2002) found that many teachers lacked the knowledge and skills to use computers and were not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices. Further, a study by Pelgrum (2001) and Al-Oteawi (2002) reported that teachers in developing countries lack technological competence, which is the main barrier to their acceptance and adoption of ICT. In Syria, teachers' lack of technological competence has been cited as the main barrier (Albarini, 2006). Likewise, in Saudi Arabia, a lack of ICT skills is a serious obstacle to the integration of technologies into science education (Albarini, 2006). These studies have shown that a lack of teacher competence is one of the strongest barriers to the integration of technologies into education. The teachers therefore require training and practice in the use of ICT, which, in the end, will make them competent users of the technology in their teaching endeavours.

Individual lack of confidence and competence will bring about resistance to change, Empiricas (2006). The development of ICT is particularly dynamic and requires acceptance and adjustment to the drastic changes that occur due to new discoveries or innovations in technology. Teachers' resistance to change would then be hazardous to the use of ICT, especially in the pedagogy of learners with special needs. It is then important to scrutinize this aspect

2.4.3 Resistance to Change

Research on barriers to the integration of ICT into education found that teachers' resistance is a significant barrier (Watson, 1999; Cox et al., 1999a; Earle, 2002; Becta, 2004). Watson (1999), an Australian researcher, argued that integrating new technologies into educational settings requires change and that different teachers will handle this change differently. According to him, considering different teachers attitudes toward change is important because teachers' beliefs influence what they do in classrooms. Becta (2004) claims that one key area of teachers' attitudes towards the use of technologies will benefit their teaching and their learners learning. Schoeppy (2005) found that although teachers felt that there was more than enough technology available, they did not believe that they were being supported, guided, or rewarded in the integration of technology into teaching. According to Empiricas (2006), as cited in Bingimlas (2009), teachers who are not using new technology, such as computers, in the classroom are still of the opinion that the use of ICT has no or unclear benefits.

Resistance to change seems not to be a barrier by itself; instead, it is an indication that something is wrong. In other words, there are reasons why resistance occurs (Bingimlas,

2009). According to Earle (2002), the change from a present level to a desired level of performance is facilitated by driving (encouraging) forces such as the power of new developments, rapid availability, creativity, internet access, or ease of communication. This could be delayed by resisting (discouraging) forces such as lack of technical support, teachers' experience, or time for planning. Most of these aspects are related to the school context.

2.5 School Environment Factors

The impact of ICT on teaching and learning necessitates its use in the classroom. Despite the fact that there are policies governing the use of technology in many countries, the use of ICT in individual school contexts remains a challenge the world over. Robah (2015) observed, "It would be inappropriate to view ICT-based education without taking into consideration the school's context, setting, and environment," as these factors have serious and varied implications. Moreover, Lim (2002) posits that to obtain an effective diagnosis of ICT use in the classroom, it is important to understand the "events, activities, contents, and interpersonal processes taking place in the context in which the technology is used." This, in other words, defines the culture of a school.

2.5.1 School Social and Cultural Environment

The school culture is one of the greatest determinants of embracing the use of ICT. The opposite of this creates a serious barrier to the effective use of the technology. Martinez (1999) found that one of the major challenges facing developing countries is making technology an essential part of their culture. According to Hodas (1993), the embracement of technology use may be inhibited by the microculture of a certain

institution or organization. Hence, acceptance of a new technology depends on how well the proposed innovation fits the existing culture. This means that within the school organization, school culture is an important consideration in terms of ICT use (Tearle, 2003). According to Maslowski (2001), school culture can be defined as the basic assumptions, norms, values, and cultural artifacts that are shared by the school members. Hence, if the technology is not well received by staff, there will be a mismatch of values between the culture of the school and the technology (Albarini, 2006). In fact, teachers who have positive perceptions about the cultural relevance of computer technology will apply ICT teaching.

There have been numerous studies designed to give information on the extent to which schools are developing the capacity to use ICT in the teaching, learning, and management processes. The evidence gathered in the UK indicated that there has been a steady increase in the number of computers and other technologies over time, with most schools achieving the baseline target for computer-to-pupil ratios (Coudie, Monro, Seagraves, & Kenessons, 2007). The extent to which schools are in a position to implement and take advantage of ICT in learning and teaching depends on development across a number of dimensions relating to infrastructure, including school policy, resources, teacher confidence and capacity, connectivity, security, and management of the system. Each of these has, to a greater or lesser extent, an influence on the way in which ICT becomes part of the learning and teaching process and has an impact on the experiences of learners, teachers, and schools (Coudie *et al.* 2007).

A study carried out by Salehi and Salehi (2012) on "integration of ICT in language teaching: challenges and barriers" examined high school English teachers' perceptions of the factors discouraging use of ICT in the classroom in Iran. Thirty high school English teachers (18 males and 12 females) were used in the study. The findings indicated that 70% of the participants were familiar with ICTs and were frequent or confident users; 76.6 percent stated that they never used ICT in the classroom.

Bauer and Kenton (2005) carried out a study to examine the classroom practice of 30 "tech-savvy" teachers who used computer technology in their instruction. They found out that the teachers who were highly educated and skilled with technology were innovative and adept at overcoming obstacles, but they didn't integrate technology in a consistent manner as both a teaching and learning tool. They stated two reasons regarding these findings: students did not have enough time at computers, and teachers needed extra planning time for technology lessons. Other concerns are outdated hardware, a lack of appropriate software, technical difficulties, and students' skill levels.

The teachers believed that insufficient support at school and little access to the internet and ICT prevented them from using ICT in the classroom, which was a barrier to the use of the technology. A lack of class time was another discouraging factor for them. The above studies demonstrate that teachers could be ICT competent, but school factors, especially the culture, can discourage them from using the technologies.

2.5.2 School Setting

The school setting could also pose a barrier to the use of ICT. Bolaji (2007) found that the original arrangement existing prior to the introduction of an innovation either inhibits or facilitates the implementation of an innovation. School settings, such as school schedules and systems of evaluating learners, need to be modified to suit the innovation. This should include all learners, regardless of their nature, ability, or disability. Casely et al. (2003) found a very interesting scenario in some integrated schools in Ghana. The learners with visual impairments were taught in the same class as their sighted peers, but when it was time for them to attend the computer laboratory, the low-vision and blind learners were prevented from attending. These learners were unable to use any of the PCs due to the absence of screen magnifier or screen reader software. The learners missed all ICT sessions scheduled and therefore lost vital contact time with the school curriculum and their peers.

According to Ghavifekr et al. (2013), the Internet and ICT in general have permeated education systems all over the world, and using the Internet for administration has the benefit of facilitating quicker and easier communication between teachers via social media platforms like Facebook, email, and Twitter. Additionally, administrators used significant online data and resources, which painted a picture of how the internet affects efficient management and administration practices.

Since the issue affects all nations, school leadership was not to blame for the lack of ICTs being a barrier to management integration. The study by Kimuyu (2016) used technology. The study found that the majority of schools (20/71.4%) did not have Internet access;

hence, email was not used for management or other forms of communication. According to a 2015 study by Nyanchoka, Matula, and Kalai, 65% of PSS were linked to dependable Internet, compared to 35% who were not. This made it easier for principals to use the Internet extensively for management-related tasks.

While using a conceptual framework and adopting the technological acceptance theory, Kimuyu (2016) did not employ the activity theory that the current study performed. The current study used a mixed-methods approach; Nyanchoka, Matula, and Kalai (2015) and Muchiri (2014) studies used questionnaires as their data collection instruments. The former used simple random sampling methodology; the latter used saturation sampling techniques.

Factors influencing the use of ICT in schools can be divided into external factors and internal factors. The two types of factors are related to each other and ICT usage level (Tezci 2011). A variety of external factors have been identified that influence the progression or effectiveness of technology availability. Accessibility of ICT equipment, time to plan for instruction, technical and administrative support, school curriculum, school climate and culture, faculty teaching load and management routine, and pressure to prepare learners for national entrance exams (Al-Ruz & Khasawneh, 2011; Lin, Wang & Lin, 2012; Tezci, 2011). According to Chen (2008), the most common among these external factors are lack of access to computers and software, insufficient time for course planning, and a lack of adequate technical and administrative support. Therefore, technology availability and overall support are important to their usage. According to Fu (2013), the higher the support structure and technology availability, the higher the

technology use efforts made by teachers. The literature reviewed here has not touched on the special schools in Kenya. There is a scarcity of documented literature about the special schools in a visually challenged context, which might lead to ineffective use of technology in the schools. The current study therefore endeavoured to bridge this gap.

2.5.3 Time Factor

Time is a very important resource, especially in the field of technology use in schools. A study by Al-Alwani (2005) shows that time is an important factor affecting the application of new technologies in education. He observed that lack of time is a barrier affecting the application of ICT in education. Furthermore, several recent studies, especially in developed countries, indicate that many teachers have competence and confidence in using computers in the classroom, but they still make little use of technologies because they do not have enough time (Bingimlas, 2009).

A significant number of researchers identified time limitations and the difficulty in scheduling enough computer time for classes as barriers to teachers use of ICT in their teaching (Al-Alwani, 2005; Beggs, 2000; Schoepp, 2005). According to Sicilia (2005), the most common challenge reported by teachers was a lack of time to plan technology lessons, explore the different internet sites, or look at various aspects of educational software.

Time to learn how to use new technology effectively, especially those that are designed and adapted for learners with special needs, is essential. Mugo (2013) observes that most of the technologies used by learners who are blind were not initially designed with the

minds of these learners. He observes that most of the professionals in the technology industry are not especially educated. Due to this, the teachers, who might also not have a clue how these technologies are made, should have ample time to learn, explore, and figure out how the technology can best be used to teach the learners. Additionally, given that learners with visual challenges have cognitive challenges, they may require more time to learn how to use ICT compared to their sighted peers. The current study therefore sought to find out whether the issue of time to learn ICT in special primary schools for learners with visual impairments in Kenya is well utilized.

2.5.4 Training of Teachers on the Use of ICT

Information and communication technology (ICT) has emerged as a crucial educational instrument in Kenya to achieve quality and equity in the application of the curriculum, mostly at the school level. The development of 21st-century pedagogical skills was dependent on the availability of instructors with the necessary ICT integration training and infrastructure for sustaining curriculum implementation in the classroom. However, even though the Ministry of Education, Science, and Technology (MOEST) provided ICT facilities to a limited number of public secondary schools, teachers typically felt unwilling to integrate ICT into teaching and learning. Therefore, the purpose of this study was to contribute important knowledge about teacher characteristics impacting ICT integration in teaching and learning.

Lack of effective training opportunities for teachers in the use of ICT in the classroom environment is one of the barriers to integrating ICT into learning (Pelgrum, 2001). According to Beggs (2000), one of the top three barriers to teachers' use of ICT in

teaching learners was a lack of training. Additionally, research in Turkey found that the main problem with the implementation of new ICT in science was the insufficient amount of in-service training programs for science teachers (Ozden 2007; Toprakci 2006). They concluded that limited teacher training in the use of ICT in Turkish schools is an obstacle to using ICT in the classroom.

Research by Gomes (2005) relating to science education concluded that lack of training in digital literacy, lack of pedagogic and didactic training in how to use ICT in the classroom, and lack of training concerning the use of technologies in science-specific areas were obstacles to using new technologies in classroom practice. Becta (2000) asserts that providing pedagogical training for teachers, rather than simply training them to use ICT tools, is an important issue. Cox et al. (1999) argue that if teachers are to be convinced of the value of using ICT in their teaching, their training should focus on pedagogical issues. They further argued that after teachers have attended professional development courses in ICT, they still do not know how to use the ICT in their classrooms; instead, they just know how to run a computer and set up a printer. This is because the courses focused only on teachers acquiring basic ICT skills and did not often teach teachers how to develop the pedagogical aspects of ICTs.

According to Newhouse (2002), teachers need training in technology education (focusing on the study of technologies themselves) and educational technology (support for teaching in the classroom). Similarly, Sicilia (2005) found that teachers want to learn how to use new technologies in their classroom, but the lack of opportunities for professional development obstructed them from integrating technology in certain

subjects, such as science and mathematics. Other problematic issues related to professional development in ICT are that training courses are not differentiated to meet the specific learning needs of teachers and the sessions are not regularly updated (Balanskat, Blamire, & Kefala, 2006).

Technical support is required to handle unneeded failures because technology is thought to be expensive and complicated to use. According to a study by Tagalou et al. (2013), although technical help was crucial for ICT integration, only 48.1% of administrators supplied technical support directly to students in their schools, making up 62.7% of administrators. The inference was that rather than recruiting technical support staff, school authorities outsourced it. According to a Matelong (2013) survey, 28.57% of schools had technicians on staff, 25.9% used MOE funding to hire outside contractors for maintenance work, 3.7% benefited from the Computer for Schools Kenya initiative, and 18.5% relied on ICT-trained teachers.

Laaria (2013) found that 64.44% lacked technical help to manage ICT equipment maintenance and repair. The majority of schools lacked trained technicians. While Laaria (2013) studied leadership challenges in ICT implementation in PSS, it did not seek to identify factors influencing principals' leadership for ICT integration in PSSM, a gap that the current study attempted to fill. Kukali, Kawasonga, and Rabari (2018) investigated the significance of ICT use in the public administration of schools. While this study was done at PSS, the Oloo (2022) survey was carried out in primary, secondary, and technical institutions.

Studies reveal that among educational administrators, the favorable attitude toward computer use is strongest when the role of computers in school management is made apparent, according to Kavagi (2010), as cited in Lenah (2015). The rate, scope, and depth of computer use in education are all influenced by school officials' attitudes about ICT. Administrators at the institution believe that the addition of computers has improved the school's reputation as a cutting-edge institution. Lenah (2015) points out that user acceptability, which is impacted by user attitude, is a prerequisite for every educational program's successful implementation. Teachers with the appropriate competencies, values, and attitudes are necessary for the successful use of technology and the drive to make education more relevant in the twenty-first century (Daily Nation, November 4, 2011:p. 13).

According to Mugo (2013), training teachers on how best to use assistive technologies in the classroom is a major concern worldwide. Quoting Newhouse (2002), Mugo argued that teachers, especially those who are blind, lack trainers to focus on the study of technologies themselves, let alone educational technology (support for teaching in the classroom). He observes that most trainers in ICT have no clue how a visually challenged person learns. Additionally, these trainers lack knowledge and skills in pedagogy and andragogy. The reviewed study focused on teacher-related factors that influence the use of ICT among trainers and students in universities. Despite the fact that the findings are informative, they may not be applicable to special primary schools. Given that some of the teachers in the schools of the visually challenged in Kenya are themselves visually challenged, it was important for this study to find out whether the training of teachers in ICT could be a factor influencing access to ICT by learners with visual impairment.

2.6 Availability of ICT Resources in Schools

The National Education Association (NEA) reports that over the previous ten years, there has been a 30% increase in the number of kids in special education programs in the United States. The NEA further notes that because three out of every four students with disabilities spend part or all of their school day in a general education classroom, children with disabilities are present in almost every general education classroom in the nation. Assistive technology is one method for assisting students with impairments, even in the face of a shortage of special education teachers. Today's students with certain challenges can learn more efficiently thanks to assistive technology solutions. Assistive technology is a developing and dynamic field, with products ranging in sophistication from "low" technologies like a graphic organizer worksheet to "high" technologies like cutting-edge software and smartphone apps. Any given classroom may contain a variety of assistive technology applications and sample items, which can influence how learners of all abilities study.

Lack or scarcity of technological resources in schools is a complex barrier that discourages teachers from integrating or using new technologies in the classroom (Bingimlas, 2009). Studies have indicated several reasons for the lack of access to technology. According to Sicilia (2005), teachers complained about how difficult it was to always have access to computers because computers had to be booked in key and padlock and that computers were few and therefore needed to be shared. According to Becta (2004), the inaccessibility of ICT resources is not always merely due to the non-availability of the hardware and software or other ICT materials within the school but

may be the result of one of a number of factors, such as poor organization of resources, poor quality hardware, inappropriate software, or a lack of personal access for teachers.

Moreover, barriers related to the availability of new technologies for teachers are widespread and may differ from one country to another. Emprincas (2006) and Bingimlas (2009) European study found that lack of access is the largest barrier and that different barriers to using ICT in teaching were reported by teachers, for example, lack of computers and adequate materials. Similarly, Korte and Husing (2007) found that in European schools, there are some infrastructural barriers, such as broadband access not yet being available. They concluded that one-third of European schools still do not have broadband internet access. Gomes (2005) found a lack of appropriate infrastructure and appropriate material resources, such as high-quality hardware and suitable educational software, in the schools as a serious barrier that needed to be addressed. In comparing the availability of assistive technologies in universities in Kenya and the USA, Mugo (2013) noted that there was an acute scarcity of the technology for learners who are visually impaired. Despite the fact that the findings from the reviewed studies were informative, most of them were carried out in institutions of higher learning. As such, there is no empirical data on the availability of ICT resources in special schools in Kenya. Therefore, the current study sought to find out the ICT resources available in the special primary schools for the visually impaired in Kenya.

2.7 School Administration Support of ICT Use

Lack or scarcity of ICT in schools is not a standalone barrier to the use of the same in the education of learners with visual challenges. The problem could be solved by

improvising the resources and successful training of the teachers of these learners on the use of technology to support learning. A bigger problem comes when there is less support from the school administration.

The establishment of an efficient management structure, goal-setting, decision-making, and relationship-building are all administrative tasks that school leaders are crucial in supporting (Nang'unda, 2019). Administration, according to Mutisya et al. (2017), is the activity that leads staff members' actions to work toward achieving organizational goals. A school administrator's job is to make sure that certain tasks are allocated, carried out, and that there is ongoing input to enhance overall school management. Technology is changing education, but not all students or staff members will benefit from its advantages, claims Malik (2018). This is because of weak leadership. Schools will continue to lag behind the society in which they are located.

To apply new technology, knowledge development is necessary. School administrators will need to update and improve their technological abilities in order to use new technology. A study on the use of ICT in three government-maintained mixed secondary schools in the United Kingdom (UK) revealed that instructors needed assistance in determining their ICT training requirements. The emphasis on ICT use during initial teacher training courses was acknowledged to have an impact on more recently qualified personnel in all three of the schools under examination, and whole school training days were recognized as being influential. Teachers must also understand what technical assistance is available and how to use it (Ghavifekr et al., 2016).

Computer use in education and training is growing in popularity. Institutions of higher learning cannot function without computers. The majority of administrators, however, find it difficult to start a computerization project at a school because ICT is a relatively new sector (Chin et al., 2022). Many school administrators feel overburdened by the mandate to incorporate ICT in classrooms and the enormous responsibility of managing schools in a world that has been altered by technologies. School administrators are expected to take on leadership roles in fields for which they have little experience and are unfamiliar. To be effective in their new roles as technology leaders in controlling the use of ICT in schools, school leaders must acquire new competencies.

Mutisya et al. (2017) conducted their study to ascertain the impact of factors connected to the school on the integration of ICT in the management of public secondary schools in Kitui County, Kenya. This study employed a descriptive survey research design. In Kitui County, 58 public secondary schools with working ICT infrastructure participated in the survey. Descriptive and inferential statistics were utilized to evaluate the acquired data, utilizing both quantitative and qualitative data analysis methods. Percentages and the mean were employed as descriptive statistics in this investigation. The Pearson Chi-square test for independence and Pearson's moment of correlation coefficient were used to assess hypotheses. The qualitative data was combined with the quantitative data and presented as a story. According to the study's findings, there is a significant positive association between computer infrastructure and ICT integration in school management ($r(50) = 0.842$, p 0.05).

Head teachers' personal beliefs and theories about the integration of new technologies in teaching and learning are widely considered to play a central role in the implementation of ICT in schools. In the school environment, the head teacher's leadership styles and beliefs can facilitate or inhibit curricular implementation. Papaioannou and Charalambous (2011) carried out a descriptive survey study on head teachers' attitudes towards ICT and their perceptions about the factors that facilitate or inhibit ICT integration in primary schools in Cyprus. Two hundred and fifty primary school heads participated in the study. The findings indicated that headteachers play an important role in the integration of ICT in schools. According to Mrazek, Hollingsworth, and Street (2005), it is clear that school leaders with a positive attitude towards ICT integration can facilitate integration largely. Additionally, several other factors have been identified as the enablers of ICT integration. For example, a leadership role should include a strong professional vision for meaningful technology integration in teaching and learning.

Afshari (2008) found out that for any successful integration of ICT in teaching and learning, there has to be proper planning at the school level. This is because the school is expected to provide the necessary ICT resources for the teachers and the learners to use. An ICT integration plan provides a detailed blueprint of the steps and methods needed to translate the school's ICT vision into reality. According to Bryderup and Kowalski (2002), a plan is a guide to action, not a substitute for it. The existence of a written ICT plan and strategy does not guarantee the comprehensive use of ICT in schools, nor does the absence of an ICT plan necessarily equate to a lack of ICT integration in a given school. It is the work of the head teacher to make sure there is a comprehensive structure to enable effective use of ICT in his or her school.

The leadership of the principals is crucial to the adoption of ICT in schools. According to a study by Uncluer et al. (2010), the usage of ICT was dependent on the principals' cooperation in setting up in-service training sessions and maintaining the school website for faculty use. Depending on the demands of the school, the administrative support could be varied. The administrative assistance from principals towards integration is mixed. The principal is responsible for hiring staff to support and manage the ICT infrastructure in order to undertake a program. Since ICT is a crucial part of organizational management procedures, the principal and the larger staff must be ICT-knowledgeable. This result supported Gronow's (2007) findings about the principal's responsibility to encourage ICT in school organizational processes.

In order to ensure integration, principals must use their creativity while obtaining resources. This creates a climate that is conducive to teamwork. Lack of appropriate ICT practice models, as well as a lack of institutional, administrative, and technical support, were cited by Akbar et al. (2022) as obstacles to ICT adoption. The hurdles were further broken down into school and individual barriers, suggesting that they might not always be about administrative help but rather going beyond their bounds. The type of administrative support offered is largely related to the attitude of principals toward ICT integration in management.

According to Nang'und (2019), principals' negative attitudes toward ICT opposition required administrative support because, in their eyes, manual integration was no better than ICT integration. They found that 75% of respondents believed that a principal's attitude affected the administrative support they offered. In contrast to Nyachoka et al.

(2015), who simply utilized a questionnaire to collect data, the current study made use of interviews, questionnaires, observations, and document analysis. While the current study employed both secondary and primary data, the review of literature by Kipsoi, Chang'ach, and Sang (2012) was secondary data that could not be validated.

In the opinion of Binder and Nederle (2007) in Biwot (2012), head teachers are implementation leaders; their principal functions are to coordinate and organize organizational parts that must operate in harmony in order to achieve the implementation of goals. Binder and Nederle (2007) argue that locating and organizing necessary human, technical, and financial resources; establishing and facilitating organizational structures; creating and operating an effective communication network; and developing viable decision-making procedures are the core functions of the head teacher. In other words, they are instrumental in enabling and facilitating the capacity of other implementers. Apart from the duty of sourcing and procuring ICT for the school, another great support the head teacher should give for effective use of ICT in schools is the provision of technical support staff. Lewis (2003) asserted that without both good technical support in the classroom and whole-school resources, teachers could not be expected to overcome the barriers preventing them from using ICT. Pelgrum (2001) found that, in the view of primary and secondary school teachers, one of the top barriers to ICT use in education was a lack of technical assistance. Korte and Husing (2007) argued that ICT support or maintenance contracts in schools help teachers use ICT in teaching without losing time by having to fix software and hardware problems.

Becta (2004) stated that “if there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdown” (p. . 16). In his study, many of the respondents indicated that technical faults might discourage them from using ICT in their teaching because of the fear of equipment breaking down during a lesson. Lack of trained support staff for ICT designed or adapted for learners with visual disabilities in special schools could pose a great threat to the use of ICT in the schools. The current study was therefore interested in finding out the extent to which the school administration created an effective technological support structure, and more specifically, the technical support both teachers and learners were given to enable them to benefit from the use of ICT.

2.8 Government Support for the Use of ICT in Schools

ICT skills are especially crucial because economies are becoming more and more dependent on technological knowledge and expertise. Early computer use fosters the development of ICT abilities in kids, which can later be applied as a tool in the educational process. For instance, 77% of Swiss students stated that they prepare for their classes using a computer many times every week. Only 3% of respondents said they had never used a computer to prepare for a class (Office Federal of Statistics, Neuchatel, 2002). Students' access to modern technology is indicated by the typical number of students per computer.

According to information from the OECD's Education at a Glance, 25% of pupils in Italy have access to a computer, compared to 90% or more in Canada, Finland, and New Zealand. Additionally, kids' access to computers varies by grade level, with secondary

school students typically having more access than elementary school students. The ratio of pupils to computers has been dropping recently. Canada, New Zealand, and Denmark have the fewest pupils per computer among the 13 nations for which data are available, with less than 12 lower secondary students per computer, compared to the Czech Republic and Hungary, who have more than 35 students per computer.

The introduction of ICT integration into school management has grown quickly, accompanied by adjustments to meet the demands of the 21st century. To ensure integration in terms of professional output, principals must redesign processes. However, the complexity of ICTs in the 21st century is surely expensive, so fixing them would cost a fortune. (Mutia, 2020).

Under the largely relied-upon Total Cost Ownership (TCO) principle and principals' leadership, financial issues are comparable to ICT integration. According to Kukali et al. (2018), respondents (93.33%) identified the high cost of ICT tools as the primary difficulty. The problem of tight financial resources borders on the lack of leadership expertise among principals about TCO for ICT integration. In the Kang'unda (2014) survey, principals claimed that a key obstacle to the use of ICT in administration in public secondary schools was a lack of funding. In order to keep up with rapidly evolving technological standards and ward off viruses, principals were unable to invest in new ICTs, upgrade them, or maintain the ones they already had. This conclusion pertains to the financial restrictions principals had to deal with, which ultimately prevented them from calculating any accurate TCO for ICT integration.

Many countries in the world now regard understanding of ICTs, mastery of the basic skills, and the concept of ICT as part of core education alongside reading, writing, and calculating (UNESCO, 2006). Education policy documents in many countries in the world have placed emphasis on promoting the use of ICT in teaching and learning, often in conjunction with curriculum reform initiatives that aim to enhance the development of 21st century skills (proceedings of the IRC 2008). According to the Ministry of Education of Trinidad and Tobago (2005), ICT has become the buzzword of the 21st century. It is now the driver of knowledge in societies. Governments worldwide have recognized the need to advantage their citizens by investing heavily in the development of knowledge-based societies, recognizing the advantage that the integration and use of ICT provide for the social and economic development of their populations.

Many countries in the world have incorporated the United Nations Millennium Development Goals and Education for All (EFA) (2003), which recognize that every child has an inherent right to an education that will enhance the development of maximum capacity regardless of gender, ethnic, economic, social, religious, or mental ability. In this issue, the philosophy of education is that the use of ICT in education would enhance human capacity, dynamize the teaching and learning environment, provide equity and access, and develop a responsible individual capable of functioning in a technology-driven knowledge-based society.

For instance, in the Republic of Ghana, the Education Policy (2008) acknowledged that for it to make any appreciable progress in its socio-economic development efforts, substantial resources will need to be directed toward improving educational delivery. The

government of Ghana Further acknowledged the need for ICT training and education in schools, colleges, and universities. The thought behind this was that the employment of ICT in the education system would result in the creation of new possibilities for learners and teachers to engage in new ways of information acquisition and analysis.

In Tanzania, the government, through the ministry of education, developed an ICT policy to guide the integration of ICT in basic education. The policy covers pre-primary, secondary, and teacher education, as well as non-formal and adult education (MoE Tanzania, 2007). The government recognizes that ICT offers new opportunities to enhance education and to improve the quality of education delivery in all areas (MoE Tanzania 2007).

Equally, the Kenyan government recognizes that the education and training of all citizens are fundamental to the development of the nation. Since independence, the government has recognized that education is the basic tool for human resource development, improving the quality of life, and cultivating nationalistic values. The education sector, therefore, is committed to providing the skills that will be required to steer Kenyans toward economic and social goals (GoK 2007). More so, the Constitution of Kenya (2010) makes education a right for every Kenyan. It has provisions on children's right to free and compulsory basic education. It includes quality service and access to educational institutions and facilities for people with disabilities. This includes the use of sign language, braille, or other appropriate means of communication and access to materials and devices to overcome constraints arising from the disability.

To address challenges facing ICT and to achieve the objective of education transformation for the knowledge society, the government has come up with measures regarding the provision of ICT in education in all aspects as a national priority. The government laid greater emphasis on ICT integration to improve teaching and learning while continuing to support ICT for educational administration and management (e-government) and the development of digital literacy relevant to the knowledge economy, and has enhanced support that has incorporated ICT in the education of learners with special educational needs. The government has also developed guidelines, minimum quality standards, and specifications for ICT hardware and software for learners with special needs and enhanced the availability and utilization of digital learning resources and software for learners with special needs (MoE and MoHEST 2012).

Despite the efforts made by various governments to come up with ICT policies for learners with special needs, the situation in schools could be different. There have been complaints about the scarcity of resources, especially in special schools, that teachers are not using the available resources or are not improvising the resources for their teaching (Karunaratne, Peiris, and Hansson, 2018). It was then the concern of this study to examine the situation in the special schools for the visually challenged in Kenya.

2.9 Education for Learners with Visual Challenges

A visual disability does not separate the child from the community. These learners, just like their sighted peers, go back to work in the same society where they are expected to be independent and active participants (Mugo, 2013). These learners, therefore, should be accorded quality education if they are to be independent. Unfortunately, Mugo (ibid.) and

Pagliano (1998) noted that despite many decades of worthy and charitable intentions, poor education and rampant unemployment continue to leave most people with disabilities without the skills and resources to emerge from isolation, poverty, and restriction. The scholars advised that educational approaches for these learners should therefore be designed to put a decisive end to dependence.

According to Kirkwood and Mccall (1997), learners with visual challenges should be helped to become active, self-directed, and productive participants in the world. Perhaps it would be possible to do this if the teachers of the learners with visual disabilities strived to improve the quality of interaction between these learners by facilitating equal access to the world's resources and opportunities. This would be possible if the teachers and the learners effectively used ICT (UNESCO, 2006). Further, the educational approaches should see these learners rise to levels of productive participation and achievement equal to those of their sighted peers. In this aspect, there is a need to develop and demonstrate the effectiveness of a modern, holistic approach to special needs based on knowledge of human perception and a philosophy of No Limits Mason (1997).

Quality education for learners with visual impairments demands that the teachers go beyond meeting the minimum requirements for functioning, life satisfaction, and accommodations for these learners by society. Mugo (2013) informs us that the key to effective living is how well we adapt to maximize our access to our environment and ourselves. He construes that the first duty of the teachers of learners with special needs is therefore to help foster learners' ability to gain fully functional and aesthetic access to their environment. To do this, the teachers should focus on a learner’s ability to perceive

the environment more completely, process what is perceived with more sophistication, and act on the environment with greater facility. Through optimized perception, these students can be most aware of their options and be able to exercise them to maximum effect (Hegarty, 2000).

Research has shown that the majority of learners with visual challenges those in special schools and even those in inclusive schools the world over have limited access to quality education (Wanjau, 2016; Pagliano, 1998). To rectify this, efforts have been made to focus on areas such as education and psychological development, methods of assessment, teaching, and learning through the tactile sense, including both Braille and Moon. However, there is a scarcity of documented literature on the use of ICT in aid of helping learners with VI to access quality education. This study, therefore, endeavoured to bridge the gap.

2.10 Use of Models for ICT Management in Schools

ICT dynamizes societal changes. It is affecting every facet of existence. Schools are starting to notice the effects more and more (F. Mikre) (2011). Society is pressuring schools to effectively adapt to this innovation since ICT gives both students and teachers additional options to adjust learning, teaching, and managing individual needs. It offers fresher, more potent strategies for addressing some of the difficulties the nation's educational system is currently experiencing. These technologies stand out for their quick development and revolution, which frequently alter the ways in which users interact with them.

Computers have been infused into society for a decade, and more recently, ICT, with various effects on learning. Educational institutions are anticipated to play a critical role as the engine for knowledge development and the learning environment in the present information age. In this sense, ICT becomes a crucial tool for making this duty easier. ICT has become a necessary component of daily life; thus, its integration into educational management and the improvement of schools goes beyond just teaching and learning. It has emerged as one of the most powerful forces behind school improvement. ICT is essential for enhancing the school system's operational efficacy.

Over the years, educational institution management has consistently been a national concern. Any educational setting's effectiveness or efficiency level is partially determined by how well its people, materials, and technological resources are used to achieve its objectives. ICT is becoming a crucial instrument for managing effectively and achieving educational objectives. It is disclosed that the institution's service delivery and overall management have significantly improved as a result of the deployment of ICT in many operational sections. To be able to accomplish bigger feats in the domain of educational management, however, there is still more work to be done.

Scholars have defined a model as a simplified image of reality. With regard to the management of school resources, it means that the model shows elements of reality (in the context of a school) that are relevant for the analysis of access to the teaching and learning resources. The purpose of the model in the management of resources in the school is to improve the problem-solving or decision-making process, facilitate analytical and creative thinking, and provide thought structures, action steps, and representation

formats. According to Shafique and Mahmood (2010), models as tools are developed in a particular context and arise out of typical questions and problems that are relevant for managers and researchers. In the school setup, the model would assist the administration in solving problems emanating, for instance, from access to ICT.

In today's information overload, models can be valuable tools to organize and present information systematically, which can help make an informed decision. Decisions concerning ICT access for learners who are visually impaired are complex issues, especially in developing countries (Banes & Seale, 2002). Quite often, decisions have been made concerning access to technology for learners with disabilities, but some of the decisions have turned out to be biased and discriminatory. According to Busha and Harter (1980), committing to a model-based management approach across an entire organization or institution can yield significant benefits. According to Kouroupetroglou, Pino, and Kacorri (2011), accessibility of ICT resources to learners with VI requires, among others, proper planning, a suitable organizational system, human resources with explicit expertise, unconventional technological support, substantial implementation effort, and functional evaluation. Loeb, Dynarski, McFarland, Morris, Reardon, and Reber. (2017) outlined the benefits of a model in resource management as follows:

- Models (if maintained) can always provide a clear representation of the current state of the situation, mitigating the risk of making decisions based on an inaccurate understanding of the situation.
- Models can reflect different viewpoints on the same situation.

- Models can help identify bottlenecks or issues with a process that would otherwise go unnoticed.
- Models can be used to anticipate the outcomes of proposed Models can ensure the completeness of a solution that is to be implemented.
- Models can increase the consistency and clarity of a communication change or solution.
- Models can provide a means of tracking the specific value of an activity, system, or service by understanding the larger end-to-end process that it supports and the revenue produced by that process.

Nevertheless, not much study has been done in this area, despite the fact that the model approach to resource management will facilitate the VI's access to ICT and other resources. In contrast, business management has been the focus of the majority of research. Therefore, this study sought to close this gap by creating a model that can enhance access and use of ICT by learners with VI.

2.11 Summary of the Literature Review and the Main Gap of the Study

Research has demonstrated that ICT accelerates changes in society. It is having an impact on many aspects of life. Schools are becoming increasingly aware of the implications. Since ICT provides teachers and students with extra alternatives to modify instruction, learning, and meeting individual needs, society is putting pressure on schools to effectively adapt to innovation. It provides newer, more effective approaches to some of the problems in the education setting. These technologies are notable for their rapid advancement and revolution, which often change the ways in which people use them.

Further, existing studies have shown that ICT technologies for learners with VI have been in existence since the 19th century. Literature reviewed in this study also revealed that learners with visual challenges access ICT differently. They hence require special training on access to ICT and use it for their personal and educational benefits. However, most of the studies were carried out in developed countries, which are more endowed in terms of technology. The literature reviewed in this study hence presented a major gap in research in terms of access to and use of ICT by learners with visual impairments, which this study endeavored to bridge. Therefore, a study of how well these learners are trained to use ICT in Kenya was imperative.

In addition, it is clear from the literature that there are many hindrances to accessing information for learners, especially those with special needs. The literature reveals that teachers have been recognized as the main implementers of any change in the education sector, but a lack of competence, confidence, and resistance to change is hindering them from implementing the changes. However, there is a scarcity of documented literature about this situation in special schools. Therefore, it was important to carry out the current study and establish teacher factors that influence the use of ICT in special schools.

Furthermore, existing studies have revealed that school administration's beliefs and perceptions about the integration of new technologies in teaching and learning play a central role in the implementation of ICT in schools. The literature also revealed that school environmental factors such as lack of time, inaccessibility, and lack of technical support contribute negatively to the ability to access ICT facilities. However, the revised studies were carried out in regular schools without learners with special needs. As such,

there is a lack of information on the situation in special schools with learners who have various challenges. Therefore, the current study focuses on filling the gap by investigating teacher and school factors that influence the use of ICT in special schools by learners with VI.

Additionally, authors have argued that in today's information overload, models can be valuable tools to organize and present information systematically, which can help make an informed decision. Decisions concerning ICT access for learners who are visually impaired are complex issues, especially in developing countries. Quite often, decisions have been made concerning access to technology for learners with disabilities, but some of the decisions have turned out to be biased and discriminatory. However, there is a lack of empirical studies in this area in Kenya. Therefore, this study sought to close this gap by creating a model that can enhance access to and use of ICT by learners with VI.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology employed in the collection of data for this study. The chapter presents the following aspects: research design, variables of the study, location of the study, target population, sampling techniques and sample size, research instruments, piloting of the research instruments, data collection techniques, data analysis, and logistical and ethical considerations.

3.2 Research Design

Research design is defined as the plot, organization, and plan of study envisioned for obtaining responses to study questions and managing variation (Kerlinger, 1986). The study design could also be defined as an outline or the arrangement of techniques and measures for obtaining the data for solving the study problem. Research design enables the researcher to arrive at certain meaningful conclusions at the end of the proposed study. This study adopted a descriptive survey research design. Descriptive survey research design describes systematically the facts and characteristics of a given population or area of interest, factually and accurately. According to Mugenda and Mugenda (1999), descriptive study is probably the best method for social scientists and educators who are interested in collecting original data for describing a population. The survey approach was used to assess the thoughts, feelings, and opinions of the respondents concerning the access and use of ICT in the instruction of learners with visual challenges (Mwanje, 2001). In order to collect in-depth and accurate data for the purpose of the study, this study also adopted both qualitative and quantitative research

paradigms. Quantitative relied exclusively on numerical or quantifiable data, while qualitative relied on themes and words (Coffey, Holbrook, & Atkinson, 1996).

3.2.1 Research Variables

A variable is a concept that can take on different quantitative values at a given point in time. According to Mugenda and Mugenda (2003), a variable is a measurable characteristic that assumes different values among the subjects and, therefore, is a logical way of expressing a particular attribute in a subject. In this aspect, the study had independent, intervening, and dependent variables. The independent variables constituted teachers factors, learners factors, school administration factors and ICT resources available for learners with VI. These were observed and described using the respondent's views. The intervening variables of the study were government policy on ICT and the school's social-cultural environment. The dependent variables of the study was integration of ICT in teaching and learning in schools of learners with VI.

3.3 Location of the Study

The ideal setting for any study is one that is directly related to the researcher's interest and should be easily accessible to the researcher (Singleton, 1993). Mugenda and Mugenda (1999) emphasize that the locale should have information that 'is information rich' for the purpose of the study. In consideration of this, the study was conducted in three counties: Kiambu County, Meru County, and Mombasa County. Although there are seven public special primary schools for learners with visual impairments spread across Kenya's counties, the researcher concentrated on these three counties due to the fact that they have the oldest special primary schools in terms of year of establishment. In

addition, the schools have a large population, which yields rich data. Further, the study assumed that because these schools were established significantly earlier than the others, they are likely to have more ICT resources, which is therefore appropriate for the purpose of the study.

3.4 Target Population

The study targeted seven special primary schools with learners with visual impairments. The schools are located in six counties, namely Kisumu, Siaya, West Pokot, Mombasa, Kiambu, and Meru. The study had a total target population of 1,845; these comprised 1667 learners with VI, 161 teachers teaching learners with VI, 7 computer teachers, 7 head teachers, and 3 Ministry of Education officers in the six counties. The seven schools were targeted because these are the only special primary schools with learners who have visual impairments (Ministry of Education, 2019).

Computer teachers were targeted based on the assumption that they were teaching computers to the learners and were in a better position to give their opinion on the determinants of ICT access by learners with VI. The teachers were selected based on the assumption that they have close contact with the learners in class and were in a position to give their opinion on the determinants of ICT access by learners with VI. The head teachers from the schools participated in the study because they are the implementation overseers of government policy implementation in the schools. The Ministry of Education officers from the counties where the schools are found were targeted based on the assumption that they are the policy-makers and are government representatives on the

ground to monitor the implementation of policies and that they have interacted with the learners, teachers, and head teachers on the issues of ICT and learners with VI.

3.5 Sampling Techniques and Sample Size

This section details the sampling procedure and the sample for the study.

3.5.1 Sampling Technique

The study employed the purposive sampling technique to sample three special primary schools. This was based on the fact that these three were the oldest special primary schools in terms of year of establishment. In addition, the schools had a large population with computer labs, thus relevant to the purpose of this study. The three schools were situated in three counties: Kiambu, Meru, and Mombasa counties. Further, the purposive sampling technique was used to sample the school headteachers of the three schools. The head teachers were sampled to participate in the study because they are the ones who are in charge of implementing government policy in the schools. Also, the purposive sampling technique was utilized by sampling officers from the Ministry of Education. The Ministry of Education officers from the counties where the schools are found were sampled because they are the policy-makers and are government representatives on the ground to monitor the implementation of policies, and they have interacted with the learners, teachers, and head teachers on the issues of ICT and learners with VI.

In addition, the purposive sampling technique was employed to sample all the computer teachers in the three schools. Computer teachers were sampled as respondents because they were teaching computer studies to the learners and were in a better position to give

their opinion on the determinants of ICT access by learners with VI. Further, a random sampling technique was used to sample teachers who teach learners with VI. The teachers were selected as respondents because they had close contact with the learners in class and were in a position to give their opinion on the determinants of ICT access by learners with VI. Finally, a simple random sampling technique was used to sample learners with VI.

3.5.2 Sample Size

According to Creswell (2018), a sample is a subset of individuals from a larger population, and sampling means selecting the group that one will actually collect data from in research. Mugenda and Mugenda (2019) recommend that a sample size of 10 to 30% of the targeted population is adequate to provide generalizable results. Based on the recommendation, the study sampled 195 respondents, which is 10% of the target population. The sample size consisted of three (3) head teachers, three (3) Ministry of Education officers, three (3) computer teachers, 18 teachers teaching learners with IV, and 168 learners with IV. Table 3.1 visually presents the sample frame for this study.

Table 3.1: Sample Frame

Category of Respondents	**Target population\ (N)**	**Sample (n)**	**Percentage (%)**
Special schools	7	3	43
Learners with VI	1,667	168	10
Teachers	161	18	11
Computer teachers	7	3	43
Head teachers	7	3	43
Ministry of Education officers	7	3	43
Total	**1,849**	**195**	**10.5**

3.6 Research Instruments

To achieve the objectives effectively, the researcher collected data using various research instruments. The objective of the study formed the basis on which the instruments were constructed. The instruments included questionnaires, observation schedules, interviews, and document analysis. The instruments described are as follows:.

3.6.1 Questionnaire for Teachers

The teacher's questionnaire obtained information about the use of ICT in the classroom and about how the teachers and the learners benefited from the use of it. Further, the instrument collected information on challenges faced in accessing ICT. The use of questionnaires in research is important because it enables the researcher to collect a large amount of information within a short period of time. It also has the ability to collect information that would otherwise appear sensitive to respondents if other instruments like interviews and focus group discussions were used (Orodho, 2016).

3.6.2 Questionnaire for Learners

This questionnaire aimed at collecting information about the challenges the learners have in accessing ICT and the learners's opinions on how they benefited from the use of ICT in the teaching and learning process. The questionnaire was designed for those learners who used the system for their reading and writing.

3.6.3 Interview Schedule

Semi-structured Interview schedules were administered to computer teachers, head teachers, and Ministry of Education officials. The interview schedule involved a set of

predetermined questions. The principal interview sorted out the information about the procurement of ICT, the support the administration gives to the teachers for the use of the technology, and the challenges the school faces in the access and use of the technology. The teacher who taught the learners how to use computers was interviewed about the access to technology by the learners and the difficulties she or he and the learners face in accessing ICT. The officials from the ministry were interviewed about the support the government gives to the schools for ICT, including policies put in place for effective use of the technology.

The interview schedule was used because it follows a rigid procedure laid down in the form and order prescribed (Kothari, 2004). According to Mugenda and Mugenda (2003), interview schedules make it possible to obtain the data required to meet specific objectives of the study and are used to standardize the interview situation so that interviewers can ask the same questions in the same manner. Another advantage of the interview schedule is that responses are noted as the interview progresses, thus facilitating data analysis since the information is readily accessible and already classified into categories by the interviewer. The notes taken as the interview progresses leave no information out owing to forgetfulness or any other form of omission. Moreover, Fontana & Frey (2000) assert that interviews have been described as one of the most effective ways to understand another's viewpoint.

3.6.4 Classroom Observation Schedule

Classroom observation was carried out in three schools. Observation in the classroom was important for this study since it is a means for evaluating some aspects of learning

and development, such as performance skills and aspects of personal-social development, that are difficult to evaluate using paper-and-pen methods (Gronlund, 1985). Mathematics, English, and science lessons were observed as they conducted their lessons. Additionally, the teachers who teach computers to these learners were observed as they did so. Each of these teachers was followed three times and observed as he or she performed various aspects of the lesson presentation using ICT. A Likert-type rating scale observation protocol with three rating scales—below average, average, and above average was used to provide a common frame of reference for comparing teachers' integration skills based on the same set of characteristics.

3.6.5 Document Analysis Guide

A document analysis guide was utilized to collect data on the performance of learners with VI. In addition, the guide was utilized in obtaining data on the extent to which teachers used ICT in instruction. The researcher scrutinized the progress records of the learners with VI to establish how they performed in various learning areas. Further, the researcher analyzed the lesson plans prepared by teachers to establish whether they integrate ICT in teaching and learning. The information that was obtained was recorded on paper and used in the data analysis.

3.7 Piloting

A pilot study was conducted in one of the special schools for learners with visual challenges in Kisumu County to determine the validity and reliability of the instruments. The sample for the pilot study was 10 participants, comprised of one head teacher, one officer from the Ministry of Education, one computer teacher, three teachers, and four

learners. This exercise ensured that the instruments were in line with the research objectives and also determined the time duration that it would take to respond to the instruments. The pilot study also enabled the researcher to identify inconsistencies, discrepancies, and ambiguities that could have led to a misinterpretation of the research instruments. After analyzing the data from the pilot study, questions from the questionnaires that were found to be ambiguous or irrelevant were rectified. The rating scale of the observation guide was accordingly adjusted.

3.7.1 Validity

Validity is the degree to which the results obtained from the analysis of the data actually represent the phenomenon under study (Orodho, 2014). This study used various methods to ensure the validity of the research instruments. Thomas-Maddox, Richmond, and McCrosky (2008) identified three primary approaches to enhancing validity: face or content validity, predictive or criterion validity, and construct or factorial validity. In this study, content validity and construct validity were considered for measurement. According to Wrench et al. (2008), content, construct, and criterion are the validity approaches most commonly employed by researchers because of their inherently subjective nature. First, the content and construct validity were ascertained. This was to establish whether the instruments measured what was intended.

The researcher critically inspected the items to ascertain their validity and made sure that the instruments had a good, detailed description of the content domain. She also ensured that each instrument was comprehensive enough to adequately represent the conceptual domains that the instrument was purporting to measure. Expert opinion and judgment

from the university supervisors were sought. Content validity should be determined systematically by content experts (Galletal, 1996). Further, in this respect, piloting of the study instruments was done. Items in the questionnaire and interview protocol that were found to be inconsistent with the domain or content of interest were identified and modified to ensure clarity of information. Additionally, difficult questions were re-framed using appropriate language that could be easily understood by the respondents. This was achieved through discussions, comments, and suggestions in relation to the research objectives.

The criterion, also known as predictive validity, refers to the use of a measure in assessing subjects' behavior in specific situations (Mugenda & Mugenda, 2003). This was also measured in this research. To ensure this validity, the instruments were designed in a way to achieve measurements that conformed to the theoretical expectations of the research. Experts' guidance from the supervisors who were conversant with the area of ICT and learners with visual impairment enabled this. Further, after the pilot study, questions that caused confusion and misunderstanding among the respondents were identified and modified to ensure clarity of the information in the questions. Difficult questions were sorted and reframed using appropriate language, which was easily understood by the respondents with visual challenges. Questions that caused confusion and misunderstanding among the respondents were identified and modified to ensure clarity of the information. Difficult questions were sorted and reframed using appropriate language that was easily understood by the respondents.

3.7.2 Reliability

Reliability as a measurement concept has to do with ensuring that the research instruments measure a particular phenomenon or collect research data accurately. Wrench et al. (2008) posit that reliability refers to the accuracy that a measure has in producing stable and consistent measurements. According to Mugeda and Mugenda (2006), for an instrument to be regarded as reliable, it should be able to yield comparable scores on repeated administration. Four statistical approaches can be used to determine the coefficient of reliability. These include test-retest, alternative form, split-half, and internal consistency and reliability, Wtench et al. (ibid.).

To determine the reliability of the instruments for this study, the internal consistency technique was used. The internal consistency method of estimating reliability coefficients requires only a single administration of an instrument. MacMillan and Schumacher (2010) affirm that the internal consistency technique is the most common type of reliability because it can be estimated by giving one form of a test once. The instruments for this study during the piloting study were administered once. The Cronbach alpha formula was then employed to compute the reliability of the instrument. The Cronbach Alpha reliability test is the most popular single-administration reliability test. It determines the agreement of answers to questions targeted at specific traits. Besides estimating the reliability coefficient, the Cronbach coefficient alpha has the added advantage of reducing the number of times the researcher is required to visit the field for data collection. Additionally, the Alpha reliability test is probably the most consistently reported reliability test in social sciences research. (Mugo, 2013; Wrench et al., 2008).

The alpha approach is especially useful when answers are made on a scale of some kind rather than as right or wrong. Since a number of the items in this study were in the form of scale measurement, requiring the respondents to indicate their levels of agreement, the Cronbach Alpha reliability approach was judged most appropriate in estimating the reliability of the instruments. In determining reliability, the higher the reliability coefficient, the more consistent participants are when filling out the questionnaire. Hence, in this study, the reliability coefficient of 0.72 was used to judge the reliability of the instruments. This implied that there was a higher degree of reliability in the data (Mugenda & Mugenda, 2003). Orodho (2009) opines that a reliability coefficient of 0.75 is considered high enough to judge the reliability of the instrument.

3.8 Data Collection Procedure

Data collection refers to gathering information to serve or prove some facts (Kombo & Tromp, 2006). The study considered the use of primary data, which was collected by administering interviews, questionnaires, and class observation to the respondents. The researcher adopted a drop-and-pick approach to administering the research instruments to the respondents. This approach was found appropriate since it would ensure a high rate of return for the instruments (Robinson, 2010). Upon obtaining authority from the university through the Graduate School and after obtaining research authorization from the National Commission for Science, Technology, and Innovation (NACOSTI), I visited the sampled schools, explained the purpose of the study, asked for permission from the school heads, and created rapport with the respondents. She also arranged with the research subjects for the data collection. The researcher later administered the research instruments in the following order:.

3.8.1 Classroom Observations

This was the first instrument to be administered. It was important to commence with this instrument since the researcher wanted to collect the data in a natural setting. The teachers could not have detailed information about what the research was after, and therefore they would not have a way of fine-tuning the class activities to please the researcher or taking cover. These increased the accuracy of the collected data.

The researcher sat in classes six and seven in each of the three selected schools and observed lessons directly in each school. Each lesson lasted for 30 minutes. The observation guide to get the intended data guided the researcher. After and before observing each lesson, the researcher held discussions with the respective teachers about his or her expectations. The head of departments who included head of Mathematics, head of sciences, head of languages and head of humanities (4) teachers from each of the schools sampled was followed and observed at least three times. A total of 36 observations in the three schools were therefore carried out.

3.8.2 Interviews

Face-to-face interview schedules with the head teacher, the ministry of education representative, and the computer teacher were the next things to be done. The researcher met each one of them to book an appointment. Then Guided by the interview schedule, the researcher interviewed each one of them at each school on different days and recorded their responses. The use of interview schedules gave the researcher an opportunity to probe the respondents for clarification and elaboration (Weirsam & Jurs, 2005).

3.8.3 Questionnaires for Teachers and Learners

The researcher distributed the questionnaires to the teachers herself and collected them three days later. This gave the respondents enough time to respond at their convenience, ensuring a high rate of return. Questionnaires in large print and in braille were prepared in advance for the low-vision and totally blind learners, respectively. The learners' questionnaires were distributed to them with the assistance of the class teachers in the sampled schools. The researcher requested the teachers assemble the students in a hall and explained to the students her expectations before filling out the questionnaires. The students were given one and a half hours to respond to the questionnaires, and then the researcher, assisted by their respective teachers, collected them as they left the hall. This ensured 100% collection of the questionnaires.

3.9 Data Analysis and Presentation

The study collected both qualitative and quantitative data. Each of these sets of data was analyzed independently, where the quantitative data was analyzed using the Statistical Package for Social Sciences (SPSS) version 22, and the qualitative data was analysed quantitatively using the deductive approach.

3.9.1 Qualitative Data

The researcher converted the field notes generated through interviews and observations into Word documents for qualitative data analysis using open coding (Glasser & Strauss, 1967). This set of data was analysed deductively. The researcher first converted the responses that were written in braille to print; she then listened to the audio recordings and converted them to print. Then she became familiar with the data, that is, their range

and diversity, and gained an overview of the materials gathered. She did this by reading the transcripts and studying observational notes. The researcher then coded the text data, developed categories from the data, and merged common categories into predetermined themes. In this approach, the researcher was very careful not to force data into the categories. This approach, however, also allows for categories and themes that may emerge during data analysis. Miles & Huberman, 1994). In consideration of this, the researcher took note of any other emerging themes and interpreted them too. She then studied the data to determine its meaning in context and reported the findings. The qualitative data was presented in narrative form, where the voices of the interviewees were captured in the analysis. This enabled the researcher to present the views of the respondents in a manner that demonstrated their feelings and perceptions on the access of ICT in an endeavour to enable the learners with visual challenges to acquire quality education.

3.9.2 Quantitative Data

The quantitative data obtained through the research instruments was first organized based on the study variables. Organizing data is important since it makes the data more compact, easy to work with, and easier to understand (Weiss, 2004). The data was then entered into SPSS version 22 and analyzed using descriptive statistics. Data on all the specific objectives were analysed using frequencies, means, and percentages based on the objectives. The qualitative and quantitative data were used to complement each other in answering research questions. The findings of the study were presented using tables, graphs, pie charts, frequencies, ratios, and percentages in relation to research objectives and questions.

3.10 Logistical and Ethical Considerations

A research permit to conduct the study was sought from the National Commission for Science, Technology, and Innovation (NACOSTI). The participating school was assured that they would not be disclosed in the report of the study without their consent. The consent of the respondents was also sought before subjecting them to the research instruments. The participants were given assurance that the information they provided would be treated confidentially and that it would be used only for the purpose of the study. The questionnaires had cover letters attached explaining the purpose of the proposed study as well as ensuring the respondents of confidentiality. Additionally, the respondents were given directions on how to fill out the questionnaires and return them. The reason for this was to help reduce the likelihood of obtaining biased responses.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter details data presentation, interpretation, analysis and discussion. This is done accordingly based on the study objectives. The purpose of the study was to investigate the access of ICT and its influence on the education for learners with visual impairments. Hence, to achieve this purpose the study looked at the following:

Identify ICT resources available in the special schools for learners with VI and determine the level of integration of ICTs in teaching and learning in these schools. It was also to find out the learner and teacher factors that influence the access to and use of ICT in teaching and learning in the special primary schools for the learners with VI. The research was to establish the school administrative factors that influence access to and use of ICT in the special schools, and to propose a model for access and provision of learning support in the use of ICT that would effectively influence education for learners with visual impairments. In consideration of this, this chapter presents the data thematically using tables and charts, followed by interpretations and discussion of the findings.

4.2 Demographic Data

The study collected demographic data from the respondents. This included age, and experience, academic and professional qualification. From the data gathered, percentages and means were calculated for each category. The findings are presented in subsequent sections.

4.2.1 Demographic Characteristics of the Teachers

The information gathered about the teachers included gender, age ranges, and educational and professional backgrounds. The results from the respondents are shown in Table 4.1.

Table 4.1: Demographic Information of the teachers (N=18)

Demographic Information		**F**	%
Gender	Male	8	44
	Female	10	56
Ages (Years)	20-30	1	6
	31-40	2	11
	41-50	7	39
	51-60	6	33
	Beyond 60	1	6
	Non commital	1	6
Experience in teaching VI	1-5 yrs	-	00.0
	6-10 yrs	3	17
	11-15 yrs	6	33
	16-20 yrs	4	22
	20 yrs & Over	5	28
Highest academic qualification	KCSE/ KCE	11	61
	B. Ed	5	28
	Post graduate	1	6
	Noncommittal	1	6
Highest professional qualification	P1	3	17
	Diploma	8	44
	B.Ed	5	28
	Masters	1	6
	Noncommittal	1	6

According to Table 4.1, slightly less than half of the eighteen teachers sampled for this study were men and slightly more than half were women. The age range of the teachers who taught classes six and seven was primarily between forty-one and fifty years old. A little over 25% of the participants were aged 51 to 60. Less than 25% of the population was in the 31–40 age range. One teacher was younger than thirty years old, and another was older than sixty. The teachers' experiences instructing students with visual impairments varied. Most of the instructors had taught for 11 to 15 years, over 25% had taught for over 20 years, and over 25% had taught for 16 to 20 years. Each teacher had been in the classroom for more than five years. The data also shows that slightly less than 25% of the teachers held a bachelor's degree in education, whereas the rest of them held diplomas. This demonstrates that these professors have strong academic credentials in addition to their teaching experience. It is true that individuals who completed their diplomas did so at the Kenya Institute of Special Education (KISE). This clearly shows that the teachers were trained and had substantial experience in teaching the learners who are visually challenged and, hence, could make a concrete contribution to this study.

4.2.2 Demographic Data of the Learners

The two main categories of learners with visual impairments or issues are those who are blind and those who have other visual impairments. These two categories apparently use ICT in distinct ways (Mugo, 2013). Therefore, this study initially classified the students according to their gender before determining the degree of vision impairment. The gender and eyesight classifications of the leaners are shown in the Table 4.2.

Table 4.2: Demographic Information of the Learners

Category of Learners	**Male**	**Female**	**Total**
Blind	40 (24%)	73 (43%)	113 (67%)
Low Vision	34 (20 %)	21 (13 %)	55 (33%)
Total	**74 (44%)**	**94 (56%)**	**168 (100%)**

Table 4.2 demonstrates that the majority of the study's students with sight problems were female. Majority of the students were blind and nearly half of the blind students in the sample were female. The proportion of low vision learners in the sample was somewhat higher than 50%, and males made up the majority of low vision learners. The gender issue had to be considered when analysing the demographic data for this research since it affects how the implementation strategies for the recommendations and suggestions are carried out.

4.3 ICT Resources Available in Special Primary Schools for the Visually Impaired

The first objective of this study was to identify the ICT resources available in the special schools for the visually impaired. The researcher first obtained the school resource inventory and ticked off in the observation checklist the resources that were available in each of the schools sampled. The researcher then went further to establish the functioning status of the ICT resources. Additionally, the research established the adequacy of these resources based on the user's ratio. Table 4.3 presents the findings.

Table 4.3: ICT resources Available in the Schools for VI

Type of AT	Number of items		Ratio of functional items to number of leaners
	Functional	Non functional	
Ipods and ipads	6	-	6:1667
Computers with voice output software	52	-	52:1667
Enhanced Vision Systems Cameras	2	-	2:1667
Talking calculators	32	-	32:1667
Embossers	3	-	3:1667
Scanners	3	-	3:1667
Braille sense	1	-	1:1667
CCTVs	6	-	6:1667
Smartphones	68	-	68:1667
Tablets	30		30:1667
JAWS (Screen reader software)	6	-	6:1667
NVDA (screen reader software)	Free online	-	1667
Audio recorders	6		6:1667
Electronic books	36		36:1667
Compacts Discs	8		8:1667

From Table 4.3, it is evident that the schools have a variety of modern ICT resources, which could be helpful in accessing quality education for the learners. The findings

disagree with the findings reported by Kisanga and Kisanga (2021), who carried out research on the availability of assistive technology for students with visual impairments at higher education institutions in Tanzania. The study revealed that the biggest obstacles for students with visual impairments to using assistive technologies were a lack of ICT infrastructure and a lack of assistive technology tools.

Further, the findings are central to the findings reported by Unal and Ozturk (2012) in their study on "Barriers to ICT Integration into Teachers' Practice in Turkey. The results of the study indicated that the main barriers to the use of ICT-based methods and equipment in teachers' instructional practices were a lack of ICT equipment in the classrooms and a lack of ICT-based teaching resources.

Based on the data presented in Table 4.3, the schools had adequate ICT resources based on the number of learners with VI. For instance, there were six (6) iPods and iPads. These gadgets have many built-in functions that help improve productivity and academic performance for these learners. Braille sense, though it was only one in the three schools that were sampled for the study, offers the ability to perform various tasks simultaneously. This device provides all the functionality of a laptop computer, including WiFi, MSN chat, document processing, and so on. Braille embosser technology (3) enhances the production of braille in terms of the production of many copies of braille documents. It was observed that the embossers were used to create tactile graphics and also to make copies of braille texts in the schools. (Johnson, 2004). In a relative study, Zaid (2018) supports this finding when he identified computers, video conferencing, the Internet, and the World Wide Web as the top ICT facilities that are helpful in learning for

the visually impaired. Also crucial is the use of various AT tools for visually impaired pupils, including screen readers, Braille translation software, Braille writing instruments, closed-circuit television (CCTV), Braille embossers, and scanners.

Print-enlarging technology, including the enhanced vision system camera (2), enables magnification of very small print for easy reading. In addition, there was CCTV (6), which enabled the students to read printed text easily. The screen readers, which included Jaws (6) and the NVDA, allow the challenged users to interact independently and efficiently with the computer. Some of this software, for example, the Jaws and the NVDA, have features that enable the enlargement of print text on the computer screen for easy reading. The special scanner (1) is used to scan texts with small fonts and change the image to digital form, which can be enlarged and even converted into braille (Mugo, 2013). According to Simui *et al.* (2017), assistive technologies can help visually impaired students all over the world learn by facilitating information access and retrieval, contacting friends, and knowledge sharing, just like sighted individuals do. ICT is essential for promoting the participation of the blind, especially in educational activities. In fact, ICTs can aid in exceptional ways to reduce and even eliminate the feeling of prejudice and open access to knowledge. ICT is typically utilized as a tool to enhance efficacy and efficiency in several socio-economic spheres, including education, hence raising quality of life.

Further, Table 4.3 presents the rations, which indicate whether the ICT available in the schools met the demands of the users. Looking at the ratios, one would say that only those technologies that were multi-user, for instance, audio recorders (6:1667) would

efficiently serve the three schools. However, it was noted that one of the schools had only one while another had three. The NVDA software was free online, and hence the schools could access it with ease. The scanners (3) and the embossers (3) would also be used to serve many users at the same time. Smartphones from the ratios appear to be many, but these belonged to individual teachers, and therefore the learners would only access them when their teachers used them in the classroom. According to Kisanga and Kisanga (2020), assistive technologies benefit people with visual impairments by making electronic resources and tests more accessible, improving the reliability of students' work, expanding employment options, and decreasing overdependence. Additionally, assistive technology, including audio recorders, helps people with vision impairments manage their academic and social obligations as well as direct their career paths. In the field of education, scanners (3) and embossers provide instructors with cutting-edge resources to assist students with VI and other special needs in overcoming obstacles to their teaching and learning (Tom et al., 2018).

From the ratios presented in Table 4.3, it was clear that the resources were not enough in the schools. The scarcity of ICT resources in schools is a common thing, especially in developing countries. ETD (2012) postulates that a very small number of learners with disabilities get access to adaptive technology in developing countries. This problem is not unique to developing countries. Studies in developed countries, including the USA, have also shown that these learners suffer from the same problem (ACAMPESD, 2011; Mugo, 2013). The cost, especially for special ICT, is intimidating. According to Hasselbring (2000), the special technology ranges between 700 and 2000 US dollars. This means that the ICT resources are not easily affordable, especially by students and even in schools in

developing countries. The scarcity of ICT resources poses a serious challenge to the access to quality education for learners living with visual impairments.

Mutisya et al. (2017) conducted their study to ascertain the impact of factors connected to the school on the integration of ICT in the management of public secondary schools in Kitui County, Kenya. According to the study's findings, there was a significant positive association between computer infrastructure and ICT integration in school management ($r(50) = 0.842$, p 0.05). Accessing the ICT resources in the schools of learners with VI is crucial because it will inform the researcher on how to approach other objectives. The availability of resources in schools means that teachers are expected to use them during teaching and learning to process.

Integrating ICT in education is necessary for all individuals to develop and advance in the knowledge-driven world. Most of the current educational curriculum is oriented towards the use of eyesight; hence, individuals who are visually impaired experience challenges when acquiring education. The challenges experienced by the visually impaired can be resolved by the use of technologies, materials, devices, and equipment.

4.4 Level of integration of ICT in Teaching and Learning

The second objective of this study was to determine the level of ICT integration in teaching and learning of learners with visual impairments. The information gathered by the research included how often the teachers used these resources and their degree of preference, comfort, and ability to teach using the ICT tools. In this context, this research established how learning with ICT took place in classrooms. The heads of the

departments, who included the heads of mathematics, sciences, languages, and humanities (4 teachers) from each school, were followed in the classroom at least three times each. This made a total observation of 36 lessons. The connotation here is that in order to benefit from the impact of the role played by ICT in education, one's ability and style to navigate and explore through ICT are critical.

Classroom observation was done based on the instructional strategies and what the strategies supported to enable the learners' long-life learning and that which influence acquisition of skills and values that would help the learners fit in the current dynamic trends of life and education of the 21st century. Table 4.4 presents the findings.

Table 4.4: Use of ICT in the Classroom of Learners with Special Needs

Strategy	**Support**	**Lessons observed**	**Percentages**
Student motivation	Principles, attitude etc.	2	6%
Developing creativity	Brain sketching, concept mapping, role-play, case studies etc.	1	3%
Evoking prior knowledge	Concept mapping, charts, graphics organizing, anticipatory guiding etc.	3	8%
Development of different skills	Problem solving, research, communication etc.	7	19%
Supporting Process	Interpreting, organizing, logical thinking, reasoning, etc.	3	8%
Total		**16**	**44%**

From Table 4.4, it is clear that ICT was used to support learning in very few lessons (16) out of the 36 lessons that were observed. It was only in two lessons that the teachers used ICT to motivate learners. It was only in one lesson that the teacher endeavored to develop creativity in the learners. These findings are contrary to the findings reported in the UK by Caudie *et al.* (2017). The study indicated that there has been a steady increase in access to and use of computers and other technologies in most schools, achieving the baseline target for computer-to-pupil ratios. Further, the findings from this study disagree with the findings reported in Iran by Salehi and Salehi (2012) on "integration of ICT in language teaching: challenges and barriers." The findings indicated that 70% of the teachers were familiar with ICTs and were frequent and confident users.

Making learners creative is one of the core aspects of the 21st century, and ICT plays a great role in enhancing this. However, it was observed in the current study that it was only in three lessons out of the 36 that the teachers tried to capture the learner's previous knowledge with ICT. Prior knowledge helps the learner understand new concepts and construct new knowledge (Hoque, 2016). The development of different skills in learners with special needs is a vital part of their education. However, from the 36 lessons observed, it was only in seven that the teachers endeavored to develop various skills in the learners. In only three lessons, ICT tools were used to develop processes, for instance, interpreting, logical thinking, reasoning, and so on.

According to Mugo (2013), in a situation where there is a scarcity of ICT resources and a lack of relevant and effective training, creativity is a priority on the part of the user.

Botelho (2012) construed that what can really help in such a situation is the ICT strategy, not devices. In consideration of this and based on the data in Table 4.4, one would conclude that ICT was not well employed to ensure integration in teaching and learning. According to the statistics of the World Health Organization, only people with impairments, especially students, have limited access to ICT (WHO, 2016). In most of the classes, it was observed that the teachers orally systematically explained the lesson concepts and then dictated notes to the learners. In other words, the teachers put little effort into actively involving the learners in the lessons where they could get the opportunity to learn with ICT in an enabling learning environment.

Normally, the special ICT should be used to support learning in all academic areas (Mugo, 2013; Wiazowski, 2009). Accordingly, the use of ICT with special needs learners should influence the psychological, intellectual, social, and cultural conditions exposed to them. In the 21st century, what matters most is what a learner can do with the knowledge he or she has acquired, not how much of the knowledge the learner has accumulated (Botelbo, 2012). It means the learners did not effectively access the ICT resources. This is contrary to the developed countries where ICT has helped learners access quality education.

According to Hassellbring and Glaser (2000), ICT, especially in developed countries, has enhanced the participation of visually impaired learners in teaching and learning and has helped them become independent and competitive learners. Further, findings by UNESCO (2006) attest to the fact that ICT offers potential support for lifelong learning for all groups of students, including those who have special educational needs, and has

made learners develop greater pride in their work and ensure that tasks are completed on time. Also, Fu (2013) construed that ICT offers more opportunities for developing critical higher-order thinking skills in learners. ICT also offered diversity in the teaching methods applied by teachers, encompassing all learners.

4.5. Learners' Factors that Influenced Access to ICT

The third objective of this study was to establish learners' factors that influenced access to ICT in the special schools for learners with VI. The study was first interested in establishing the extent to which the learners were affected visually. Different categories of these learners would perhaps access learning resources differently. Following this, by using the Snellen screen, it was found out that the learners were in five major categories based on the extent to which they could use their eyesight, or, in other words, their degree of vision. The following table presents this information.

Table 4.5: Extent to which the learners were affected visually

Categories	Visual acuity	Frequencies	Percentages
Mild Vision	6/12 to 6/18	13	7.7
Moderate Vision	6/18 to 6/60	18	10.7
Severe Vision	6/60 to 3/60	24	14.3
Blindness	Worse than 3/60	46	27.4
Complete blindness	Worse than N6 at 4 centimetres	67	39.9
Total		168	100%

Adopted from: The International Classification of Diseases 11 (2018)

From Table 4.5, the majority of the learners sampled were blind, meaning they were more comfortable using braille as a system of writing since their degree of vision would not allow the use of print reading. Further, from the sample of learners, more than a quarter could use print, but at different ability levels. Those with mild and moderate visual problems, which represent less than a quarter of the sample, could read normal print with some strain, but those with severe visual problems would find it difficult to read print unless it was extra-enlarged.

These findings imply that access to ICT among the students could not be presumed to have the same degree. Bacconni *et al.* (2007) opine that despite both groups simply being referred to as "visually handicapped," blind and low-vision students typically present very different visual issues, encounter very different challenges, and want very different types of assistance and support. Many of these issues stem from the challenges of using the tools effectively, and they might also be detrimental to learning in general.

Further, those with mild vision and those with moderate vision could access the learning material through laptops with Zoom text software; they could also use enlargers such as CCTV and programs such as Join Me, which allowed them to see what was on their teacher's laptop on their laptops. These two categories could also read large print, including enlarged print pictures and other graphics presented to them by their teachers. The third category, severe vision, represented less than a quarter of the sample and was able to recognize large visual images from the computer but would still depend on assistive devices and software to read the large print. Slightly above a quarter was the fourth category of blindness. This category would apparently recognize large visuals and

color from the computer but would find it difficult to read large print unless it was extra enlarged, and they would still use assistive devices, for instance magnifiers, to access the learning material. The last category was complete blindness, which represented above one-third of the sample. In this category, there were those learners who would perceive some light with some difficulty, some color, and some movement, while there were those who would not perceive light at all. This category used Braille as the system of reading and writing and was very dependent on the voice output software that included the Jaws for Windows and the non-visual desktop access (NVDA) to access learning material.

JAWS is a potent accessibility tool for people who are blind or visually impaired that reads text on a computer screen using synthesized speech. It offers a variety of helpful instructions that simplify using programs, editing documents, and browsing the Web. In addition to or instead of voice output, JAWS may produce Braille on a refreshable Braille display. It offers options that can be tailored to each user's needs and interests.

Furthermore, it was found out that though the learners with low vision used laptops with zoom enlargers to access learning material, the rate at which they did this was slow. For instance, the learners were presented with an 800-word passage on the computer. They commenced reading at the same time and were stopped at the same time, and each of them was requested to state the exact word he or she read last. On average, those with mild visual challenges read at a faster rate of 240 words per minute, while those with moderate visual challenges read at an average speed of 155 words per minute. Those with blindness read at a lower average speed of 122 words per minute.

Though the speed of reading by low-vision learners was considerably faster compared to that of braille reading, the speed of reading by sighted readers was far slower. The speed of reading is supported by the study findings by Groenewegen (2007), where he asserts that a braille reader can read at a speed of between 90 and 120 words per minute, while a sighted reader can read at a speed of between 400 and 600 words in a minute, or even faster in the case of skimming. Various variables could have contributed to the reading slowness.

From the findings, it was clear that the learners accessed ICT differently. Learners with any kind of visual impairment have a method of accessing the learning material through ICT. However, those with blindness have major cognitive challenges that create a great barrier to accessing ICT.

First, their process of concept formation is dominated by two extremes: extremely verbal notions, which have very little support in their experience, and extremely concrete tactile images that possess little potential for generalization. The second challenge could emanate from the difference between the simultaneous character of visual perception and the successive character of tactile perception (Mugo 2013). In this aspect, the acquisition of a comprehensive picture of experiences is deterred, and the daily concepts that possess a certain degree of generality are underrepresented in the cognitive repertoire of the learners. In essence, many of the cognitive tools used by sighted students could be undeveloped in these learners, especially those with severe visual problems and those with blindness.

The findings concur with the findings reported by Mugo (2013), who pointed out that, by its nature, blindness presents obstacles that might greatly affect access to quality education. For instance, understanding information and applying the lessons derived from it require a fully developed cognitive ability. Unfortunately, learners with VI are faced with major cognitive problems. One of the problems is related to the difference between the concurrent character of visual perception and the successive character of tactile perception. Another problem stems from the process of concept formation in learners who are visually challenged, which is dominated by two extremes: (i) extremely abstract verbal notions that have minimal support in the learners' experience, and (ii) extremely concrete tactile images of everyday life objects that hold little potential for generalization (Gauzman and Kozulin, 1998). This clearly shows that the way learners with visual challenges access and benefit from ICT is different from their sighted peers' access, use, and benefit from the technology.

This research was further interested in finding out from the learners about their perceptions of the use of ICT in teaching and learning. The learners were asked to give their opinions on the use of ICT in teaching and learning. The findings were presented in Table 4.6.

Table 4.6: Learners opinion of instruction when ICT is used

	N=168	Percentage
ICT is useful in the instruction for I understand easily And remember the content	99	59
ICT is un necessary and consumes the precious time for learning	55	33
I am not sure whether ICT has positive or negative impact in the instruction. It might have both effects.	14	8

From Table 4.6, Majority of the sampled learners strongly agreed that ICT improved their learning. More than a quarter disagreed with the issue while a few far below a quarter were undecided.

From the findings, majority of these leaners had positive attitudes towards the use of ICT in teaching and learning. This is important since it could lead to the learners getting interested in learning how to use ICT and hence benefit fully from the teaching where ICT is used. Waddell, (2000) argue that learners with visual challenges could benefit from ICT since it enables the learners to use the internet to access information alongside their sighted peers. Additionally, Moore and Taylor, (2000), asserts that learners with special educational needs are able to accomplish tasks working at their own pace where ICT is used.

The findings contradict the findings reported by Ampratwum *et al*. (2016) who reported that majority of students with VI were reportedly uninformed about using computer assistive technology, suggesting that they frequently are not aware of the potential of

ICTs to improve education. Further, the study reported that 95% of students had trouble using the computer keyboard and the screen reader Job Access with Speech (JAWS) (ibid.). Because the order of the alphabet did not follow the typical arrangement of the alphabet from A to Z, some keyboard keys were difficult for students to recognize. The pupils also had trouble using JAWS because the school only allowed access to certain applications because it used unlicensed software (Ampratwum *et al.*, 2016). Additionally, some students mentioned having trouble with voice recognition because the pronunciation was foreign to them.

Nonetheless, not all the learners expressed their opinions of the benefits they gained from the use of ICT implying a negative attitude they had. ICT has made it possible for blind women to use assistive technology and programs to read braille, operate assistive equipment, and express themselves freely. Eligi and Mwantimwa (2017) revealed that ICT assists creative learning, support independent learning, and support participatory and collaborative learning, according to the study. However, issues like a lack of special ICTs to meet the needs of students who are blind or visually impaired, poor training on how to use special ICTs, and a lack of ICT experts were identified. The research further enquired how the learners benefited from teaching and learning through the use of ICT. Table 4.7 presents the learner's sentiments.

Table 4.7: How the learners benefited in learning through use of ICT

	N	Frequency	Percentage
It is really fun to work out tasks using ICT	168	81	48.2
I concentrate more. understand and remember better when the teacher uses ICT e.g., computer to teach us	168	155	92.2
I am able to go ahead of the teacher since I can get information through ICT especially internet.	168	76	45.2

The research further enquired how the learners benefited from teaching and learning through the use of ICT. Table 4.7presents the learner's sentiments. The research established that the majority of the respondents concentrated more, understood better, and remembered more when ICT was used in teaching and learning. About half of the learners had fun performing tasks using ICT, especially computers, and slightly below half of the learners benefited from ICT through browsing the internet, hence learning content ahead of what their teachers taught.

The findings of this study concur with the findings reported by Worth (2001) who observed that learners with visual impairments concentrated more on learning when their teachers used ICT. Additionally, Chai, Koh, and Isai (2010) found that ICT provided increased creative solutions to the different types of learning inquiries.

During classroom observation, it was noted that few learners could access most types of texts from low to advanced levels through computers, laptops, personal digital assistants (PDAs), or iPads. Further, e-books, which came with some reading applications offering

a reading-aloud interface, relevant vocabulary-building activities, games related to reading skills and vocabulary acquisition, and more, were available, but it appeared that both the teachers and the learners were not fully exposed to them. What was clear is that ICT involved purpose-designed applications that could provide innovative ways to meet a variety of learning needs for learners with visual impairments. In essence, the level of skills needed to use technology by both the teachers and the learners was very low.

Moreover, according to the findings, the majority of the learners knew the importance of ICT in learning and were ready to embrace the technology. Indeed, some could be able to perform some tasks and even get more lesson content from the internet. The learners, however, seemed to lack exposure to the technology, and hence they lacked the confidence to use it. Waddell (2000) established that increased ICT confidence amongst students motivates them to use the ICT at home for schoolwork and leisure. The learners should be helped to access and use the technology effectively since, through doing so, they would compete equally with their sighted peers. According to Castro, Sanchez, and Alema (2011), learners, including those with disabilities, are now more frequently engaged in the meaningful use of computers. They build new knowledge by accessing, selecting, organizing, and interpreting information and data. Based on learning through ICT, they are more capable of using information and data from various sources and critically assessing the quality of learning materials.

Additionally, Murray and Compell (2000) affirm that access to technology makes learners carry out learning even in the absence of their teachers. Moreover, Van der Geest, van der Meij, and Van Puffelen (2014) showed that currently, most learners with

visual challenges regard the internet as the main means to access information. According to Cook and Polgar (2014), writing by learners with visual challenges poses a barrier to effective communication because it is tedious and time-consuming. Research has also shown that in developed countries, learners with visual challenges use a combination of assistive technologies to enhance their communication.

The role of ICTs in supporting learners with visual challenges is to ease and facilitate effective learning in school and other settings. ICTs generally help learners to have control over their learning by promoting independence and enhancing their academic performance. Kim-Rupnow and Burgstahler (2004) argue that ICT allows students with vision challenges to manage themselves and their learning demands, including supporting their study experience and helping them to develop academic skills. However, an important condition is that the technology must be accessible. It is not obvious that learners with special needs access ICT. Thus, technology abandonment can occur if ICTs are unable to meet the specific needs of the learners, such as supporting independent functioning, working as intended, or helping to address the demands of the curriculum, as pointed out by Mull and Sitlington (2003).

4.6. Teachers factor that Influenced Access to ICT for the VI

The fourth objective of this study was to find out the teacher’s factors that led to learners' access to ICT who are visually impaired in special primary schools. The study was therefore first interested in finding out if teachers were aware of the importance of using ICT in teaching learners with visual impairments. The findings are presented in Table 4.8.

Table 4.8: Teachers Awareness about use of ICT in Teaching

	N	Yes	No	Not sure
I am aware that one should use ICT with learners who are visually impaired in teaching and learning process	18	15 (84%)	3 (16%)	-
Knowing how to use ICT in teaching the learners with VI is crucial since it makes the teacher's work easy to present the content and make learners to understand better.	18	12 (67%)	4 (22%)	2 (11%)

The sentiments from the teachers as presented in Table 4.8 indicate that the majority of teachers of learners with visual impairments were aware of the use of ICTs in teaching, while far below a quarter were not aware. The majority even acknowledged the importance of learning to use special ICT for the blind for them to effectively teach the learners. However, 16% reported that they were not aware that one should use ICT with learners who are visually impaired in the teaching and learning process, and 22% acknowledged that they did not know how to use ICT in teaching learners with VI, which is crucial. This finding implies that despite the growth of ICT in the teaching of learners with visual impairment, some instructors still hesitate about ICT acceptance and adoption.

The findings of the current study are in line with the findings presented by Eligi and Mwantimwa (2017), who conducted a study at the University of Dar es Salaam to evaluate the usability and accessibility of information and communication technology

resources to support learning for visually impaired students (UDSM). The study established that some of the teachers did use ICT in instruction due to challenges like poor training on how to use special ICTs in instruction and a lack of ICT experts. Similarly, the findings agree with the findings reported by a study carried out by Ghavifekr *et al.* (2016), who assessed how ICT tools were used for teaching and learning in Malasyia. The study reported that a proportion of teachers do not embrace technology in teaching because they lack technological proficiency and awareness of the issues and challenges related to ICT use in teaching and learning.

In support of this finding, Bangok (2004) claims that although ICT may facilitate independent, self-paced learning, its potential may not be optimized if there is no shift in the teaching paradigm. The integration of ICT is associated with a shift from instructivism to constructivist philosophies of teaching and learning (Barker, 1999). In this sense, teachers need to embrace constructivist instructional approaches where ICT plays a great role. The unfortunate thing is that teachers, especially those teaching learners with special needs, are still struggling to learn how to use ICT resources.

Resistance to change adversely affects the adoption of technology and the implementation of ICT in education pedagogy, as some teachers still do not utilize the available resources in their instructional activities. Resistance to change seems not to be a barrier by itself; instead, it is an indication that something is wrong. According to Earle (2002), the change from a present level to a desired level of performance is facilitated by driving forces such as the power of new developments, rapid availability, creativity, internet access, or ease of communication.

The findings further imply that integrating new technologies into educational settings requires change, and different teachers will handle this change differently depending on their attitude. Also, according to Becta (2004), considering different teachers' attitudes toward change is important because teachers' beliefs influence what they do in classrooms. The research went further to investigate how the teachers became aware of ICT for the visually impaired. Table 4.9 presents the findings.

Table 4.9: Ways in which the Teachers became aware of the ICT for VI (N-18)

Means of awareness	**F**	**%**
Training	4	20.0
Social media	5	23.0
Conference, Seminars & Workshops	5	24.0
KICD Circulars	6	32.0
School policy	3	17.0
MOE policies	1	5.00

Table 4.9 shows that the teachers were made aware of the use of ICT through various means. About a quarter of the teachers become aware through social media, conferences, seminars, and workshops. More than a quarter through KICD circulars and far below a quarter through school policy and even MOE policy. Looking at the data, one can tell that it was the circulars from the curriculum developer that made most of the teachers aware of the use of technology. One would expect them to be made aware of this through training and practice. Being aware of something does not always lead to action. The findings are in line with the findings reported in America by Allen and Seaman (2006) on the awareness of teachers of the integration of ICT in teaching science subjects. The

study indicated that the teachers did not integrate technology into their teaching, despite being aware of this practice. The awareness must therefore be accompanied by interest in its use.

Similarly, the findings agree with the findings reported in India by Philomia and Anutha (2016) in their study on the teacher's competence in the use of computers in teaching. The study reported that the teacher's awareness and interest in using the technology led to their understanding, tenacity, and competency in offering quality instruction. Also, Miima (2014) observed in her study that awareness and interest in ICT are helpful in teaching and learning since it is the first step to promoting innovativeness in teachers' use of ICT in pedagogy. In this study, a larger number of the teachers of learners who are visually impaired were aware of ICT, but a smaller number would say the importance of using the technology in pedagogy. Further, the findings corroborate with the findings reported by Falloon (2020). He established that many instructors lacked the knowledge and abilities necessary to use computers and that they were unenthusiastic about the adjustments and integration of supplemental learning that came along with incorporating computers into their teaching practices. According to studies, teachers' lack of technological proficiency is a major obstacle to their use of ICT.

This research was further interested in finding out the teachers' feelings about the use of ICT in the teaching and learning process in the special schools for the VI. Table 4.10 presents the findings.

Table 4.10: Learning through ICT

	N	Percentage
ICT is very useful in the instruction for learners with VI.	10	55.5
ICT might un necessarily consume the precious time for learning by VI	6	33.3
I am not sure whether ICT has positive or negative impact in the instruction of learners with VI. It might have both effects.	2	11.1

The research established that the majority of the respondents had the opinion that computers can be useful for instruction in all subject areas for learners with VI, while slightly more than a quarter were of the opinion that ICT might consume a lot of learning time for learners with VI. Only a few were undecided. These findings are in agreement with Fu's (2013) research on the benefits of using ICT for learners with special needs. He concluded that ICT improved teaching and learning quality and supported teaching by facilitating access to course content. It is clear that teachers' opinions towards the use of ICT with all learners were positive, and hence the teachers should be further assisted in using ICT with the learners.

On the other hand, not all participants acknowledged whether ICT is very useful in instruction for learners, with VI implying that teachers still perceived more limitations in using ICT. This finding is supported by the findings of Ghavifekr et al. (2016), which revealed that the following critical concerns and challenges prevented instructors from effectively using ICT tools: limited accessibility and network connection, limited technical support, inadequate training, time constraints, and a lack of teacher

competency. The findings concur with the findings reported in Syria by Albirini (2006) that teachers had negative perceptions towards the use of digital tools in instruction because they lacked technological proficiency. According to the research, teachers who don't use computers in the classroom often cite "lack of skills" as a barrier to their ability to use ICT for instruction. Similarly, Chin *et al*. (2022) discovered that adopting ICT in primary and secondary schools is seriously hampered by teachers' lack of knowledge and abilities in another global study of nationally representative samples of schools from 26 nations.

The teachers were asked what would make them not use ICT in their teaching. Some of the statements from the teachers were as follows:

> *I do not have the knowledge and skills to use most of the ICT devices and software, especially the computer. I even feel very tensed and uncomfortable when I hear that the quality control officers from the Ministry of Education are coming to the school. You know, they tell us to use the computer to teach, but they do not effectively train us on how to use it.*

This statement was a clear indication that the majority of the teachers had not been trained on how to use ICT in pedagogy. The teachers were therefore not able to use the technology and, hence, were not able to help their learners use it. Competence is directly related to teachers' confidence. A study by Newhouse (2002) in Australia found that many teachers lacked the knowledge and skills to use computers and were not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices. These findings are also corroborated by Albarini (2006), who indicated that teachers' lack of technical competence has been cited

as the main barrier. The researcher asked teachers whether they have competence in using ICT in teaching learners with VI

The following statement was echoed by the majority of the teachers, that

> *The majority of us lack competence in the use of computers. Although there is an NGO known as UWEZO that has supported the school with computers and some trainers, we don't have time for the training because we have to prepare for our lessons. Our learners are not easy to teach, and therefore, a teacher has to take time to prepare for the lesson. It also takes time to teach them since one must give remedial teaching to them. Most of the time, we are not able to cover the syllabus on time.*

From this statement, one observes that there is a scarcity of training for teachers on ICT for pedagogy from the Ministry of Education. Additionally, one would conclude that the majority of the teachers are ignorant of the fact that ICT would make the work of teaching easier for them. According to Sepulveda-Escobar and Morrison (2020), teachers' ability to incorporate ICT into pedagogical practice presents another difficulty that is closely tied to teacher confidence.

The findings concur with findings reported in Denmark by Motzfeldt and Naesborg-Andersen (2018). The study established that many teachers still choose not to use ICT and media in teaching situations due to a lack of ICT skills rather than for pedagogical or didactic reasons, according to the findings of the study. Further, the findings agree with the findings reported by Nang'unda (2019) that a number of issues, including poor pre-service training for teachers in ICT and a dearth of instructors with ICT diplomas, hamper the integration of ICTs in secondary schools. Also, in a relative study by Falloon (2020), it was revealed that many instructors lacked the knowledge and abilities necessary to use computers and that they were unenthusiastic about the adjustments and integration of supplemental learning that came along with incorporating computers into

their teaching practices. According to the research, teachers who do not use computers in the classroom often cite a "lack of skills" as a barrier to their ability to use ICT for instruction. Motzfeldt and Naesborg-Andersen (2018) further revealed that many teachers still choose not to use ICT and media in teaching situations due to a lack of ICT skills rather than for pedagogical or didactic reasons. Contrary to the findings of the study, Lui (2022) revealed in his study that teachers' ICT knowledge and skills are no longer seen as the main barrier to ICT use in the Netherlands.

The problem of lack of competence in the use of ICT for the visually impaired is not unique to Kenyan schools. A study conducted in western Australia by Newhouse (2002) found that many teachers lacked the knowledge and skills to use computers and that they were not enthusiastic about the changes in integration of supplementary learning associated with bringing computers into their teaching. The teacher’s complaints about lack of time to learn ICT are also common problems. Sicilia (2005) found that the most common challenge reported by teachers was a lack of time to plan technology lessons, explore the different internet sites, or look at various aspects of educational software, thus making teaching and learning in the classroom difficult. Further, Schlepp (2005) indicated that the act of integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties. More time and resources are therefore required for the training of the teachers. In essence, in this study, during the classroom observation, it was found that the learners were found to be anxious and willing to try out the new technology, even with their limited knowledge. Teachers getting tensed and uncomfortable while using computers is a sigh of lack of competence,

and therefore more in-service training on the use of the new technologies is needed for these teachers.

The researcher further wanted to know from the teachers whether they got the ICT support they needed from the head teacher of their schools. The findings were presented in Figure 4.1

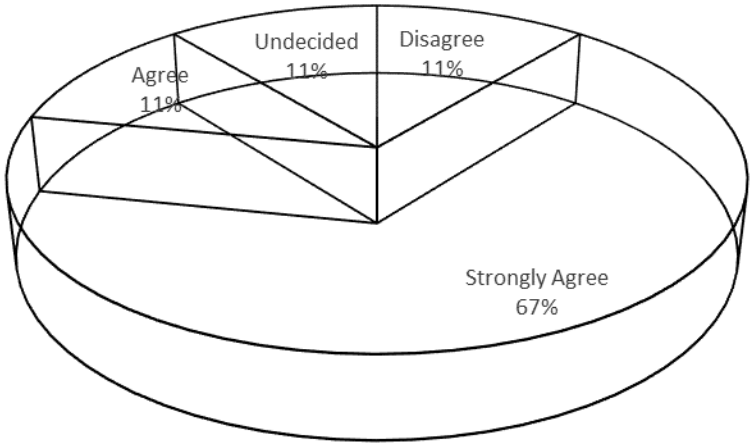


Figure 4.1 The School Administration's ICT support

The study established that slightly above three-quarters of the respondents agreed with the view that school managers were committed and supported ICT, while a few disagreed and far below a quarter were undecided. This is in agreement with the findings of Papaioannou and Charalambous (2011), who carried out a descriptive survey study on head teachers's attitudes towards ICT and their perceptions about the factors that facilitate or inhibit ICT integration in primary schools in Cyprus. Two hundred and fifty primary school heads participated in the study. The findings indicated that headteachers play an important role in the integration of ICT in schools. According to Mrazek,

Hollingsworth, and Street (2005), it is clear that school leaders with a positive attitude towards ICT integration can facilitate integration largely. Additionally, several other factors have been identified as the enablers of ICT integration. For example, a leadership role should include a strong professional vision for meaningful technology integration in teaching and learning.

According to Mutisya *et al.* (2017), administration is the activity that leads staff members' actions to work toward achieving organizational goals. A school administrator's job is to make sure that certain tasks are allocated, carried out, and that there is ongoing input to enhance overall school management. Technology is changing education, but not all students or staff members will benefit from its advantages, claims Malik (2018). This is because of weak leadership. Schools will continue to lag behind the society in which they are located. Moreover, the researcher wanted to find out from the teachers whether there was support for technical infrastructure in the schools. The findings are as presented in Table 4.11.

Table 4.11: Support for technical infrastructure

	Frequency	**Percentage**
Strongly Agree	4	22.2
Agree	8	44.4
Undecided	1	5.6
Disagree	3	16.7
Strongly Disagree	2	11.1
Total	**18**	**100**

The study indicated that the majority of the respondents agreed that there was available technical staff at school to maintain technical infrastructure, train, and support the teachers, while slightly above a quarter disagreed with this. Only one teacher was undecided. This was very important since the teachers would then get quick rescue in case they were using the technology and somehow it stopped working. Korte and Husing (2007) argued that ICT support structures or maintenance contracts in schools help teachers use ICT in teaching without losing time by having to fix software and hardware problems. It was therefore necessary for this study to find out if technical support was provided in the schools for learners with VI, for it is a crucial component for effective implementation of ICT in teaching and learning.

Time is a very important resource, especially in the field of technology use in schools. This finding agrees with Al-Alwani's (2005) finding that time is an important factor affecting the application of new technologies in education. Lack of time is a barrier affecting the application of ICT in education. Schoepp (2005) further identified time limitations and the difficulty in scheduling enough computer time for classes as a barrier to teachers' use of ICT in their teaching. According to Sicilia (2005), the most common challenge reported by teachers was a lack of time to plan technology lessons, explore different internet sites, or look at various aspects of educational software. Mugo (2013) observes that most of the technologies used by learners who are blind were not initially designed with the minds of these learners. Due to this, the teachers who might also not have a clue how these technologies are made should have ample time to learn, explore, and figure out how the technology can best be used to teach the learners.

4.7 School Administrative Factors that Influenced Access to the ICT

The fifth objective of this study was to determine the administrative factors that enabled or deterred access to ICT for the pedagogy of learners with visual impairments. Accordingly, the school head teachers were interviewed on various issues that included the time the school gave for the training of the teachers and the learners on ICT, the technical support the school gave to both the teachers and the learners in accessing and using ICT, and the school's ICT support infrastructure, among other factors.

To begin with, the researcher requested to be allowed to access the ICT infrastructure. It was found out that all the sampled schools had electricity, and each school had a computer lab with desktop computers. There was also an internet connection, but quite often, the internet was unstable. On asking why the internet was unstable, the school headteachers complained that it was even more expensive for the schools to maintain it since the fee was high. It was also found out that each school had an ICT technician who was often in the laboratory. The technician's work was to repair computers and maintain them. Additionally, he was to train any willing staff on how to use the computers. On asking why the lab technicians did not train the learners, they mentioned that they only supported them to learn any new skill since the schools had teachers to train the learners on how to use the computers based on the curriculum.

This being the case, the researcher was further interested in finding out how ICT was being accessed by both the teachers and the learners. The findings are as presented in Table 4.12.

Table 4.12: ICT Access by the leaners with VI

	N	Frequency	Percentage
They access ICT resources at school	3	3	100
They access ICT outside the school.	3	0	0

From the table above, the head teachers confirmed that learners with VI accessed ICT at school. This made the researcher interested in knowing why the head teachers said that ICT could not be accessed at home. A common sentiment from the three head teachers was that

> *It is clear that most learners with VI come from poor backgrounds and, as a result, cannot access ICTs at home. ICT for the blind is extremely expensive, and most of it is not found locally. Even some parents who might be able to afford it might not have knowledge of where to get the technology. The NGOs and the government provide the ICT resources.*

The above findings are supported by Kimuyu (2016), who found that the majority of schools did not have Internet access; hence, email was not used for management or other forms of communication. The findings are also in agreement with Kahn (2007), who found that 80% of all people with disabilities in the developing world live in what can be considered poor living conditions and are therefore among the world's poorest and thus cannot afford to buy or even access new technologies. Most learners learned computers at school and were appreciative of them. The findings agree with the research carried out by Coudie (2007), which indicated that the extent to which schools are in a position to implement and take advantage of ICT in learning and teaching depends on development across a number of dimensions relating to infrastructure, including school policy, resources, teacher confidence and capacity, connectivity, security, and management of

the system. Each of these, to a greater or lesser extent, has an influence on the way in which ICT becomes part of the learning and teaching process and has an impact on the experiences of learners, teachers, and schools.

Moreover, it is imperative that the learners access ICT, including computers, at home for the purpose of academic and social connection. Waddell (2000) found that increased ICT confidence amongst students motivates them to use the internet at home for schoolwork and leisure interests, among these being keeping in touch between themselves and even their teachers. Also, MoE (2006) observed that ICT can play a role in preparing students' competencies and socio-skills that are fundamental for competing in the emerging global 'knowledge economy.'

The school head teachers were questioned about the time they allocated for the training in ICT use. The respondent unanimously asserted that learning how to use ICT, including computers, takes a well-deserved short period of time. One of them, Johnstone (pseudonym), stated that,

> *"It is a matter of interest. The school does not even require offering separate time for computer training, especially for the teachers. Those who know what they are doing can learn during their free time, for instance, during the weekend and during holidays. But due to some of the teachers' negative attitudes, they always demand time to be trained; surprisingly, when we give them time, they don't train'.*

This statement showed that the head teachers were not very willing to give time for training both the learners and the teachers. One head teacher even thought that learning special computer applications was so easy. The researcher got interested in getting more information from the head teacher and asked him whether he would be willing to be part

of the team of trainers of computers for the blind. He responded that he would be willing if he were first well trained on the various technologies for the blind. Time is a very important resource, especially in the field of technology use in schools. This finding is in agreement with Al-Alwani's (2005) finding that time is an important factor affecting the application of new technologies in education. Lack of time is a barrier affecting the application of ICT in education. Schoepp (2005) further identified time limitations and the difficulty in scheduling enough computer time for classes as a barrier to teachers' use of ICT in their teaching. According to Sicilia (2005), the most common challenge reported by teachers was a lack of time to plan technology lessons, explore different internet sites, or look at various aspects of educational software. Mugo (2013) observes that most of the technologies used by learners who are blind were not initially designed with the minds of these learners. Due to this, the teachers who might also not have a clue how these technologies are made should have ample time to learn, explore, and figure out how the technology can best be used to teach the learners.

Learning ICT, especially for learners with special needs, requires ample time. Waycott, Bennet, Palgamo, and Kennedy (2010) conducted a study on 99 undergraduate students who had gone through some computer training and found that most students were uncomfortable with computer use, and most of them indicated that using technology in their learning increased their workload. It was clear that some learners were not yet competent in using the new technologies, and that is why they found it taking a lot of time. Giving very little time for training on ICT is therefore not fruitful at all.

Due to the inaccessibility of ICT for the blind in schools, it was therefore demanded that the Kenyan government come in to provide support. The role of the government in equipping teachers and learners with the requisite ICT knowledge was instrumental in enabling access to quality education for these learners. The researcher therefore sought from the head teachers whether teachers had attended in-service training on technology for the blind. The findings are as presented in Figure 4.

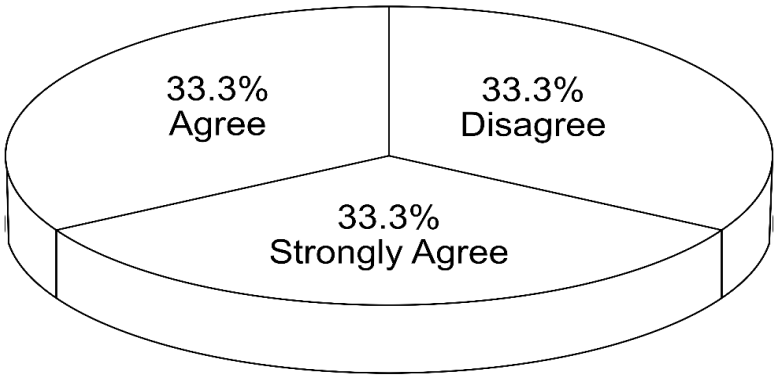


Figure 4.2: In-service teachers Training

From the figure, two-thirds of the respondents indicated that teachers had attended in-service training on the new technology, while a third disagreed. It was also established that the in-service training was to equip teachers with the new technology, though the teachers who attended it still found using ICT a frustrating affair.

The findings are not unique to the Kenyan situation. Ozden (2007) conducted research in Turkey and found that the main problem with the implementation of new ICT in science was the insufficient number of in-service training programs for science teachers. Also,

research by Gomes (2005) relating to science education concluded that lack of training in digital literacy, lack of pedagogic and didactic training in how to use ICT in the classroom, and lack of training concerning the use of technologies in science-specific areas were obstacles to using new technologies in classroom practice. This finding is also in agreement with Mugo's (2013) training of teachers on how best to use assistive technologies in the classroom, which is a major concern the world over. Thus, teachers, especially those who are blind, lack trainers to focus on the study of technologies themselves, let alone educational technology (support for teaching in the classroom). These trainers lack knowledge and skills in pedagogy and andragogy.

The head teachers were asked to give reasons why they supported the use of ICT in their schools. The following assertions were made: (i) “The learners use computers to write notes and access textbooks, a practice that has improved their performance." (ii) “Braille material is very expensive and therefore soft copies, which are easily accessed, hence cutting down on the cost." (iii) “Most ICT resources, for instance, laptops, are more portable compared with braille text books, which are cumbersome and heavy to carry. (iv) “The learners are able to access academic and non-academic material online and even learn at their own pace." What the head teachers concluded has been supported by various empirical studies. For instance, UNESCO (2006) affirmed that ICT offers a great potential to support lifelong learning for all groups of students, including those who have special educational needs. Additionally, Mugo (2013) construed that those ICT resources, if well used, lead to access to quality education for learners who are visually impaired.

Although the head teachers knew the importance of supporting the use of ICT in their schools, implementing what they said was an issue. They revealed that they feared that some of the ICT resources would be stolen, that the learners could access pornographic sites, that most learners tend to depend on the voice output software, thus forgetting how to use braille, and that the schools lacked storage facilities. In other words, this fear made the head teachers restrict the use of ICT in the school. Mwakyeja (2013) postulates that schools for learners with special needs face many challenges and are often forgotten by the government and society when it comes to the provision of learning resources and materials. Additionally, there is often an inadequacy of teacher training in special areas, including school management for schools that house learners with special needs (Korir, 2015). The inadequacy of teacher education gives rise to challenges within the course of the acquisition of education by visually impaired students (Mwakyeja, 2013).

When asked how the schools obtain the ICT for their schools, the school head teachers unanimously revealed that the that the ICT resources used by learners with VI were donated and maintained by non-governmental organizations (NGO) and not the government. The headteachers were of the opinion that the government should come in to support the schools. They also requested teacher training to enhance their ICT skill levels and, consequently, their quality of teaching the learners with VI. The head teacher reiterated, saying that in-servicing teachers on the use of ICT for the blind should be allocated more time.

On the issue of technical support, the researcher requested that the computer laboratory technicians describe the management of ICT resources in the schools. The computer

specialists revealed that they were all employees of the In-able (NGO), which installed computer laboratories for learners with VI in the schools. They said that the computer labs are not free for students and teachers to access and use as they wish during free time but must request from them for access. In other wards they man the laboratories. They further reiterated that computer laboratories are not enough for the learners. One statement, which was echoed by all, was that:

> *"The management of the school could include parents and the community to raise funds to build more computer laboratories to decongest the available ones. This will go a long way to improving ICT accessibility for many learners with VI."*

These findings contradict the ICT policy, where the Ministry of Education demands that all teachers embrace the use of ICT in the process of teaching and learning (MoE, 2010). Furthermore, MoHEST (2012) found out that there was a key issue affecting ICT provisions, especially in special schools. The lack or scarcity of ICT in schools is not a standalone barrier to the use of the same in the education of learners with visual impairment. According to Nang'unda (2019), the establishment of an efficient management structure, goal-setting, decision-making, and relationship-building are all administrative tasks that school leaders are crucial in supporting. A school administrator's job is to make sure that certain tasks are allocated, carried out, and that there is on-going input to enhance overall school management. Technology is changing education, but not all students or staff members will benefit from its advantages, claims Malik (2018).

The emphasis on ICT use during initial teacher training courses was acknowledged to have an impact on more recently qualified personnel in all three of the schools under examination, and whole school training days were recognized as being influential.

Ghavifekr et al. (2016) opine that teachers must also understand what technical assistance is available and how to use it. Computer use in education and training is growing in popularity. Institutions of higher learning cannot function without computers. School administrators are expected to take on leadership roles in fields with which they have little experience and are unfamiliar.

The findings of this study are also in agreement with those of Mutisya et al. (2017), which revealed that there is a significant positive association between computer infrastructure and ICT integration in school management. Head teachers' personal beliefs and theories about the integration of new technologies in teaching and learning are widely considered to play a central role in the implementation of ICT in schools. According to a study by Uncluer et al. (2010), the usage of ICT was dependent on the principals' cooperation in setting up in-service training sessions and maintaining the school website for faculty use. Since ICT is a crucial part of organizational management procedures, the principal and the larger staff must be ICT-knowledgeable.

To ensure integration, principals must use their creativity while obtaining resources. This creates a climate that is conducive to teamwork. The lack of appropriate ICT practice models, as well as a lack of institutional, administrative, and technical support, were cited by Akbar et al. (2022) as obstacles to ICT adoption. The hurdles were further broken down into school and individual barriers, suggesting that they might not always be about administrative help but rather going beyond their bounds. The type of administrative support offered is largely related to the attitude of principals toward ICT integration in management. Nang'unda (2019) further claims that principals' negative attitudes toward

ICT opposition required administrative support because, in their eyes, manual integration was no better than ICT integration. In contrast to Nyachoka et al. (2015).

Due to the foregoing, the study was interested in hearing from the ministry of education representatives. The researcher sought to establish the role played by the Ministry of Education in addressing the issue of access to ICT by learners with VI. In this context, three representatives from the Ministry of Education were interviewed. A common sentiment they put across was that:

> *"Learners with VI should be treated equally in the area of access to ICT as their sighted counterparts. This is in line with the Millennium Development Goals (MDGs) as well as the resolutions from the Salamanca Framework of Action, which gave equal educational opportunities to all learners regardless of disability or gender.".*

In this statement, one would say that the representatives from the ministry were aware of the educational rights of learners with special needs. On asking why the ministry had neglected the school for the VI in terms of provision for the ICT resources and training of teachers, The officers revealed that:

> *"There are not enough trained personnel who could handle ICT for the blind, for instance, adapted computers in the country. More so, ICT is very expensive. For example, installing jaws on computers is very expensive, and the government does not have enough money for it. Additionally, learners with VI need more time to learn the special ICT, which is not allocated in the school's timetable due to the large content in the curriculum.".*

The above sentiments imply that training forms an essential part of the implementation of ICT in teaching and learning in special schools and units. However, the lack of effective training opportunities for teachers in the use of ICT in the classroom environment is one of the barriers to integrating ICT into learning. According to Beggs (2000), one of the top three barriers to teachers' use of ICT in teaching learners was a lack of training.

Additionally, Gomes (2005) concluded that lack of training in digital literacy, lack of pedagogic and didactic training in how to use ICT in the classroom, and lack of training concerning the use of technologies in science-specific areas were obstacles to using new technologies in classroom practice. Becta (2000) asserts that providing pedagogical training for teachers, rather than simply training them to use ICT tools, is an important issue.

Concerning the study findings, teachers need training in technology education (focusing on the study of technologies themselves) and educational technology (support for teaching in the classroom). Sicilia (2005) supports this claim by emphasizing that teachers want to learn how to use new technologies in their classroom, but the lack of opportunities for professional development obstructed them from integrating technology in certain subjects such as science and mathematics. Balanskat et al. (2006) identified other problematic issues related to professional development in ICT: training courses are not differentiated to meet the specific learning needs of teachers, and the sessions are not regularly updated.

In a nutshell, technical support is required to handle unneeded failures because technology is thought to be expensive and complicated to use. According to a study by Laaria (2013), the majority of the teachers lacked technical help to manage ICT equipment maintenance and repair. The majority of schools lacked trained technicians. By this allegation, one would construe that the government has neglected its duty of provision for the learners who are visually impaired. MoE and MoHEST (2012) made

various recommendations, which included, among others, incorporating ICT in the education of children with special educational needs.

Lack of access to special technology means that the learners living with VI are not getting the type of education that, in their future lives, would make them independent and active members of society. According to Sahasrabudle and Palvia (2013), learners with VI face various cognitive challenges in their education, and the solution to this is to help them possess adequate knowledge of how to make use of devices and technology in order to access quality education. Additionally, UNESCO (2006) noted that if ICT is inaccessible to the learners with VI or the principal information is processed in such a way that it is inaccessible to them, it will hence exclude them from its access, and thus the society will turn out to be a threat for such people.

4.8 Model of ICT Accessibility services for Learners with VI in Kenya Primary schools

The sixth objective of this study was to propose a model for accessibility teaching and learning resource provision that would effectively ensure quality education for learners with visual impairments. Accordingly, in addition to the information collected through the researcher's diary and interview schedules, a literature review was done, and the data gathered was critically analysed before the customization of the model. The literature review helped to enhance the quality of the data by reducing the bias of the data source, putting the data in its correct context, and increasing relevant information in the data (Loeb *et al.*, 2017).

The number of students requiring accessibility to ICT has increased over the years. Nevertheless, research has proved that not all learners receive adequate levels of support (Banes & Seale, 2002). According to Kouroupetroglou, Pino, and Kacorri (2011), accessibility of ICT resources to these learners requires, among others, proper planning, a suitable organizational system, human resources with explicit expertise, unconventional technological support, substantial implementation effort, and functional evaluation.

However, in this domain, there has been a scarcity of theories and models that could describe, explain, and develop effective practices (Banes & Seale, 2002; Embry et al., 2005; Seale, 2006; Boguz & Buxzynski, 2009; Kiss-Glavas & Zubak, 2009). The model of accessibility services for learners with VI, as presented in Figure 3, was hence an effort designed to add to the few existing models based on this consideration.

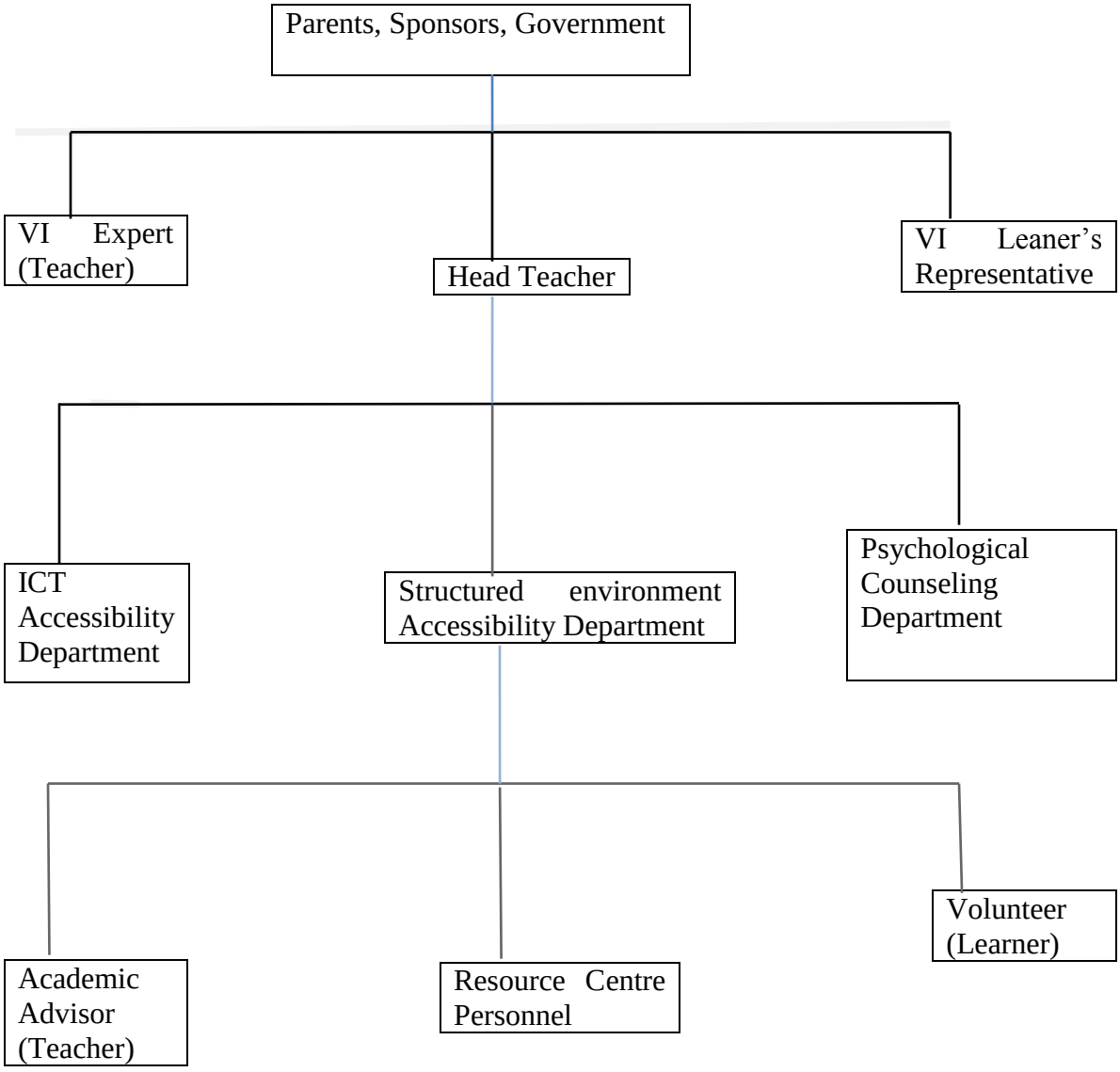


Figure 4.3: Model of accessibility service for learners with VI

Source: Kouroupetroglou, Pino and Kacorri (2011)

The proposed model in Figure 4.3 aimed to actively realize equal access to education for learners with VI through access to ICT and other assistive technologies, environmental modification, and access to services. According to the figure, the government of Kenya, with the support of the parents and sponsors, should be able to solicit the ICT resources and store them in a central place. The head teachers of the schools, together with the experts in ICT in the field of education for the VI and a learner representative, should be

able to obtain these resources for the school. In each school, there should be three departments. The work of the ICT accessibility department is to generate and maintain adequate media information and provide the necessary services to both the teachers and the learners. The department's work on structured environment accessibility is to ensure that the school's physical and social-cultural setting is conducive to the use of ICT technologies. Lastly, the department of psychological counselling should ensure that learner's perceptions of the use of technology are positive. The last tier of the model includes the academic advisers, in this case the teachers, represented by one of them as a secretary.

The teachers are implementers of the curriculum and should be aware of the type and nature of technology required for their effective delivery of the content to the learners. The resource center should help in the distribution of the technology to both teachers and the learners, repair and maintain the technological devices and software, train both the teachers and the learners on the use of the technology, design new, improvise, adopt, and network with other schools in the effort of sharing information. The learner volunteer should help inform other students about the ICT services available in the school and encourage them to use them.

The proposed accessibility model may also allow the professionals in each department to participate in research projects related to facilitating equity of access to teaching and learning for learners with VI. Such projects may extend to various scientific domains, including universal learning, web accessibility, and assistive technologies, among others.

It was imperative for this research to come up with a model. According to Busha and Harter (1980), when a researcher has access to descriptive details that accurately and thoroughly characterize the context and conditions of a phenomenon in a study, he or she should be able to design or adopt a model where necessary. A model provides a mental framework for the analysis of a system that involves simplified representations of real-world phenomena (Busha & Harter, 1980; Powell & Connaway, 2004). Scholars in the US have suggested that doctoral research should develop a model to provide guidance for the completion of their research work and to represent a real-world phenomenon (Leedy & Ormrod, 2001). Accordingly, researchers have come up with the following characteristics of an effective model, which are presented in the model proposed herein: (i) ease of enrichment or ability to modify and expand; (ii) relatedness to other models and techniques; (iii) transparency in terms of ease of interpretation; (iv) fertility or richness in deductive possibility; and (v) robustness or sensitivity to assumptions made (Loeb et al., 2017). In consideration of this, it was envisaged that the proposed model in this study, therefore, might go a long way in creating a connection between this research and society where VI learners can have equal access to technologies and quality education. According to Shafique and Mahmood (2010), models as tools are developed in a particular context, which arises out of typical questions and problems that are relevant for managers and researchers. In the school setup, the model would assist the administration in solving problems emanating, for instance, from access to ICT.

Computers have been infused into society for a decade, and more recently, ICT, with various effects on learning. Educational institutions are anticipated to play a critical role as the engine for knowledge development and the learning environment in the present

information age. In this sense, ICT becomes a crucial tool for making this duty easier. ICT has become a necessary component of daily life; thus, its integration into educational management and the improvement of schools goes beyond just teaching and learning. It has emerged as one of the most powerful forces behind school improvement. ICT is essential for enhancing the school system's operational efficacy.

Moreover, Kouroupetroglou et al. (2011) revealed that accessibility of ICT resources to learners with VI requires, among others, proper planning, a suitable organizational system, human resources with explicit expertise, unconventional technological support, substantial implementation effort, and functional evaluation. Models (if maintained) can always provide a clear representation of the current state of the situation, mitigating the risk of making decisions based on an inaccurate understanding of the situation (Loeb et al., 2017). Models can be used to anticipate the outcomes of proposed Models can ensure the completeness of a solution that is to be implemented.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study investigated the extent to which access to ICT resources determined the integration of the same in teaching and learning for the learners who are visually impaired in selected special primary schools in Kenya. In the previous chapter, the data collected was analysed, and the results were presented and discussed. This chapter presents a summary of the study findings, a conclusion, recommendations for the study, and suggestions for further studies.

5.2 Summary of the Findings

The main findings of the study were summarized based on the objectives of the study.

5.2.1 ICT Resources Available in Special Primary Schools for learners with VI

Objective one of this study was to identify ICT resources available in the special primary schools for the visually impaired in Kenya. The study found that the schools had a variety of modern ICT resources, which could be helpful in accessing quality education for the learners. For instance, iPods and iPads These devices could provide all the functionality, including WiFi, MN chat, and document processing. There was also braille embosser technology, which enhanced the production of braille in terms of the number of copies.

In addition, there was CCTV available that enabled the learners to read printed text easily. The screen readers, which included the jaws and the NVDA, allowed the learners with VI to interact independently and efficiently with the computer. The special scanner was used to scan texts with small fonts and change the image to digital form, which could

be enlarged and even converted into braille. Despite the availability of these modern technologies in the schools, it was evident that the resources would not meet the demands of the learners because they were inadequate. In other words, the ICT resources were accessed by a small number of learners with VI. This was especially so with those in the category of single users, for instance, laptops, iPods, and even CCTVs. Hence, there is a need for more resources in the schools of learners with VI in order to meet their demands.

5.2.2 Level of Integration of ICTs in Teaching and Learning

The second objective of this study was to determine the level of integration of ICTs in teaching and learning in the special primary schools for VI. The study found that ICT was used to support learning in very few lessons 16 out of the 36 lessons that were observed. It was only in two lessons that the teachers used ICT to motivate learners. It was only in one lesson that the teacher endeavoured to develop creativity in the learners. Making learners creative is one of the core aspects of the 21st century, and ICT plays a great role in enhancing this. It was in three lessons out of the 36 observed that the teachers tried to capture the learner's previous knowledge with ICT. From the 36 lessons observed, it was only in seven lessons that the teachers endeavoured to develop various skills in the learners. In addition, it was only in three lessons that ICT tools were used to develop processes, for instance, interpreting, logical thinking, reasoning, and so on. In most of the classes observed, the teachers orally systematically explained the lesson concepts and then dictated notes to the learners. In other words, the teachers put little effort into actively involving the learners in the lessons where the learners could get the opportunity to learn with ICT in an enabling learning environment. Despite the fact that the resources are limited, the few available were not utilized by the teachers in class during lessons.

5.2.3 Learner Factors that Influence Use of ICT in Teaching and Learning

The third objective of this study was to find out the learners' factors that influenced their access to and use of ICT in teaching and learning. The study revealed that the learners accessed the ICT resources differently. This was determined by their nature of blindness. The study revealed that there were two broad categories of these learners: those with mild visual problems and those with moderate visual problems. Those with mild vision and those with moderate vision could access the learning material through laptops with Zoom text software; they could also use enlargers such as CCTV and programs such as Join Me, which allowed them to see what was on their teacher's laptop on their laptops. These two categories could also read large print including enlarged print pictures and other graphics presented to them by their teachers. Severe vision, blindness, together with the last one, complete blindness, would perceive some light with difficulties, some color, and some movement, while there were those who would not perceive light at all. This category used Braille as the system of reading and writing and was fully dependent on the voice output software that included the Jaws for Windows and the non-visual desktop access (NVDA) to access learning material.

Though the speed of reading by low vision learners was faster compared to that of braille reading, the sighted readers were slower compared the speed to the speed of reading. The speed of reading is supported by the study findings by Groenewegen (2007), where he asserts that a braille reader can read at a speed of between 90 and 120 words per minute, while a sighted reader can read at a speed of between 400 and 600 words in a minute, or even faster in the case of skimming. Various variables could have contributed to the

reading slowness. From the findings, it was hence clear that the learners accessed the ICT using different methods and hence accessed the technology differently. Further research found that the learners had positive attitudes towards the use of ICT in teaching and learning. This is important since it could lead to the learners getting interested in learning how to use ICT and, hence, fully reaping the benefits of the ICT resources.

Based on the study's findings, it can be concluded that visually impaired students have some access though with some restrictions while trying to use ICT resources to improve their educational experience. The study findings show that it is important to keep offering learners with visual impairment with educational opportunities as well as supportive technologies that enhance their learning processes and results. Effective ICT-based learning support can be given to them, especially when good strategic plans and procedures are in place.

5.2.4 Teacher Factors that Influence Use of ICT in Teaching and Learning

The fourth objective of this study was to identify teacher's factors that influenced the access and use of the ICT resources in teaching and learning. It was found out that various factors characterized the teachers. First, majority of the teachers had positive attitude toward the use of ICT in teaching their subjects. The lack of competence and confidence in using the ICT in teaching and learning was another factor. However, the teachers lacked training in the use of the technology and pedagogical methods. Quite a number of the teachers had not been trained on the teaching of the learners with VI using the ICTs.

5.2.5 School Administrative Factors that Influence Access and Use of ICT in Special Schools

The fifth objective of this study was to establish the school administrative factors that influenced the access to ICT for the learners. Accordingly, it was found out that there were various factors that were administrative-based, which deterred the access to ICT. First, the school head teachers had not been trained on the management of the school resources, which included ICT. Secondly, the school administrators had little knowledge on where to get the ICT resources for the VI. At the same time, the school administration did not have resources or a proper mechanism or model for the accessibility of ICT and other assistive resources for the VI.

5.2.6 Proposed Model of ICT Accessibly and Services for Leaners With VI

The sixth objective of this study was to propose an accessibility model that would enhance the provision and accessibility of ICT and other related services for learners with VI. A critical review of the literature related to this and a thorough inquiry from the schools revealed that there was a serious scarcity of models that could lead to the accessibility of the ICT resources by learners with VI. Indeed, the schools did not have any effective system that could help with the accessibility of technology. The model proposed in this study allows not only the technical system or mechanism of accessibility but also the training of experts or professionals in the different areas of visually impaired learners pedagogy and services.

5.3 Conclusions

Based on the findings, the study concluded that:

The special primary schools have a variety of modern ICT resources, which could be helpful in accessing quality education for the learners. However, the resources do not adequately meet the demands of the learners because they are inadequate. The ICT resources were accessed by a small number of learners with VI. This was especially so with those in the category of single users, for instance, laptops and iPods. Hence, the study concluded that there is a need for more resources in the schools of learners with VI in order to meet their demands.

Few teachers utilized ICT resources in instruction. ICT was used to support learning in very few lessons, and the majority of the teachers orally explained lesson concepts and then dictated notes to the learners. Therefore, the study concluded that few teachers put in much effort to actively involve the learners in the lessons by integrating ICT. Despite the fact that the resources are limited, the few available were not properly utilized by the teachers during lessons.

Learners with VI accessed the ICT resources differently; this was determined by their nature of blindness. The study concluded that visually impaired students have some access and some restrictions while trying to use ICT resources to improve their educational experience. Thus, it is important to keep offering visually impaired pupils educational opportunities as well as supportive technologies that enhance their learning processes and results.

The study concluded that the majority of the teachers had a positive attitude toward the use of ICT in teaching their subjects. However, the teachers lacked training in the use of

technology and pedagogical methods. Quite a number of the teachers had not been trained on the teaching of the learners with VI using the ICTs.

Further, the study concluded that there were various factors that were administrative-based and deterred the access to ICT. First, the school head teachers had not been trained on the management of the school resources, which included ICT. Secondly, the school administrators had little knowledge on where to get the ICT resources for the VI. At the same time, the school administration did not have a proper mechanism or model for the accessibility of ICT and other assistive resources for the VI.

Finally, the study concluded that there was a serious scarcity of models that could limit the accessibility of ICT resources for learners with VI. Indeed, the schools did not have any effective system that could help with the accessibility of technology.

5.4 Recommendations

Based on the conclusions, the following recommendations were made for different stakeholders in the education of learners with visual impairments:.

5.4.1 General Recommendation

The learner with a visual impairment faces various cognitive challenges in their education, and the solution for this is to help them possess adequate knowledge of how to make use of devices and software in technology for them to access quality education just like their sighted peers. It is therefore vital that the government of Kenya put in place appropriate and effective mechanisms to ensure that ICT and other assistive resources for

the learners who are visually impaired are accessible for quality education. The model of accessibility of ICT and services proposed in this study could go a long way in assisting the government and schools management in organizing and providing the technology and services for the learners.

5.4.2 Specific Recommendations

i. Special schools for learners with VI should be equipped with relevant, adequate and functioning ICT resources and other assistive technologies to enable the learners with visual impairments benefit from the growing technology based knowledge.

ii. The government, through the Ministry of Education, should train more teachers on ICT and in-service those teaching learners with VI to make them competent in the use of ICT and other assistive technologies in teaching and learning.

iii. The government, through the Teachers Service Commission, should ensure that there are well-trained resource center personnel available in school of learners with VI to ensure effective provision of instructional technology and other necessary technological support to both teachers and learners.

iv. The Teachers Service Commission should ensure that the head teachers and teachers posted to special schools housing learners with VI are trained in the area of visual impairment

v. A rigorous training program on the use of ICT resources and other assistive technologies should be conducted early enough for the learners with visual

impairments in order for them to fully benefit from these technologies in their education.

vi. The government of Kenya should put in place specific and very effective policies to ensure that learners with visual impairments access high-quality education just like their sighted peers.

vii. All schools should have internet access so that administrators and teachers can use ICT in the classrooms. Both academic research and communication would benefit from this. To ensure efficient ICT integration in school management, schools should also have backup power sources in locations without electricity.

viii. Schools should come up with models of access to ICT. This would make the access of ICT and other resources for the VI easier.

5.4 Suggestions for Further Research

This study did not cover all issues that may enhance access to quality education for learners who are visually impaired. The following areas were hence suggested for further research:.

i. Even though the study was a fair representation of the learners who are VI, it was limited to only the special primary schools. A similar study should be replicated in other schools in the mainstream where these learners are included.

ii. A study is required to identify the in-depth causes of the scarcity of ICT resources for the learners with VI in Kenya.

iii. The study did not work on the prevalence of learners with visual impairments, those with visual impairments accompanied by other disabilities, or those with

visual impairments who are gifted and talented in Kenya; therefore, a study is recommended.

iv. Further study should be conducted on teacher training and preparedness in the use of ICT and other assistive technologies for learners who are visually impaired.

REFERENCES

ACE CENTRE Advisory Trust (1999). *Catchnet: the use of telecommunication technology to provide remote support and training to young people with access difficulties.* ACE Center Advisory Trust.

Adam, A., & Kreps, D. (2006). Web Accessibility: A Digital Divide for Disabled People? *Social Inclusion: Societal and Organizational Implications for Information Systems, 208*, 217–228. https://doi.org/10.1007/0-387-34588-4_15

Afshari, M., Baker, K. A. & Luan, W. S. (2009). *Factors affecting teachers use of Information and Technology. International journal of instruction January 2009. Vol 2 No 11:1694-609x.www.e.finet*

Akbar, A., Jabbar, A., Saleem, Q. U. A., & Ashiq, M. (2022). Access and Use of Digital Information Resources by Students with Vision Impairment: Challenges, Prospects and Expected Role of Libraries. *International Journal of Disability, Development and Education*, 1-19.

Al- Alwani, A. (2005). *Barrier in integrating information technology in Saudi Arabia science education.* Doctoral Dissertation, the University of Kansas, Kansas.

Al Mulhim, E. (2014). The Barriers to the Use of ICT in Teaching in Saudi Arabia: A Review of Literature. *Universal Journal of Educational Research, 2*(6), 487-493.

Al- Oteawi, S.M. (2002). *The perception of administrator and teachers in utilizing information technology in instruction, administrative work, technology planning and self-development in Saudi Arabia.* Doctoral Dissertation, Ohio University, Ohio.

Al- Ruz, J.A. and Khasawneh, S. (2011). Jordanian Preservice teachers and Technology intergration. A human resource development approach, *Educational Technology and Society. Vol.14 pp. 77-87.*

Albarini, A. (2006). Teachers' attitude toward information and communication technologies. The case of Syrian EFL teachers. *Computer & Education 47,373-398.*

Allan, J. (1999). Actively seeking inclusion: Pupils with special needs in mainstream schools. London: Falmer.

Alma, R. (2014). Assessing Integration of Information and Communication Technology in classroom instruction by physics teachers in Nairobi County, Kenya.

Almanthari, A., Maulina, S., & Bruce, S. (2020). Secondary School Mathematics Teachers' Views on E-Learning Implementation Barriers during the COVID-19 Pandemic: The Case of Indonesia. *Eurasia journal of mathematics, science and technology education*, *16*(7).

Amponsah, S., & Bekele, T. A. (2022). Exploring strategies for including visually impaired students in online learning. *Education and Information Technologies*, 1-23.

Anderson, R. E. & Dexter, S. L. (2000). School Technology Leadership*: Incidence and impact (Teaching, learning and computing: 1998 National Survey Report #6). Irvine, CA: Center for Research on Information Technology and Organization, University of California, Irvine.*

Arslantas, T. K., & Gul, A. (2022). Digital literacy skills of university students with visual impairment: A mixed-methods analysis. *Education and Information Technologies*, 1-21.

Aslaksen, F., Bergh, S., Bringa, O., & Heggem, E. (1997). *Universal Design: Planning and Design for All*. The Norwegian State Council on Disability. https://hdl.handle.net/1813/76583

Balanskat, A.,Blamire,R. & Kefala, S. (2006). *A review of studies of ICT impact on schools in Europe. European School net.*

Banes, D. & Seale, J. (2002) Accessibility and inclusivity in further and higher education: an overview, in: L. Phipps, A. Sutherland & J. Seale (Eds) Access all areas: disability, technology and learning (York, JISC TechDis and Oxford, ALT), 1–5.

Bangkok, U. (2004). Integrating ICTs into Education. Retrieved from ICT in Education: http://www.unescobkk.org/index.php?id=1793

Barbareschi, G., Holloway, C., Arnold, K., Magomere, G., Wetende, W. A., Ngare, G., & Olenja, J. (2020, April). The social network: How people with visual impairment use mobile phones in kibera, Kenya. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (pp. 1-15).

Barker, P. (1999). Using intranets to support teaching and learning. Innovations in Education and Training International, 36(1), 3–10.

Bauer, J. & Keton, J. (2005). Technology Integration in the schools*: Why it isn't happening. Journal of Technology & Teacher Education, 13, 519-526.*

Beggs, T. A. (2000). *Influences and barriers to the adoption of instructional technology paper preserved at the proceedings of the Mid – South International Technology Conference,* Murfreesbore, Tn.

Ben-Moshe, L. (2006). Infusing disability in the curriculum: The case of Saramago's "blindness". Disability studies Quarterly, 26 (2). Retrieved February 20 2012 from http: www.dsq.sds.org/2006_spring _toc .html

Binder, M., & Niederle, U. (2007). Institutions of determinants of preference change. A one way relation? *Paper of Economic Evolution number 0607.*

Bingimlas, K. B. (2009). *Barriers to the successful integration of ICT in Teaching and Learning Environments:* A review of the Literature. RMIt University, Bandoora, VIC, Australia.

Biwot, J. (2012). *Evaluation of factors influencing implementation of computer studies curriculum in Nandi Central District Public Secondary Schools.* University of Eastern Africa; Baraton. Unpublished Thesis.

Bolaji, S. (2007). Evolving creativity in Nigeria Education: a philosophy paradigm. *A conference presentation at philosophy of education society of Australia, 5th July.*

Briel, L., & Getzel, E., 2001. Internships in Higher Education: Promoting Success for Students with Disabilities. *Disability Studies Quarterly, 21*(1). http://dx.doi.org/10.18061/dsq.v21i1.254.

British Educational Communications and Technology Agency (BECTA), (2004).*A review of the research literature on barriers to uptake ICT by teachers.*

Bruner, J. (1990) *Acts of Meaning* Cambridge, MA: Harvard University Press.

Bryderup, I. M., Kowalski, K. (2002). *The role of local authorities in the integration of ICT in the learning,18(4), pp 468-480*

Buabeng-Andoh, C. (2012). *Factors influencing teacher adaptation and Integration of Information Technology into teaching; A review of the literature. International Journal of Education and Development using Information and Communication Technology 8(1) 136.*

Buabeng-Andoh, C. (2012). Factors influencing teachersâ adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using ICT*, *8*(1).

Burns, R. (2000). *Introduction to Research Methods (4th Ed). London: Sage Publishers.*

Campbell, J., & Oliver, M. (1996). Disability Politics: Understanding our past, changing our future (1st ed.). Routledge. https://doi.org/10.4324/9780203410639

Campisi, T., Ignaccolo, M., Inturri, G., Tesoriere, G., & Torrisi, V. (2021). Evaluation of walkability and mobility requirements of visually impaired people in urban spaces. *Research in Transportation Business & Management*, *40*, 100592.

Casely L. & Lynch, P. (2003). *ICT and special needs Education in Africa*, Imfundo Report Phase I, Department for International Development, London.

Castro Sánchez, J. J., & Alemán, E. C. (2011). Teachers' opinion survey on the use of ICT tools to support attendance-based teaching. *Journal Computers and Education*, 56(3), 911-915.

Chai, C.S. Hong, H.Y and Teo, T. (2009). *Singaporean and Taiwanese pre- service teachers' beliefs and their attitude towards ICT*. A comparative study. The Asia Pacific Education Researcher, Vol 18, pp.117-128.

Chataika, T., Mckenzie, J. A., Swart, E., & Lyner-Cleophas, M. (2012). Access to education in Africa: Responding to the United Nations Convention on the Rights of Persons with Disabilities. *Disability & Society*, *27*(3), 385-398. https://doi.org/10.1080/09687599.2012.654989

Chen, C. H. (2008). *Why do teachers not practice what they believe regarding technology integration. Journal of Educational Research. Vol. 102. Pp. 175 – 195*.

Chia, S., (2012). *Learners and Teachers Perceptions and Attitudes Towards ICT in Assessment.*

Chin, J. M. C., Ching, G. S., del Castillo, F., Wen, T. H., Huang, Y. C., del Castillo, C. D., & Trajera, S. M. (2022). Perspectives on the Barriers to and Needs of Teachers' Professional Development in the Philippines during COVID-19. *Sustainability*, *14*(1), 470.

Cohen, L., Manion L. (1989). *Research methods in education*. (3rd Ed), London: Routledge.

Cook, A.M. & Polgar, J.M. (2014). *Assistive technologies: Principles and practice*: Fourth edition.

Coudie, R., Monro, B., Seagraves, L & Kenessons, (2007). *The Impact of ICT in schools – a lands cape review*. UK.

Cox, M., Preston, C, & Cox, K. (1999). *What factors support or prevent teachers from using ICT in their classrooms.* A paper presented at the British Educational Research Association Annual Conference.

Creswell, J. W. (2005). *Educational Research Planning Conducting and evaluating quantitative and qualitative Research. (2nd Ed.).* Ohio. Prentice Hall.

Dalton H, K., & Sarah E, K. (2020). Access to assistive technology among students with visual impairment in higher education institutions in Tanzania. *University of Dar es Salaam Library Journal*, *15*(2), 137-151.

Dau, TTL (2021). Remote Teaching amid the Covid-19 Pandemic in Vietnam: Primary School EFL Teachers' Practices and Perceptions. Asia CALL Online Journal, *13*(1), 1-21.

Davis, F. D. (2003*). Acceptance of Information Technology- Misquarterly, 13(3). 319-339.*

Detherridge, T. (1997). *Bridging the communication Gap for Learners' with Profound and Multiple learning difficulties. British Journal of Special Education. 24(1), 21-26.*

Dos Santos, A. D. P., Ferrari, A. L. M., Medola, F. O., & Sandnes, F. E. (2022). Aesthetics and the perceived stigma of assistive technology for visual impairment. *Disability and Rehabilitation: Assistive Technology*, *17*(2), 152-158.

Dowrick, P.W., Anderson, J., Hayer, K., & Acosta J., 2005. Postsecondary education across the USA: Experiences of adults with disabilities. *Journal of Vocational Rehabilitation 22*(1).

Drake AI, Gray N, Yoder S, Pramuka M, Llewellyn M.(20005). *Factors predicting return to work following mild traumatic brain injury: a discriminant analysis.*

Dutta, A., Scguri-Geist, C., & Kundu, M., (2009). Coordination of postsecondary transition services for students with disability. *Journal of Rehabilitation*, 75, 1, 10-17.

Earle, R. S. (2002). *The integration of instructional technology into public education promises and challenges.* ET Magazines, 42 (1), 5-13.

Eligi, I., & Mwantimwa, K. (2017). ICT accessibility and usability to support learning of visually-impaired students in Tanzania. *International Journal of Education and Development using ICT*, *13*(2).

Empiricas, S. (2006). *Benchmarking access and use of ICT in Europe an schools 2006. Final report from Headteacher and classroom teacher survey in 27 European countries. European Commission*.

Ertmer, P. (1999). *Addressing first and second order barriers to change; strategies for technology.* Integration educational technology research and development, 47 (4) 47-61.

European Institute for Gender Equality, (2019) Gender mainstreaming: Gender Statistics and Indicators (Retrieved on 20th April 2022 from https://eige.europa.eu/gender-mainstreaming/methods).

European Union Agency Research, (1999- 2001). *Information and communication Technology (ICT) in special needs (SNE).*

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449-2472.

Farhan, W., & Razmak, J. (2022). A comparative study of an assistive e-learning interface among students with and without visual and hearing impairments. *Disability and Rehabilitation: Assistive Technology*, *17*(4), 431-441.

Farhan, W., & Razmak, J. (2022). A comparative study of an assistive e-learning interface among students with and without visual and hearing impairments. *Disability and Rehabilitation: Assistive Technology*, *17*(4), 431-441.

Farrell, G. (2007). *Survey of ICT and Education in Africa: Kenya Country Report. www.Infoderorg. ICT in Education in Kenya.*

Fehr, L., Langbein, W. E., & Skaar, S. B. (2000). Adequacy of power wheelchair control interfaces for persons with severe disabilities: A clinical survey. *Journal of rehabilitation research and development*, *37*(3), 353-360.

Fontana, A., & Frey, J. H. (2000). The interview: From structured questions to negotiated text. In N. K. Denzin, & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 645-672). Thousand Oaks, CA: Sage.

Fred, O. N. (2020). Impact of Integrating Assistive Technologies in Learning Mathematics among the Visually Impaired Learners in St Oda School, In Siaya County Kenya.

Fu, S. J. (2013). *ICT in Education; A critical Literature Review and its implication.* National Institute of Education, Singapore.

Fullan, M. (1982). *The new meaning of Educational change London:* Cassel Educational Limited.

Gall, M.D, Borg, W.R & Gall, J.P. (1996).Educational research: An introduction (6thed); USA, Longman publishers.

Gallagher, Shaun. (2006). *The narrative alternative to theory of mind*. Conscious Emotion. 7. 10.1075/ceb.2.15gal.

Getzel, E., Stodden, R., & Brief, L. (2001). Pursuing postsecondary education opportunities for individuals with disabilities. In P. Wehman (ed.), *Life beyond the classroom: Transition strategies for young people with disabilities*. Baltimore, MD: Broodes Publishing.

Ghavifekr, S., Kunjappan, T., Ramasamy, L., & Anthony, A. (2016). Teaching and Learning with ICT Tools: Issues and Challenges from Teachers' Perceptions. *Malaysian Online Journal of Educational Technology*, *4*(2), 38-57.

Gitari, J. M. (2020). *Influence of Assistive Technology on Kenya Certificate of Secondary Education (Kcse) Performance for Visually Impaired Students at Thika High School for the Blind, Kenya* (Doctoral dissertation, University of Nairobi).

Glaser, B., & Strauss, A. (1967). The Discovery of Grounded Theory: Strategies for Qualitative Research. Mill Valley, CA: Sociology Press.

Goggin, G., Newell, G., & Newell, C. (2003). *Digital disability: The social construction of disability in new media*. Rowman & Littlefield.

GoK, (2007). *A globally competitive and prosperous Kenya:* Nairobi: Government Printers.

GoK, (2010). *The new constitution of Kenya;* Nairobi: Government Printers.

Gomes, C. (2005). Integration of ICT in science teaching. A study performed in Azores, Portugal. Recent Research Developments and learning Technologies

Government of the Republic of Kenya. (2007). *Kenya Vision 2030 - The Popular Version*. Kenya Vision 2030 | Kenya Vision 2030. https://vision2030.go.ke/wp-content/uploads/2018/05/Vision-2030-Popular-Version.pdf

Gronlund N. E. (1985). *Measurement and Evaluation in Teaching*, Mc Milan, New York.

Hall, D. L., Allen-Collinson, J., & Jackman, P. C. (2022). 'The agenda is to have fun': exploring experiences of guided running in visually impaired and guide runners. *Qualitative Research in Sport, Exercise and Health*, 1-15.

Hall, G., Mahony, J., Clapham, H., Heyworth, M., Lilley, R., Lawson, W., & Pellicano, E. (2022). 'A way to be me': Autobiographical reflections of autistic adults diagnosed in mid-to-late adulthood. *Autism*, *26*(6), 1395-1408.

Hehir, Thomas. (2003). Beyond Inclusion. School Administrator.

Hennessy, S., Ruthven, K., & Brindley, S. U. E. (2005). Teacher perspectives on integrating ICT into subject teaching: commitment, constraints, caution, and change. *Journal of curriculum studies*, *37*(2),155-192.

Hodas, S. (1993). *Technology refusal and the organizational culture of schools.* Education policy Analysis.

Hood, N., & Littlejohn, A. (2017). Knowledge typologies for professional learning: educators'(re) generation of knowledge when learning open educational practice. *Educational Technology Research and Development*, *65*(6), 1583-1604.

Hunt, P. (1966). *Stigma: The Experience of Disability*.

Hutchinson, J. S., Atkinson, K., & Orpwood, J. (1998). *Breaking down barriers: Access to further and higher education for visually impaired students*. Nelson Thornes.

Jebril, T., & Chen, Y. (2021). The architectural strategies of classrooms for intellectually disabled students in primary schools regarding space and environment. *Ain Shams Engineering Journal*, *12*(1), 821-835.

Jonassen, D. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. Educational Technology Research and Development, 45, 65-94.

Kamaghe, J. S., Luhanga, E. T., & Michael, K. (2020). The challenges of adopting M-learning assistive technologies for visually impaired learners in higher learning institution in Tanzania.

Kapote, S., & Srikanth, P. (2021). Barriers and the role of assistive technology to access education for children with visually impaired during COVID-19 times. *Indian Journal of Clinical Medicine*, *11*(1-2), 55-56.

Karunaratne, T., Peiris, C.R., & Hansson, H. (2018). Implementing Small Scale ICT Projects in Developing Countries – How Challenging Is It? *International journal of education and development using information and communication technology, 14*, 118-140.

Katz, L.G. (1989). Afterward: Young children in cross-national perspective, in hoe young nations serves young children profile of childcare and education in 14 countries. Michigan High/scope Educational Research Foundation.

Kaur, A., Bhatia, M., & Stea, G. (2022). A Survey of Smart Classroom Literature. *Education Sciences*, *12*(2), 86.

Kayange, G. M. (2021). Analysis of the Impact of Accessible Digital Technologies on Public Libraries: A Case of Organizations of Persons with Disabilities in Botswana. *Academia Letters*, 2.

Keitany, J., Munyi, C., & Muthee, J. (2020). Learner Related Factors that Influence Access to ICT By Learners With Visual Impairment In Selected Special Schools In Kenya. *Journal of Education and Practices ISSN 2617-5444 (ONLINE) & ISSN 2617-6874 (PRINT), 3*(1), 14-29.

Kelly, S. M., & Smith, D. W. (2011). The Impact of Assistive Technology on the Educational Performance of Students with Visual Impairments: A Synthesis of the Research. Journal of Visual Impairment & Blindness, 105(2), 73–83. https://doi.org/10.1177/0145482X1110500205.

Kelly, S. M., & Wolffe, K. E. (2012). Internet use by transition-aged youths with visual impairments in the United States: Assessing the impact of postsecondary predictors. *Journal of Visual Impairment & Blindness*, *106*(10), 597-608. https://doi.org/10.1177/0145482x1210601004

Kenya Law reports. (2012). *Persons with disabilities act*. Welcome to the United Nations. https://www.un.org/development/desa/disabilities/wp-content/uploads/sites/15/2019/11/Kenya_Persons-with-Disability-Act.pdf

Kerlinger F. N. (1986). *Foundations of behavioral research* (3rd ed.). Holt Rinehart and Winston.

Khan, S. (2007). *The G3 ICT initiative; implementing the resolution of the world summit on the information society and the millennium Goals.* InGzict (Editor). The accessibility imperative.

Kim-Rupnow, W. S., & Burgstahler, S. (2004). Perceptions of Students with Disabilities regarding the Value of Technology-Based Support Activities on Postsecondary Education and Employment. Journal of Special Education Technology, 19(2), 43–56. https://doi.org/10.1177/016264340401900204

Kimuyu, D. N. (2016). *Factors Influencing Principals' Integration Of Information Communication Technology In Administration Public Secondary Schools In Kitui Central Sub County, Kenya* (Doctoral dissertation, University of Nairobi).

Kisanga, D. H., & Kisanga, S. E. (2021). Access to assistive technology among students with visual impairment in higher education institutions in Tanzania: challenges and coping mechanisms. *University of Dar es Salaam Library Journal*, *15*(2), 137-151.

Koc, M. (2005). *Implications of learning theories for effective technology integration and pre service teacher training: Critical literature review journal of Turkish science Education. Vol. 2, pp. 2-18.*

Kombo, K. D. and Tromp, L. A. D. (2006). Proposal and thesis writing: an introduction. Nairobi: Pauline Publications Africa.

Kong, W. H., & Loi, K. I. (2017). The barriers to holiday-taking for visually impaired tourists and their families. *Journal of Hospitality and Tourism Management*, *32*, 99-107.

Kopha, T. J. (2012). *Teachers` perceptions of the Barriers to Technology integration and Practices with Technology under situated professional Development.*

Korte, W. B. & Husing. T. (2007). *Bench Marking access and use of ICT in European schools 2006. Results from head teachers and a classroom Teacher surveys in 27 European countries. Learning papers, 2(1), 1-6.*

Kothari, C. R. (2004). *Research methodology; methods and techniques, 2nd Edition.*NewDehli; New Age International (P) Ltd.

Kouroupetroglou, G., Pino, A., & Kacorri, H. (2011, February). A model of accessibility services provision for students with disabilities in higher education. In *Proceedings of the international conference universal learning design* (Vol. 8, p. 11).

Krishna, S., Colbry, D., Black, J., Balasubramanian, V.N., & Panchanathan, S. (2008). A Systematic Requirements Analysis and Development of an Assistive Device to Enhance the Social Interaction of People Who are Blind or Visually Impaired. *Workshop on Computer Vision Applications for the Visually Impaired.*

Kukali, A. N., Kawasonga, M., & Rabari, J. (2018). 1. Department of Educational Management and Foundations, Maseno University, Kenya 2. Department of Educational Communication, Technology and Curriculum Studies, Maseno….

Kukali, A. N., Kawasonga, M., & Rabari, J. (2018). Department of Educational Management and Foundations, Maseno University, Kenya 2. Department of Educational Communication, Technology and Curriculum Studies, Maseno

Kumar, S., & Sanaman, G. (2013). Preference and use of electronic information and resources by blind/visually impaired in NCR libraries in India. *Journal of Information Science Theory and Practice*, *1*(2), 69-83.

Laaria ,M. (2013). Leadership Challenges in the Implementation of ICT in Public Secondary Schools, Kenya. *Journal of education and learning*, *2*(1), 32-43.

Langat, W. K. (2020). *Teacher Related Factors Influencing Integration of Information and Communication Technology in Public Secondary Schools in Narok North Sub-county, Kenya* (Doctoral dissertation, University of Nairobi).

Law, N., & Chow, A. (2008). Teacher Characteristics, Contextual Factors, and How These Affect the Pedagogical Use of ICT. *Pedagogy and ICT Use*, *23*, 181–219. https://doi.org/10.1007/978-1-4020-8928-2_6

Lee, R. M., & Fielding, N. (1996). 'Qualitative Data Analysis: Representations of a Technology: A Comment on Coffey, Holbrook and Atkinson.' Sociological Research Online, 1(4), 15–20. https://doi.org/10.5153/sro.1326

Leedy, P. D. & Ormrod, J. E. (2001). Practical research: Planning and design (7th ed). Upper Saddle River, NJ: Merrill/Prentice Hall.

Leedy, P. D. (1989). *Practical Research Planning and Design 4th Edition*. United States of America, Macmillan Publishing company.

Lenah, M. G. (2015). Factors Affecting Utilization of ICT In Administration Of Public Secondary Schools In Kiambu Sub-County, Kiambu County, Kenya.

Lewis, D. E. (1994). Assistive devices for classroom listening: FM systems. *American Journal of Audiology*, *3*(1), 70-83.

Lewis, S. (2003). *Enhance teaching and learning of science through use of ICT:* Methods and materials school science review, 84(309), 41-51.

Li, C., Omar, M., & Rasul, M. S. (2022). Research on the Effects of Integrating Information and Communication Technology (Ict) Into English Teaching in Technical and Vocational Colleges. *Journal of Positive School Psychology*, *6*(9), 1945-1954.

Lim, C. P. (2002). A theoretical framework for the study of ICT in schools: A proposal. *British Journal of Educational Technology*, *33*(4), 411-421. https://doi.org/10.1111/1467-8535.00278

Lin, M. C., Wang, P.Y. & Lin, I-C. (2012). *pedagogy technology; a two-dimensional model for teacher' ICT integration, British Journal of Education Technology, Vol.15. Pp.5-23.*

Liu, S., Shao, W., Li, T., Xu, W., & Song, L. (2022). Recent advances in biometrics-based user authentication for wearable devices: A contemporary survey. *Digital Signal Processing*, *125*, 103120.

Loeb, S.J., Dynarski, S.M., McFarland, D.A., Morris, P., Reardon, S.F., & Reber, S.J. (2017). Descriptive Analysis in Education: A Guide for Researchers. NCEE 2017-4023. *National Center for Education Evaluation and Regional Assistance*.

Luy, D. T. T. (2022). Remote Teaching amid the Covid-19 Pandemic in Vietnam: Primary School EFL Teachers' Practices and Perceptions.

Makanda, J. L. (2015). Use of ICT in teaching physics: A case of secondary schools in Kimilili, Bungoma County, Kenya. http://ir-library.ku.ac.ke/handle/123456789/13431

Malik, R. S. (2018). Educational challenges in 21st century and sustainable development. *Journal of Sustainable Development Education and Research*, *2*(1), 9-20.

Marshall, S., & Taylor, W. (2017). The role of ICT in supporting various learning environments. *International Journal of Education and Development using Information and Communication Technology*, *13*(2), 2-3.

Martinez, E. (1999). "Boosting public understanding of science and technology in developing countries", Paper presented at World Conference on Science, 1999. Retrieved from http://www.nature.com/wcs/c16.html.

Maslowski, R, (2001). *School culture and school performance; An explorative study into the organizational of culture secondary school and their effects twenty*, Tweate University press. Enscheda.

Matelong, E. C. (2019). *Influence of Socio-Economic Factors On Sustainable Fish Farming In Moiben Sub-County, Kenya* (Doctoral Dissertation, KISII UNIVERSITY).

Mcguire, J. M., Scott, S. S., & Shaw, S. F. (2006). Universal Design and Its Applications in Educational Environments. *Remedial and Special Education*, 27(3), 166–175. https://doi.org/10.1177/07419325060270030501

McMahon, G. (2009). *Critical thinking and ICT integration in a Western Australian secondary school.* Education al Technology and Society, Vol. 12, pp.269-281.

McMillan, J. H. & Schumacher, S. (2010). Research in education – Evidence-based inquiry. (7thed.) International Edition. Boston: Pearson Education Inc.

Medina, M. (2002). *Computer literacy initiative of Kenya: A proposal for the*

Meeks, L., & Geither, E. (2014). Writing and the autism spectrum: helping students through the process. *Good Autism Practice (GAP)*, *15*(2), 79-83.

Mertens, D.M. (2005). *Research and evaluation in education and psychology: Integrating Diversity with quantitative and qualitative and mixed methods (2nd Ed.).* London: Sage Publication.

Mikre, F. (2011). The roles of information communication technologies in education: Review article with emphasis to the computer and internet. *Ethiopian Journal of Education and Sciences*, *6*(2), 109-126. The roles of information communication technologies in education: Review article with emphasis to the computer and internet. *Ethiopian Journal of Education and Sciences*, *6*(2), 109-126.

Miles, M. B., & Huberman, A. M. (1994). Qualitative Data Analysis: An Expanded Sourcebook. Thousand Oaks, CA: Sage Publications.

Ministry of Education. (2005). *Draft policy for Information and Communication Technology in Education.* Republic of Trinidad and Tobago. Government press

Ministry of Education. (2006). *National information and Communication Technology (ICT) Strategy for Education and Training. Nairobi; Government Press.*

Ministry of Education. (2009, July). *The national special needs education policy framework*. The African child Policy Forum. https://www.africanchildforum.org/clr/policy%20per%20country/kenya/kenya_specialeducation_2009_en.pdf

MoE & MoHEST. (2012). *Reforming Education and training sectors in Kenya. Sessional paper No.14.*Nairobi: Government Press.

MoE & Vocational Training. (2007). Information and Communication Technology (ICT) Policy for Basic Education. Dar es salaam. Government press.

Montenegro, Rueda, M., Fernández, Batanero, J. M., & Fernández, Cerero, J. (2022). Impact of ICT on university students with visual impairment. *British Journal of Special Education*.

Moore, D. & Taylor, J. (2000). *Interactive Multimedia systems for Learners with Austisin. Journal of Education media. 25(2), 169-175.*

Motzfeldt, H. M., & Næsborg-Andersen, A. (2018). Developing administrative law into handling the challenges of digital government in Denmark. *Electronic Journal of e-Government*, *16*(2), pp136-146.

Mrazek, R., Hollingsworth, M. & Street, M. (2005). *Scaling the digital leadership divide*. Norfolk.

Muchiri, G. M. (2014). *Factors influencing school principals' integration of ICT in administration of public secondary schools in Githunguri Sub County, Kiambu County, Kenya* (Doctoral dissertation, University of Nairobi).

Mugenda O.M & Mugenda A.G (1999). *Research Methods. Quantitative and qualitative Approaches.* Nairobi. Acts press.

Mugenda, O. M. & Mugenda, A. G. (2003). *Research methods; Quantitative and Qualitative approaches.* Nairobi. Acts Press.

Mugo, B. C. (2013). Assistive Technology and Access to Quality Instruction for Blind and Visually Impaired Students: A Comparative Study of Kenyatta University, Kenya and Syracuse University, USA [Thesis]. http://ir-library.ku.ac.ke/handle/123456789/9009

Mukhopadhyay, S., Moswela, E., & Habulezi, J. (2021). Experiences of learners with visual impairments in Botswana primary schools. *International Journal of Inclusive Education*, 1-18.

Mull, C. A., & Sitlington, P. L. (2003). The Role of Technology in the Transition to Postsecondary Education of Students with Learning Disabilities: A Review of the Literature. The Journal of Special Education, 37(1), 26–32. https://doi.org/10.1177/00224669030370010301

Munyi, C.M. (2017). Analysis of Teachers' Perceptions on Instruction of Braille Literacy in Primary Schools for Learners with Visual Impairment in Kenya. Unpublished PhD Thesis, Kenyatta University, Kenya. http://ir-ibrary.ku.ac.ke/handle/123456789/17844

Murrray, D. & Compell, N. (2000). *Barriers to Implement Information Technology in some New Zealand schools*. Computers in New Zealand schools.

Musambai, E. A., Ndirangu, M., & Mukhwana, F. (2017). Influence of ICT on the Quality of Educational Management in Secondary Schools in Kakamega County, Kenya. In the International Journal of Science And Technology, Vol. 5,Issue 6, PP. 90-97

Mustafa, Koc. (2005). Implications of Learning Theories for Effective Technology Integration and Pre-service Teacher Training: A Critical Literature Review. *Journal of Turkish Science Education*.

Mutia, T. O. (2020). *Challenges in Teaching Visually Impaired Students in Kenya-the Case Study of Kitui Secondary School in Kitui Central* (Doctoral dissertation, University of Nairobi).

Mutisya, A. M., Mulwa, D. M., & Mwania, J. M. (2017). The influence of principals' related factors on ICT integration in the management of public secondary schools in Kitui County, Kenya.

Mwanje, J.I (2001a). Issues in Social Science Research. Social Research Methodology Series. Module I. OSSREA. Addis Ababa, Ethiopia.

Nahar, L., Sulaiman, R., & Jaafar, A. (2022). An interactive math braille learning application to assist blind students in Bangladesh. *Assistive Technology*, *34*(2), 157-169.

Namibia Training Authority, (2006). *International Journal of Education and Development using information and communication Technology (IJEDICT). Vol 2. Issue 3. Pp.70 -85.*

Naneetha, R., & Srihari, M. (2021). A Case Study on Information and Communication Technology in Empowering the Visually Challenged Women in Inclusive Education. *Shanlax International Journal of Education*, *9*(4), 374-381.

Nang'unda, K. A. (2019). *Assessment of Principals' Leadership in Information communication Technology Integration in Public Secondary Schools Management in Bungoma County, Kenya* (Doctoral dissertation, Maseno University).

Nardi, B. A. & Day, O. (1999). *Information ecologies; using technology with heart*. Cambridge, Massachusetts: MIT Press.

Newhouse, P. (2002*). Literature review: The impact of ICT on learning and teaching,* Perth, Western Australia: Department of Education.

Ngwu, O. G. (2014). Assessment of Availability and Utilization of ICT Resources in Teaching in FCE Eha-Amufu Enugu, Nigeria.

Nochajski, S., Oddo, C., & Beaver, K. (1999). Technology and transition: tools for success. Technology and Disability, 11, 93-101.

Nyanchoka, M. O. (2015). *Factors influencing principals' integration of information communication technology in administration of public secondary schools in Isinya sub-county, Kenya* (Doctoral dissertation, University of Nairobi).

Nzioka, J. N. (2011). Factors Influencing the Selection and Utilization of Learning Resources by Tutors in Three Selected Primary Teachers' Colleges in Kenya. Unpublished PhD Thesis, Kenyatta University, Kenya. http://ir-library.ku.ac.ke/handle/123456789/3603

Okonji, P. E., & Ogwezzy, D. C. (2019). Awareness and barriers to adoption of assistive technologies among visually impaired people in Nigeria. *Assistive Technology*, *31*(4), 209-219.

Oloo, O. O. A. D. (2022). Online digital platform use by adolescents in Kenya. *Journal of Children and Media*, *16*(2), 261-270.

Omolara, A. E., Alabdulatif, A., Abiodun, O. I., Alawida, M., Alabdulatif, A., & Arshad, H. (2022). The internet of things security: A survey encompassing unexplored areas and new insights. *Computers & Security*, *112*, 102494.

Orodho A.J. (2009). Elements of Education and Social Science Research Methods, Kanezja Publisher. ISBN: 978 – 9966 – 7350 – 1 –1.

Orogbemi, O., Uzor, M., & Oduwale, A. (2022). Information and Communications Technology in Education for Persons with Special Needs (ICTEPSN). *Science*, *10*(1), 12-17.

Ozden, M. (2007). *Problems with science and technology education in Turkey: Eurasia Journal of Mathematics Science & Technology Education, 3(2), 157-161.*

Papaloannou, P. & Charalambous, K. (2011). *Principals Attitudes towards ICT and their perceptions about the factors that facilitate or inhibit ICT integrate in primary schools of Cyprus. Vol. 10, 2011.*

Park, H. J., Takahashi, K., Roberts, K. D., & Delise, D. (2017). Effects of text-to-speech software use on the reading proficiency of high school struggling readers. *Assistive Technology*, *29*(3), 146-152.

Pelgrum, W. & Law, R. (2003). *ICT in Education around the World*: Trends, problems and prospect international institute for Educational Planning, Paris.

Pelgrum, W. J. (2001). *Obstacles to the integration of ICT in education; result from worldwide education al assessment.* Computer in education 37,163-178.

Pinquart, M., & Pfeiffer, J. P. (2013). Perceived social support in adolescents with and without visual impairment. *Research in Developmental Disabilities, 34*(11), 4125–4133. https://doi.org/10.1016/j.ridd.2013.08.004

Presley, I., & D'andrea, F. M. (2009). *Assistive technology for students who are blind or visually impaired: A guide to assessment*. Afb Press.

Rabah, J. (2015). Benefits and Challenges of Information and Communication Technologies (ICT) Integration in Québec English Schools. *Turkish Online Journal of Educational Technology, 14*(2), 24-31. Retrieved from https://www.learntechlib.org/p/160580/.

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020, January). Students and teachers' challenges of using technology in blended learning environments. In *Proceedings of the 2020 the 3rd International Conference on Computers in Management and Business* (pp. 195-200).

Raskind, M. H., & Higgins, E. L. (1998). Assistive technology for postsecondary students with learning disabilities: An overview. *Journal of Learning Disabilities*, *31*(1), 27-40.

Renukadevi, S., Rajarajan, S., Vedanayagi, R., & Raja, J. (2018). Factors Influencing the effective use of ICT in education and learning–Indian perspective. *JETIR.*, *5*(8), 327-331.

Republic of Ghana. (2008). Information and Communication Technology Policy. Government press.

Republic of Trinidad & Tobago. (2003). Information and Communication Technology policy. Government press.

Rimmerman, Arie & Araten- Bergman, Tal. (2005). Disability rights and their implementation in Israel-trends and future directions. Social Security. 69. 11-31.

Ritchie, H., & Blanck, P. (2003). The promise of the internet for disability: A study of on-line services and web site accessibility at centers for independent living. *Behavioral Sciences & the Law*, *21*(1), 5-26. https://doi.org/10.1002/bsl.520

Robinson, V. (2010). From Instructional Leadership to Leadership Capabilities: Empirical Findings and Methodological Challenges. *Leadership and Policy in Schools*, 9, (1). 1-26.

Rogan, J. M. (2003). *Towards a theory of curriculum implementation with particular reference to science education in developing countries*. International Journal of Science Education. 25(10) 1171- 1204.

Rogers, E. (1995). *Diffusion of Innovations. 4th Edition*. The free press. New York.

Rogers, E. (2003). Diffusion of Innovations. 5th Edition. New York. NY: The Free Press.

Rose, D. H., & Meyer, A. (2006). *A practical reader in Universal Design for Learning*. Cambridge, MA: Harvard Education Press.

Rose, D., & Meyer, A. (2002). *Teaching every student in the digital age*. Alexandria, VA: ASCD.

Rose, D.H., Meyer, A., & Hitchcock, C. (Eds.). (2005). *The universally designed classroom: Accessible curriculum and digital technologies*. Cambridge, MA: Harvard University Press.

Sabomana, A. (2017). *Determinants of Integration of Information and Communication Technology in teaching and learning of science in low public primary schools in Gasabo District, Rwanda.* Unpublished project. Kenyatta University.

Salehi, H. & Salehi, Z. (2012). *Integration of ICT in Language teaching: Challenges and Barriers.*

Savatia, E. M. (2016). *Human computer interaction framework for visually challenged students in Kenyan public universities* (Doctoral dissertation, KIBU).

Schles, R. A., & McCarthy, T. (2022). Exploring States' Variations in Prevalence and Eligibility Criteria for Students With Visual Impairments Including Blindness. *Remedial and Special Education*, 07419325221083656.

Schoepp, K. (2005). *Berriers to technology integration in a technology rich environment, Learning and teaching in higher education; gulf perspectives, 2 (1),1-24.*

Scott, S. (2013). iOS - Worthy of the hype as assistive technology for visual impairments? A phenomenological study of iOS device use by individuals with

visual impairments. (Doctoral Dissertation), Tennessee State University, Nashville, Tennessee.

Sepulveda-Escobar, P., & Morrison, A. (2020). Online teaching placement during the COVID-19 pandemic in Chile: challenges and opportunities. *European Journal of Teacher Education*, *43*(4), 587-607.

Seymour, W., & Lupton, D. (2004). Holding the line online: Exploring wired relationships for people with disabilities. *Disability & Society, 19*(4), 291–305. https://doi.org/10.1080/09687590410001689421

Shafique, F. & Mahmood, K. "Model Development as a Research Tool: An Example of PAKNISEA" (2010). Library Philosophy and Practice (e-journal). 427. https://digitalcommons.unl.edu/libphilprac/427

Shaw, G. & Marlow, N. (1999). *The role of Learners learning styles. Gender, Attitudes and Perceptions on ICT Assisted learner. Vol. 35.*

Shefketi, B. (2020). Technologies That Enhance the Education of Students with Learning Disabilities. *Knowledge-International Journal*, *38*(2), 385-389.

Shiue, Y. M. (2007). *Investigating the resources of teachers' instructional technology use through the decomposed theory of planned behaviour. Journal of Educational Computing Research, 36(4), 425-453.*

Sicilia, C. (2005). *The challenges and Benefits to Teachers; practices in constructivist learning environment supported by technology.* Unpublished master's thesis, Mc Gill University, Montreal.

Simui, F., Ngandu, S. K., & Nyaruwata, L. T. (2017). ICT as an Enabler to Academic Success of Students with Visually Impaired at Sim University. *Zambia ICT Journal*, *1*(1), 5-9.

Singhal, R., Singhal, A., Bhatnagar, M., & Malhotra, N. (2019). Design of an audio repository for blind and visually impaired: a case study. In *Advanced Computing and Communication Technologies* (pp. 77-85). Springer, Singapore.

Singleton, P. A. (1993). *Approaches to social research;* New York: Oxford University.

Smith, D. W., & Kelly, S. M. (2014). Assistive technology for students with visual impairments: A research agenda. *Current issues in the education of students with visual impairments*, 46, 23-53.

Stodden, R. A., Dowrick, P. W., Anderson, J., Heyer, K., & Acosta, J. (2005). Postsecondary education across the USA: Experiences of adults with disabilities. *Journal of Vocational Rehabilitation*, 22, 41- 47.

Stronge, J. H. Tucker, P.D. & Hindman, J. L. (2004). *Handbook for qualities of effective teachers.* Virginia ASCD.

Stumbo, N., Martin, J.K., Hedrick, B.N. (2009). Assistive technology: Impact on education, employment and independence of individuals with physical disabilities. *Journal of Vocational Rehabilitation* 30(2), pp. 99-110.

Sutcliffe, J. (1999). Information technology. In H. M. S. McCall (Ed.), Visual impairment: Access to education for children and young people (pp. 264-278). London: David Fulton Publishers.

Tagalou, A., Massourou, V., Kuriakopoulou, K., & Efthimiopoulos, A. (2013). ICT in Educational Management. In *EDULEARN13 Proceedings* (pp. 3840-3846). IATED.

Tatut, S. M. (2022). A View on the Virtualizability of Practical Courses: Romanian Medical Students' Perspective in the Context of a Sudden Online Shift.

Tearle, P. (2003). *Enabling teachers to use information and communication technology for teaching and learning through professional development influential factors, Teachers Development, 7, 3, (457). https://online library.Wiley.com/dol/full/10:1046/j007-1013. 2003.00351.x*

Tezet, E. (2011). *Factors that influence pre service teachers' ICT usage in Education. European Journal of Teachers Education. Vol. 34. Pp483-499.*

Theodorou, P., & Meliones, A. (2022). Gaining insight for the design, development, deployment and distribution of assistive navigation systems for blind and visually impaired people through a detailed user requirements elicitation. *Universal Access in the Information Society*, 1-27.

Tom, S. L., Mpekoa, N., & Swart, J. (2018, March). Factors that affect the provision of visually impaired learners in higher education. In *2018 Conference on Information Communications Technology and Society (ICTAS)* (pp. 1-5). IEEE.

Tomlinson, C. A. (1999). *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

Toprakci, E. (2006). *Obstacles at integration of schools into information and communication technologies by taking into consideration the opinions of the*

teachers and principle of primary and secondary schools in Turkey. Journal of Instructional science and Technology. (e-JIST), 9(1), 1-16.

Trut, L. N. (1999). Early Canid Domestication: The Farm-Fox Experiment: Foxes bred for tamability in a 40-year experiment exhibit remarkable transformations that suggest an interplay between behavioral genetics and development. *American Scientist*, *87*(2), 160–169. http://www.jstor.org/stable/27857815

UN. (2018, April 19). *Convention on the Rights of Persons with Disabilities*. Welcome to the United Nations. https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html

Unal, S, & Ozturk, H. (2012). *Barriers to ICT integration into teacher's classroom practice*: lessons from case study on social studies teachers in 2012.

UNESCO IITE, (2006). *ICTs in Education for people with special needs; specialize Training course.*

UNESCO, (2009). *Policy guidelines on inclusion in education,* Paris, UNESCO.

UNHCRPD, (2006). United Nations Conventions on the rights of persons with disabilities.

UNICEF, (2007). *Promoting the Rights of Children With Disabilities.* Innocenti Research Centre.

UPIAS, (1977). Fundamental principles of disability. London: Union of the Physically Impaired Against Segregation.

Van der Geest, T., van der Meij, H. & van Puffelen, C. Self-assessed and actual Internet skills of people with visual impairments. *Univ Access Inf Soc* 13, 161–174 (2014). https://doi.org/10.1007/s10209-013-0304-5

Waddell, L. (2000). *The pilot Internet Project:* Evaluation Report. London: Royal national Institute for the Blind.

Wadlington, E., & Wadlington, P. L. (2008). Helping students with mathematical disabilities to succeed. *Preventing School Failure: Alternative Education for Children and Youth*, *53*(1), 2-7.

Wanjau, A.W. (2016). Policy and Provision of Learning Supports and Accommodations for Students with Disabilities in Kenyan Public Universities. Unpublished PhD Thesis, Kenyatta University, Kenya. http://ir-library.ku.ac.ke/handle/123456789/17971

Ward, P. L. (1981). Reviews : Busha, Charles H., and Harter, Stephen P., Research methods in librarianship: techniques and interpretation, London, Academic Press, 1980. 417pp. £11.00. ISBN 0 12 147550 6. *Journal of Librarianship*, 13(3), 193–195. https://doi.org/10.1177/096100068101300310

Watson, G. (1999). *Barriers in the integration of the internet into teaching and learning: professional development.* Paper presented at the Asia Pacific Regional internet conference on operational technologies.

Waycott, J., Bennet, S., Palgamo, B. & Kennedy, G. (2010). *The Role of Learners learning styles, Gender, Attitudes and Perceptions on ICT Assisted learner.*

Weiss, R. S. (2004). In Their Own Words: Making the Most of Qualitative Interviews. Contexts, 3(4), 44–51. https://doi.org/10.1525/ctx.2004.3.4.44.

Wiersma, W., & Jurs, S. G. (2005). Research methods in education: An introduction. Boston, MA: Ally and Bacon.

Wisniewski, L., & Sedlak, R. (1992). Assistive devices for students with disabilities. *The Elementary School Journal, 92*(3), 297–314. https://doi.org/10.1086/461694

Worth, N. (2001). *Fountain able communication project. International Journal of Language and Communication Disorders. 36,240-245.*

Wrench, Jason S. Quantitative Research Methods for Communication: A Hands-on Approach. New York: Oxford UP, 2008. Print.

Young, M. C., Courtad, C. A., Douglas, K. H., & Chung, Y. C. (2019). The effects of text-to-speech on reading outcomes for secondary students with learning disabilities. *Journal of Special Education Technology*, *34*(2), 80-91.

Yusuf, M. O. (2005). *An investigation into teacher's self-efficacy in implementing computer education in Nigerian secondary schools; Meridian: A middle school computer technologies journal Vol. 8, Issue 2.*

Zaid, Y. A. (2018). Inclusive Education Policy as Platform of Library Services for Students with visual Impairment in Nigerian Universities: Lessons from the United States of America.

Appendix I

Table 4.3: ICT resources Available in the Schools for VI

Type of AT	Number of items		Ratio of functional items to number of leaners
	Functional	Non functional	
Ipods and ipads			
Computers with voice output software			
Enhanced Vision Systems Cameras			
Talking calculators			
Embossers			
Scanners			
Braille sense			
CCTVs			
Smartphones			
Tablets			
JAWS (Screen reader software)			
NVDA (screen reader software)			
Audio recorders			
Electronic books			
Compacts Discs			

Appendix II:

Classroom Observation Schedule

Use of ICT in the Classroom of Learners with Special Needs

Strategy	**Support**	**Comment**
Student motivation	Principles, attitude etc.	
Developing creativity	Brain sketching, concept mapping, role play, case studies etc.	
Evoking prior knowledge	Concept mapping, charts, graphics organizing, anticipatory guiding etc.	
Development of different skills	Problem solving, research, communication etc.	
Supporting Process	Interpreting, organizing, logical thinking, reasoning, etc.	
General comment		

Appendix III:

Questionnaire for Learners

Section A- Biographical Data

i. Class: 6 ☐ 7 ☐

ii. Sex: Male ☐ Female ☐

Section B:

Instructions: Please respond to the following statements according to the following scale.

SA – Strongly Agree, A – Agree, UD – Undecided , D – Disagree, SD – Strongly disagree

No.	Statement	SA	A	UD	D	SD
1	Knowing how to use ICT resources is a worthwhile skill.					
2	Learning computers takes a lot of time					
3	ICT is helpful in instruction for I understand easily and remember the content					
4	I can learn many thing when I use computers					
5	It is really fun to work out tasks using ICT					
6	I am able to go ahead of the teacher since I can get information through ICT, specially the internet					
7	Using ICT resources is very frustrating					
8	It is fun to figure out how computers work					
9	I think that working with computer would be enjoyable and stimulating					
10	I concentrate with computer when I am using it.					
11	ICT resources are difficult to use					

12	I access ICT resources at home					
13	ICT at home has helped me in development of skills					
14	I access computer at school					
15	I get technical support when using computer at school					
16	ICT is un necessary and consumes a lot of time which would have been used in learning					
17	I am not sure whether ICT has a positive or negative impact in learning					
18	I can access educational resources when using ICT					
19	I believe using computers is more convenient for me					
20	ICT keeps me in touch with my teachers and peers anytime anywhere					
21	Our teacher are competent in using computers in class					
22	My relationship with peers has become more open and free since I used computers.					

27. In your opinion what are the difficulties you encounter when using ICT in class?

(i) _____

(ii) _____

(iii) _____

_____

28. In your opinion what do you think can be done to make ICT access successful in your school?

(i) _____

_____

Appendix IV:

Questionnaire for Class Teachers

Section A-Biographical Data

i) Class teachers of class: 6 ☐ 7 ☐

ii) Sex: Male ☐ Female ☐

iii) Age: 20-30 ☐ 30 – 40 ☐

41-50 ☐ 51-60 ☐

Beyond 60 ☐

iv) Experience in teaching VI:

1-5years ☐ 6-10 years ☐

1-15years ☐ 16-20years ☐

20years and over ☐

v) Highest academic level:

KCSE/KCE ☐ B. ED ☐

Postgraduate ☐

vi) Highest professional qualification:

P1 Diploma ☐ B. ED ☐

Master's ☐

Section - B

Instructions: Please respond to the following statements according to the liker scale provided below.

SA – Strongly Agree, A – Agree, UD – Undecided, D – Disagree, SD – Strongly Disagree

No.	Statement	SA	A	U D	D	SD
1	Knowing how to use computer is a worthwhile skill					
2	Using computers in teaching is a waste of time					
3	Computers can be a useful instructional aid in almost all subject areas					
4	Computers could enhance remedial instruction					
5	It is not easy for learners with VI to learn computers					
6	I am aware that one should use ICT with learners with VI in teaching and learning					
7	Computers is very frustrating					
8	Working with computers makes me tense and uncomfortable					
9	Computers can relieve teachers of routine work					
10	I believe I am a better teacher with technology					
11	I avoid using computers where I can					
12	Use of computers in education reduces personal contact on Learners					
13	Teaching is more difficult using ICT					
14	Using ICT in the classroom makes collaborative group work more difficult					
15	All teachers should use ICT in the classroom					
16	ICT is an important aspect of inclusive practice					
17	Knowing how to use ICT in teaching learners with VI is crucial since it makes the teachers' work easy to present to present the content and make learner to understand better					
18	Access of ICT at home improves children's capacity to learn					
19	Using ICT can enhance child's cognitive development					
20	Schools can help build a digitally inclusive society					
21	I try to use computer as part of my teaching as often as possible					

22	There is a strong link between digital exclusion and education exclusion					
23	ICT is a tool for learning for all Learners					
24	ICT is a communication Aid between Learners and teachers					
25	ICT is an adaptive technology to most various needs					
26	School administration are committed and support ICT					
27	I have attended IN – Service training on the new technologies					
28	I access computers when I need					
29	I use computers to teach my Learners					
30	I am confident using computers					
31	I have enough time to prepare for computers lessons					
32	There is networking and pedagogical collaboration among teachers on the use of computers					
34	We have technical staff in school to maintain technical infrastructure					
35						
36	I use computers more outside school than in school					
37	We have computer lessons in our school					

38. In your opinion what do you think can be done to increase ICT access to learners in your school

38**.** Indicate how you became aware of the ICT for VI

Means of awareness	**Tick**
Training	
Social media Conference, Seminars & Workshops KICD Circulars	
School policy MOE policies	

Thank you for responding to the questions

Appendix V:

Computer Teachers Interview Guide

1. In your opinion, do you think knowing how to use ICT by learners with VI is a worthwhile skill.
2. In your opinion, what are the challenges in accessing the ICTs?
3. To what extent has the school administration support the learners with VI in accessing ICT?
4. In your opinion, how best can the challenges be addressed?

Thank you

Appendix VI:

Head teachers Interview Guide

1. In your opinion, how useful are the ICT resources as teaching aid?
2. What is the level of accessibility of ICTs to learners?
3. What are the challenges facing ICT access in your school?
4. As the head teacher, what are you doing to support ICT access in your school?
5. As policy implementer in your school, what do you suggest to be done to make ICT access and use a success?

Thank you for accepting to be interviewed.

Appendix VII:
Ministry of Education Officers Interview Guide

1. As policy makers, how often do you supervise the implementation of ICT in primary schools of learners with VI?
2. As policy makers, what do you think are the challenges facing ICT implementation among learners with VI in Kenya?
3. What do you think should be done to make ICT implementation successful in Kenya and especially among learners with VI?
4. What is the role played by the MOE in addressing the issue of access to ICT by learners with VI

Thank you for answering my questions.

Appendix VIII:

Letter of Consent

KENYATTA UNIVERSITY

P.O. BOX 43844-00-00

NAIROBI.

Dear Répondent,

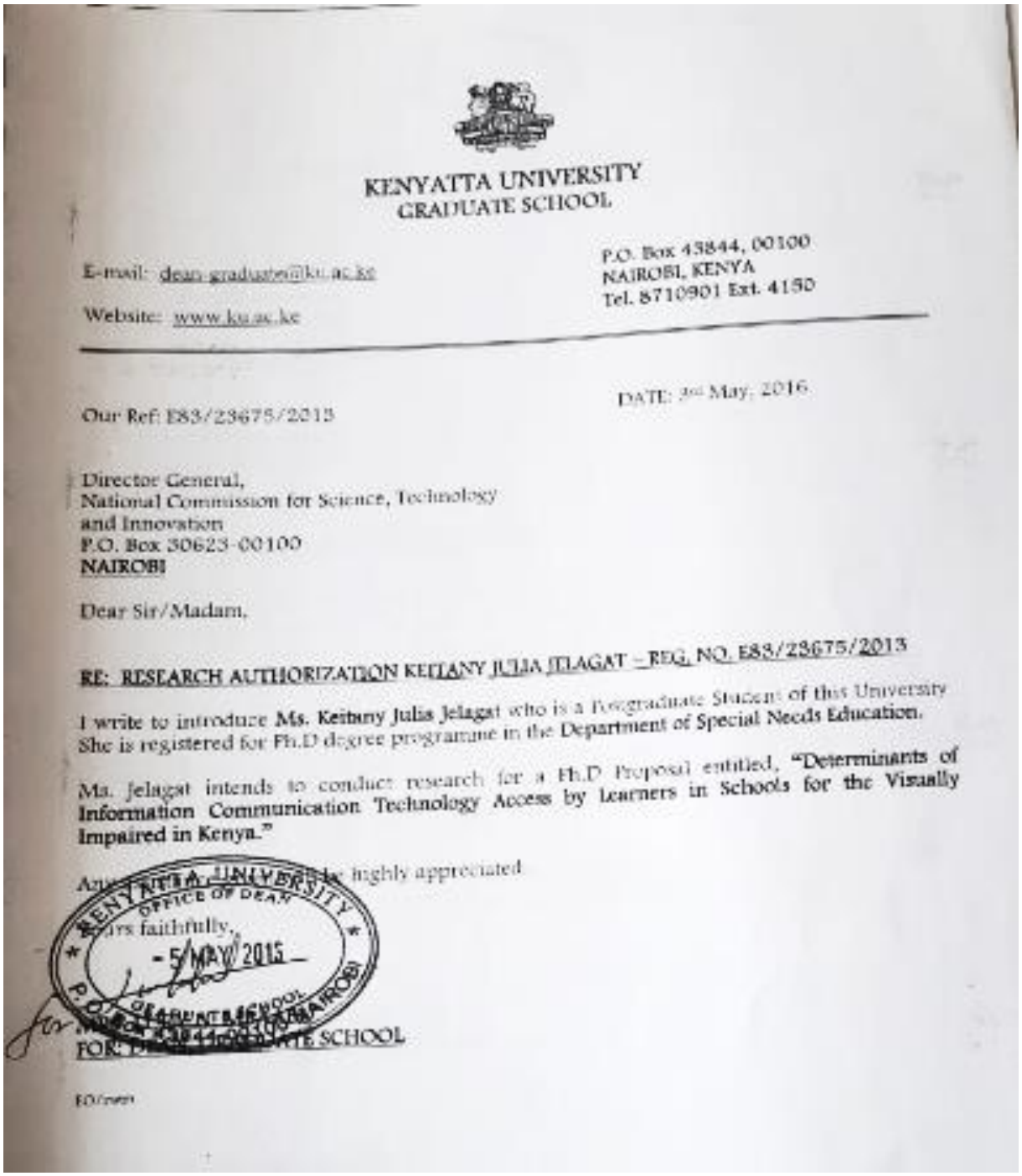
I am a PhD student from Kenyatta University conducting a research study on the ***"Access of ICT and its influence on the education for Learners with visual impairments in selected special primary School in Kenya".*** I kindly request you to participate as a respondent in this study.

Your honest in giving correct information for this study will be highly appreciated. The information you give will be treated with maximum confidentiality and will be used only for the purpose of this research. The information will not be shared unless with your consent.

Thank you for your cooperation.

JULIA JELAGAT KEITANY.

APPENDIX IX: AUTHORIZATION FROM GRADUATE SCHOOL



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean.graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 4150

Our Ref: E83/23675/2013

DATE: 3rd May, 2016

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION KEITANY JULIA JELAGAT – REG. NO. E83/23675/2013

I write to introduce **Ms. Keitany Julia Jelagat** who is a Postgraduate Student of this University. She is registered for Ph.D degree programme in the Department of Special Needs Education.

Ms. Jelagat intends to conduct research for a Ph.D Proposal entitled, **"Determinants of Information Communication Technology Access by Learners in Schools for the Visually Impaired in Kenya."**

Any assistance accorded to her will be highly appreciated.

Yours faithfully,

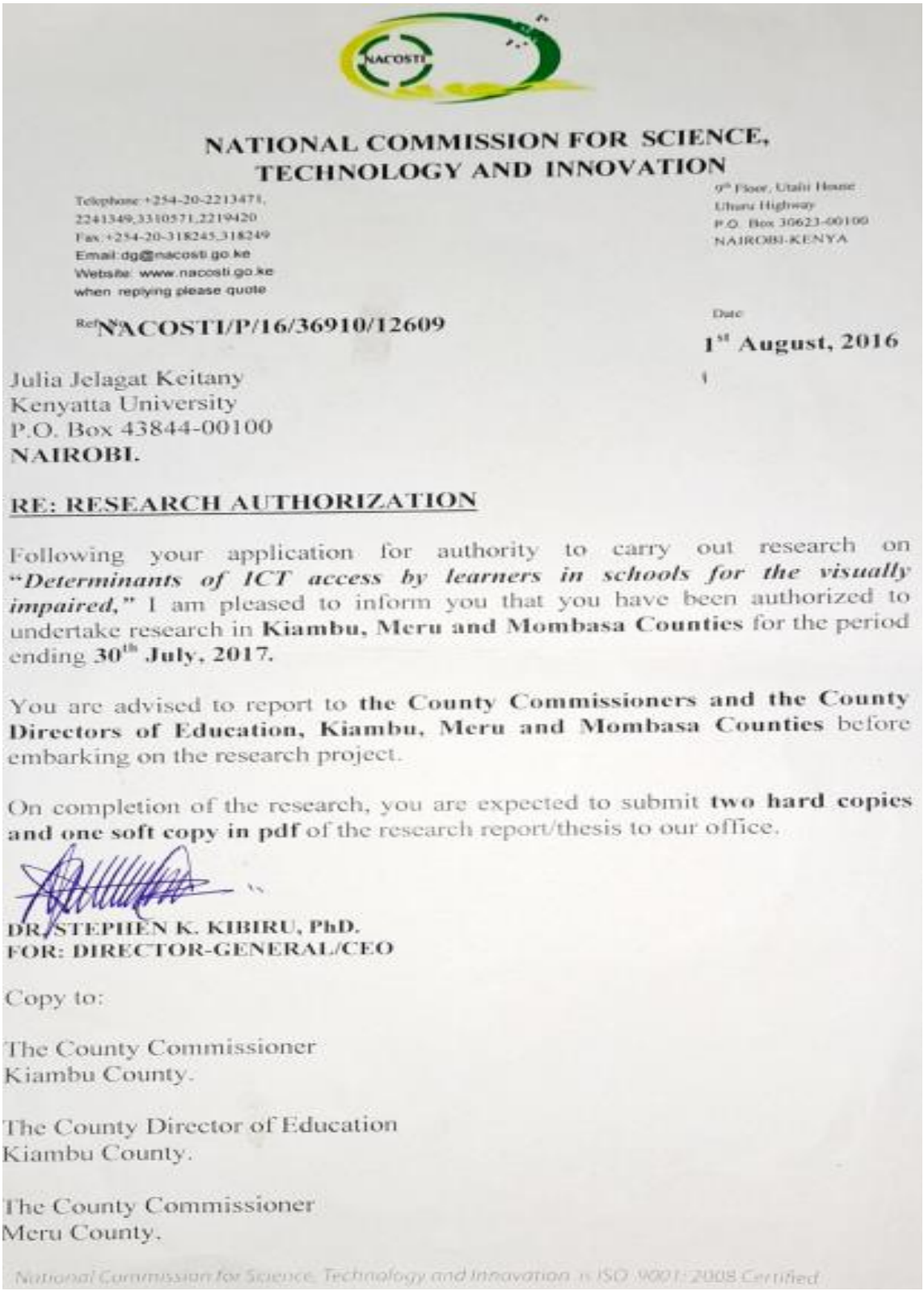
KENYATTA UNIVERSITY OFFICE OF DEAN - 5 MAY 2016 P.O. BOX 43844-00100 NAIROBI

for: DEAN, GRADUATE SCHOOL

FOR: DEAN, GRADUATE SCHOOL

EO/mwn

APPENDIX X: AUTHORIZATION FROM NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref No. **NACOSTI/P/16/36910/12609**

Date
1st August, 2016

Julia Jelagat Keitany
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Determinants of ICT access by learners in schools for the visually impaired,"*** I am pleased to inform you that you have been authorized to undertake research in **Kiambu, Meru and Mombasa Counties** for the period ending **30th July, 2017.**

You are advised to report to **the County Commissioners and the County Directors of Education, Kiambu, Meru and Mombasa Counties** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

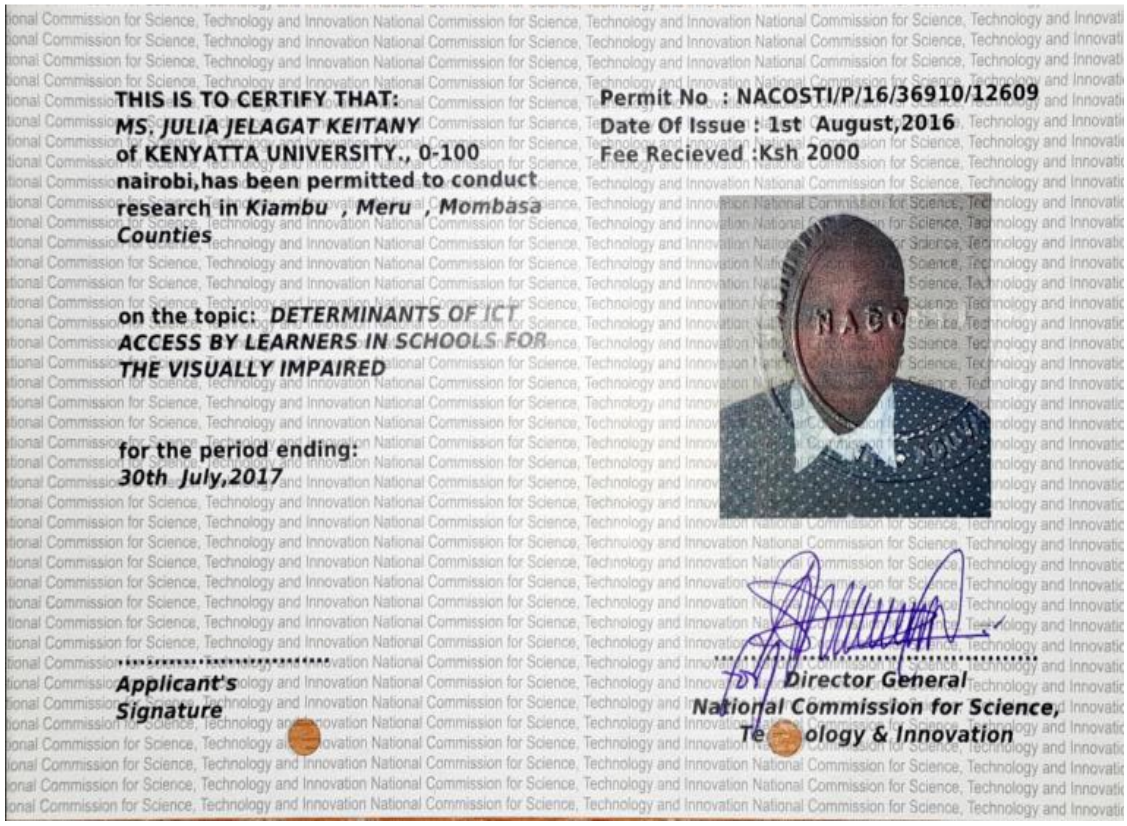
The County Commissioner
Kiambu County.

The County Director of Education
Kiambu County.

The County Commissioner
Meru County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

APPENDIX XI: PERMIT FROM NACOSTI



THIS IS TO CERTIFY THAT:
MS. JULIA JELAGAT KEITANY
of KENYATTA UNIVERSITY., 0-100
nairobi,has been permitted to conduct
research in *Kiambu , Meru , Mombasa*
Counties
on the topic: *DETERMINANTS OF ICT*
ACCESS BY LEARNERS IN SCHOOLS FOR
THE VISUALLY IMPAIRED
for the period ending:
30th July,2017

Permit No : NACOSTI/P/16/36910/12609
Date Of Issue : 1st August,2016
Fee Recieved :Ksh 2000

.....
Applicant's
Signature

.....
Director General
National Commission for Science,
Technology & Innovation