The Integration of ICT to Facilitate Teaching of Learners with Visual Impairment in Special Primary Schools in Kenya

***Odanga Collins Ouma., Dr. Rose Koweru., Dr. Washington Wachianga**

Jaramogi Oginga Odinga University of Science and Technology, Kenya

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ABSTRACT

Learners including those with sight problems, need effective ICT skills and the failure to provide for the same may lead to a gross disadvantage. With current effectuation of ICT integration program in all primary schools since 2016 and the shift to Competency Based Education system in 2017 that recognized ICT as a core competency area in learning, the researcher explored the integration of ICT to facilitate teaching of learners with visual impairment in Kenya. Through a multiple-case study design anchored on Lev Vygotsky theory of social constructivist and scaffolding of learning theory by Jerome Bruner, the researcher triangulated interview and focus group discussion with secondary data. Purposive, saturated and stratified random sampling techniques were applied to arrive at a sample size of 55 out of a target population of 157. Thematic approach was used to analyze the experiences of each school separately. The findings established that special primary schools for LWVI were ill prepared to integrate ICT, The ICT resources were inadequate and inaccessible and schools continued to use analogue braille equipment. The study recommended the government to work closely with development partners in improving ICT infrastructure, train teachers to use adaptive ICT resources and ensure their adequacy and accessibility to LWVI, employ ICT technicians and limit the use of mechanical braille. For future research it is important to investigate how best refreshable braille devices in combination with computer technology and internet may be incorporated in the education of LWVI. Further investigation is needed to determine how best SNE teacher trainees can be trained on the use of assistive technology while in colleges.

Keywords: Integration of ICT, facilitate, teaching, learners with visual impairment, special primary schools

INTRODUCTION

The integration of Information and Communication Technology (ICT) in education has transformed teaching and learning and is projected to improve educational outcomes, quality, and effectiveness (Sudhakar, 2023). As a result, governments have made significant investments in incorporating ICT into education at all levels. This is done to provide learners with the necessary skills for contemporary life and beyond (Apostolou, 2020). Special Needs Education (SNE) aims to offer supplementary assistance, tailored curricula, conducive learning environments, and specialized resources to facilitate the learning and inclusion of persons with disability (PWD) in the educational process (Ojok, 2018). Integration of ICT in teaching /learning has the potential to support the transformation of teaching, learning, and assessment practices in special schools and it can link education policy with economic and social development (Rana & Rana, 2020).

Similarly, it's critical to recognize that students with special needs and disabilities are varied, even within each category, while preparing to include ICT into a lesson. For example, there are two types of visual impairment: low vision and total blindness. Each of these types of impairments is varied and needs different support in the form of content development, learning experience planning, resource selection, and delivery method (Fernández, Rueda & Fernández, 2022). Given the variety of learning styles among students, it is critical to offer curricular knowledge through mediums other than traditional written text, i.e., through other digital delivery methods (Ashraf, 2019). Equally, ICT delivery methods must be carefully selected. In this regard, the modified delivery methods for SNE curriculum must cover multiple modality methods of presentation, which

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can be designed to appeal to kinesthetic and tactile sensory systems, in addition to technology addressing visual or auditory processes alone, (Sudhakar).

Historically, individuals with visual impairments were marginalized and denied equal rights within society. For example, in education, ICT resources were inaccessible in terms of their availability, affordability and adaptability to suit the needs of learners with disability, (Ashraf). Over time, the recognition of this prejudice led to the creation and enforcement of several laws aimed at protecting the rights of learners with disabilities (Ashraf). Article 9 of the UN convention states that having access to ICT resources facilitates not just employment, education, and independence but also acts as a crucial instrument for regulating social boundaries in society. (UNCPWD, 2006) cited by Kisanga & Kisanga, (2020). Even so, educational inequalities have widened while learners with disability have suffered greater social and digital imbalances, (Moberg, Muta, Korenaga, Kuorelahti, & Savolainen, 2020).

One major concern of the educational system today is the proper and suitable integration of ICT in instruction for learners with visual impairment (LWVI), (Fernández, et al). People who are visually impaired (VI) may find themselves at a social disadvantage due to their visual limitations, which prevent them from carrying out their expected contextual roles in conformity to their age, sex, social and cultural factors. The limitation of activity and restriction of participation can extend to all areas of life for those with visual impairment (VI), including learning, communication, mobility and interpersonal relationships, (Montenegro-Rueda, Fernández-Batanero & Fernández- Cerero, 2022). However, there are potential ways to overcome some of the problems resulting from visual limitations. One such way is using ICT as a pedagogical tool to support LWVI, (Ofori Atta, Teye & Awini, 2023).

ICT usually improves the efficiency and effectiveness of a common individual learner, but for a learner with disability, it represents more than this. ICT for them is a sort of extension of their physical body organ and provides an opportunity to communicate, gain access to education services and become gainfully employed, (Mishra, 2019). In this context, moreover, concerning the purpose of this study, it was necessary to rethink of the effect of ICT integration programme also referred to as Digital Learning Programme (DLP) in education for all learners at primary schools that was initiated in Kenya in the year 2014 by Jubilee Government. In fact, this article precisely focused on exploring the integration of ICT to facilitate teaching of learners with visual impairment in special primary schools in Kenya

It is a complicated task to integrate ICT into the teaching, learning, and evaluation of LWVI, and just having technology in the classroom does not guarantee that it will be used effectively (Keitany, Muthee & Ondigi, 2023). Similarly, there is mounting evidence that digital technology is transforming where and when learning occurs, as well as how teachers teach and how learners learn (Rana & Rana, 2020). Using ICT in education means embracing a constructivist view of learning and a student-centered approach, where students utilize the technology to control their learning rather than the instructor using it as in the more traditional (content-centered) approach. Learning techniques that make use of modern ICT offer a wealth of options for constructivist learning because they facilitate resource-based, student-centered settings and allow learning to be connected to practice and context (Koehler, 2019).

According to Idowu, Bokoh, and Bello (2023), assistive devices utilized in special education change over time. Technological innovation is being realized. Day by day, new technological features are being launched. They involve the use of computer options, PDAs, refreshable braille display, e-book readers, touch tablets and the computer word, talking books, the talking processing programmes, screen reading software, dictionaries and embossers among others, (Rana & Rana). Despite all the progress in the development in the area of assistive technologies (ATs), the advancement in integration of ICT at different levels including teaching and learning, for supporting LWVI still suffers from limitations, like inadequate specialized disability friendly teacher training, limited flexibility in training options, insufficient specialized disability friendly hardware and software, inefficient formal involvement of the government organizations and support structure for ICT for people with disability, negative attitude towards people with disability, lack of appropriate disability friendly policies and their implementation and limitation of finances, (Mishra). Therefore, there was need to explore how ICT is Integrated to learners with visual impairment at special primary schools in Kenya.

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The Kenyan government through the Kenya Institute of Curriculum Development (KICD), Teachers Service Commission (TSC) and the Ministry of Education have made considerable investments in guiding ICT based instructions to support learners at primary schools, (Morogo, 2022). The decision to supply tablets to all first-graders in Kenya's public Primary Schools stemmed from the appreciation of and realization of the significance of ICT in education in accomplishing the country's development roadmap, "Vision 2030" (Amutabi, 2021). By July 2018, 19,000 of the 23,951 public primary schools were reported to be having technological devices, but only 70,000 of the more than 300,000 teachers had received training (Murithi & Yoo, 2021). This was months before the Competency Based Education (CBE) was implemented. In contrast to the previous system, which only included ICT integration as an elective in secondary schools, the CBE under the 2-6-3-3 educational system, which was announced in 2017, placed an emphasis on integrating ICT into every subject. With the current implementation of ICT integration program, which recognizes ICT as a core competency area in learning, a complete assessment of how integration of ICT to visually impaired students in special primary schools needed to be investigated.

Finally, the survey research conducted by Teachers Service Commission of Kenya determined that the biggest professional skills gap influencing teacher's ability to provide services is technology integration (Muinde& Mbataru, 2019).

With the current implementation of ICT integration program, which recognizes ICT as a core competency area in CBE and ratification of disability related treaties together with enactment of Kenya disability legislations including 2025 disability act, a comprehensive assessment of the the integration of ICT to facilitate teaching of learners with visual impairment in special primary schools therefore became necessary to be investigated.

The key purpose of the article: To Explored how ICT was integrated to facilitate teaching of learners with visual impairment in special primary schools in Kenya.

Theoretical Framework of the Study

The researcher explored the theory of a Russian psychologist, Lev Vygotsky on social constructivist theory that emerged in 1978 and was supported by scaffolding of learning theory of Jerome Bruner of 1976. According to Vygotsky, The Zone of Proximal Development (**ZPD**) is the "distance between the actual development level, as determined by independent problem solving and the level of potential development, as determined through problem solving under adult guidance or more capable peers" (Kirschner, Swellerand Clark, 2006). The theory of Jerome Bruner on scaffolding of learning that emerged in 1976 is also relevant in the advancing of social constructivist theory developed by Lev Vygotsky. Likewise, Bruner believed that when children start to learn new concepts, they are dependent on teachers and other adults in the form of active support, but as they become more independent in their thinking and acquire new skills and knowledge, the support can be gradually faded.

Proponents of Social Constructivism including Jean Piaget (1896–1980) Paul Watzlawick (1921–2007) Ernst von Glasersfeld (1917–2010) among others, hold that social constructivism depicts each learner as a unique individual with unique needs and backgrounds. From the social constructivist viewpoint, it was thus important to acknowledge unique needs and sundry of learners with visual impairment and identify ICT devices and applications that suit their needs. However, Critics of social constructivism like Merill (1997) argues that this theory is often destructive for introverts, as they don't relish the social pressure. Similarly, for extroverts, who perhaps relish the social contact too much, social learning can disrupt progress for not only for themselves but others too.

To bring social constructivist theory to the context of the current research, this theory was closely related to the purpose and objectives of the investigation at hand. The Vygotsky tenets that we learn best in a social environment, where we construct meaning through interaction with others is seamlessly associated with the objectives of the study in hand. For a meaningful learning to be realized in this case, there should be a well-choreographed triangular interaction that involved the teacher, the ICT devices and the learner. In this scenario, the "social environment" include the teacher who is assumed to have been trained and having more knowledge in technology, the ICT resources that are used for training and the learner to be coached for the

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same purpose. If any disconnect appear and interfere with the "social environment" for learning as iconized by Lev Vygotsky, it will lead to challenges in integration of ICT.

LITERATURE REVIEW

This section focused on the literature review on related empirical research carried out to explore materials connected to the present article. The purpose was to identify findings generated by different authorities from various parts of the world that would enable the study to gain insights necessary for the effective solutions to the research problem at hand, (Efron & Ravid, 2019). Globally, several studies in America have established that students with visual impairment can participate effectively in inquiry based methods of exploration in a similar manner as their sighted peers, but require accommodations and access to modified ICT equipment (Koehler, 2019). For example, a student who is blind may need access to modified lab equipment such as a talking thermometer, braille metric ruler or a braille periodic table in order to be a full participant in a scientific investigation, (Koehler).

Fernández, Rueda, and Fernández conducted a study to determine the amount of training and technical expertise of primary school teachers in Spain about the use of ICTs to serve students with special needs. The findings influenced teachers' understanding of ICT and disability, as well as the hurdles to their training. Among the conclusions, instructors' poor training in ICTs for learners with special needs stood out, as did the lack of training experiences in this subject. Ashraf, Hasan, Lewis, Hasan, and Ray (2017) conducted a study to investigate the utilization of assistive technology (AT) by teachers who work with visually impaired (VI) learners in Singapore. The teachers were quizzed on their acquisition of expertise in AT, the sources from which they obtained this knowledge, their utilization of AT in their teaching practices, and the obstacles or achievements they encountered. It was widely acknowledged that AT plays a crucial role in helping students with VI access information and enhance their quality of life. Simultaneously, there were clear evidence of substantial disparities and lack of coherence in AT knowledge and proficiency among teachers.

Subedi (2021) conducted a study in Nepal that examined the efficacy of accessibility conditions and challenges faced by VI learners in using ICT software. The results suggested that adherence to web content accessibility criteria set by World Wide Web Consultium (W3C) is crucial for improving the accessibility of VI users in modern technology. In another study conducted in Iran by Allahi, Bakhtiarvand, and Dehzireh, (2019) on the effect of instruction through mobile phone-based virtual networks on the learning rate of students with Visual Impairment revealed that the instruction through the virtual networks has a positive impact to the increase of learning rate in students with VI. However its success highly depended on the ICT integration level to LWVI. The research conducted by Rony (2017) in Bangladesh examined the ways in which ICT facilitates the integration of visually impaired students into mainstream classrooms. The results indicated that VI students utilized ICT to facilitate their educational journey, enabling their integration into mainstream schools when their instructors offered appropriate ICT resources to supplement their teaching methods. The teacher's experiences demonstrated the necessity for comprehensive training in utilizing ICT in their pedagogical approach.

In Zambia, with sudden outbreak of a deadly disease called Covid-19, Mwanza, Simalalo & Simui, (2021) explored the accessibility of virtual learning platforms for person with VI in the home environment. The study found that integration of virtual learning in a home environment depended on internet connectivity and having rightful gadgets which were user-friendly to individuals with visual impairment. Additionally, the challenges they encountered were a scarcity of computers and phones equipped with internet access, inadequate internet connectivity, and an unsuitable home environment for learning. In Nigeria, Onejeme (2017) did a study to investigate the accessibility and usage of assistive technology (AT) for special education in Ibadan Metropolis. It was revealed that a very limited number of AT devices were available for SNE due to reasons ranging from high-cost of AT gadgets and scarcity due to difficulty in the importation of devices from other countries. Teachers training in Rwanda is guided by The Rwandan ICT policy (2016) which is keen on providing effective ICT literacy training programmes for all teachers at all levels that promotes change and ensures quality in ICT Integration. Again, in Tanzania, Eligi & Mwantimwa carried out a study where the main purpose was to evaluate the accessibility and usage of ICT facilities to facilitate learning among students with VI at the University of Dar es. Salaam (UDSM). The findings showed that ICT integration support innovative

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

learning, encourage independent learning, and promote participatory and collaborative learning, (Eligi & Mwantimwa).

Keitany, Muthee & Ondigi, (2023) investigated school administration factors that influence access to and use of ICT in special schools for learners with visual impairments in Kenya. The findings revealed that head teachers are willing to support the learners with visual impairment to access and use ICT in the schools. However, there are hindering factors such as unstable internet connection, low teachers' capacity to use ICT, inadequate time allocated to ICT learning, insufficient knowledge on how to get adapted ICTs for learners with visual impairment and no mechanism or model for accessibility of the ICT and other assistive resources for learners with visual impairments in the schools. Morogo, (2022) assessed the available opportunities on the integration of ICT program into inclusive classroom. The findings indicated that ICT tools and devices play fundamental role in providing platforms which can address diversity of learners in an equitable manner. The study concluded that learners miss ICT opportunities because; KICD didn't effectively provide digitized content, the government had failed to provide facilities, no follow up and the teachers were not competent to use adapted ICT content. Subsequently, another study carried out in one of the primary schools for the visually impaired in Siaya County by Onyancha (2020) examined the potential of Arts to enhance the learning of Mathematics for visually impaired students in Kenya. It was determined that the ATs used for teaching and studying Mathematics in the school were insufficient. The research uncovered that the learners encountered difficulties in effectively utilizing ATs designed to enhance the acquisition of Mathematics, such as the abacus. Again, the mathematics class that lasted for thirty-five minutes was insufficient to effectively instruct these students.

RESEARCH METHODOLOGY

The researcher deployed Multiple Case Study Research design and the Area of the study covered included Siaya, Kisumu, Bomet and Trans Nzoia counties special primary schools for LWVI all situated in the Lake Region of Kenya. Study target population was 157 and sample size was 55 participants. Sampling techniques applied were Stratified Random Sampling for teachers and learners, Saturated Sampling for Head of Institutions (HOIs) and Purposive Sampling for ICT Personnels as indicated in table 1. Data collection instrumentation included interview, focus group discussion and document analysis guides. Data was analyzed thematically with strict observance of research ethics.

Table 1. Sampling Techniques and Sample Size

Target Population	Sample Technique	Sample Frame	Sample Size
Grade 6 learners	Stratified random sampling	70	24
Teachers	Stratified random sampling	76	24
Head teachers	Saturated	4	4
ICT technician	Purposive	7	3
Sample Size	-	157	55

Ethical Considerations

The researcher keenly observe the following ethical principles. Voluntary participation of respondents in the research was followed. Moreover, participants had rights to withdraw from the study at any stage if they wish to do so. Again, Respondents participated on the basis of informed consent. The principle of informed consent involves researchers providing sufficient information and assurances about taking part to allow individuals to understand the implications of participation and to reach a fully informed, considered and freely given decision about whether or not to do so, without the exercise of any pressure or coercion. Further, the use of offensive, discriminatory, or other unacceptable language was avoided in the formulation of Questionnaire/Interview/Focus group questions. Moreover, Privacy and anonymity or respondents is of a paramount importance and was maintained. Similarly, Acknowledgement of works of other authors used in any part of the dissertation with the use of APA referencing system according to the Dissertation Handbook of Jaramogi Oginga Odinga University of Science and Technology was adhered to. Subsequently, Maintenance

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

of the highest level of objectivity in discussions and analyses throughout the research was of paramount importance.

FINDINGS OF THE STUDY

This section is a presentation and discussion of the findings of the study which was guided by a research question: How did teachers integrate ICT to facilitate the teaching of learners with visual impairment in special primary schools in Kenya? It consists of three subsections. The first subsection involves background information of the respondents, the second, the return rate of the instruments used, while the third subsection includes the results and discussions of the study.

Demographic and Background Information of the four Schools for LWVI

The main purpose of this section was to paint the general picture of the four special schools for LWVI (4 cases) in terms of their similarities and differences. Most remarkably, all the four cases shared a lot of convergent demographic characteristics. To start with, all the cases were special primary schools for learners with visual impairment found in the Lake Region of Kenya. Again, all the cases were public and comprehensive schools and benefited from ICT integration program initiated in 2014 by the government of Kenya. Further, all schools were founded by religious organizations. Moreover, although the learners were visually impaired, they range from blindness to low vision, some had albinism and others with multiple disabilities. Further, a few teachers were totally blind, a few had low vision and most of the teachers had normal vision.

Case 1 and 2 shared a lot of similarities. For example, the two schools were the oldest having been established towards the end of colonial time that is 1961 and 1963 respectively. Again, both of them share commonality because their first head of institutions were whites depicting transitional era from colonial time to independent Kenya. Both institutions enjoyed the leadership from both British and Kenyan head teachers. Case 3 and 4 had also remarkable similarities. These two cases were relatively new school having been founded in 2016 and 2014 respectively. They were also similar in the sense that unlike the first and second case, all their head of institutions were Kenyan depicting that both of them were established in the (modern Kenya) era.

Even though case 1 and 2 had a lot of similarities, both of them exhibited some notable differences. Case 1 was established in a rural area while case 2 was situated in an urban set up. Again, although these schools were established by religious organization, the fact is that case 1 was under the patronage of Roman Catholic while case two was under Salvation Army church, with varied doctrines that guided their respective schools. Most remarkably, all head teachers for case 1 were roman catholic Sisters, meaning that case 1 is and was headed by female leadership since its inception to date. Contrary, in case 2, there have been a mixture of both male and female in the leadership role. Further, despite the fact that all the four cases were found in Lake Region, each school was situated in various counties. Moreover, case 1, 2 and four have permanent building structures that were constructed under the patronage of their respective churches while case three have both permanent and semi-permanent structures. Having analyzed the demographic information of four cases, the next section will analyze the return rate of the instruments used in this article.

Return rate of the instruments

The study targeted 4 interviews for Head of Institutions which were effectively conducted, making a response rate 100%. Again, 4 interviews were anticipated for ICT personnel's/technicians. Out of 4, 3 were effectively carried out as one of the school didn't have an ICT personnel by the time of data collection. This amounted to 75% response rate. Further, the study targeted 8 FGD sessions that is 4 for teachers and 4 for learners across 4 schools which were effectively conducted, making a response rate 100%. Finally, another instruments used in this study was document analysis. According to the document analysis guide, six documents were to be analyzed in the four schools under study. CBE curriculum design and textbooks were available and promoted ICT integration in all the schools, two schools lacked Timetable entrenched with ICT training session, one school possessed ICT Integration Training Manual designed by Inable while all the schools lacked both national and school ICT policies. However, in relations to other relevant ICT documents that emerged, Orbit

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Reader 20 Manual was present in all the schools under study. Analysis of these documents were necessary because they would demonstrate whether they promoted effective integration of ICT in the schools. According to Morton, Bandara, Robinson and Carr(2012), a return rate of approximately 50% is suitable for analysis, 60% is considered good, 70 – 85% very good while above 85% is excellent. Based on this scale, the response rate for this study was excellent. Having analyzed the demographic information of four cases, the next section will analyze the findings related to research questions.

RESULTS AND DISCUSSIONS OF THE STUDY

This section is a presentation and discussion of the findings of the study which was guided by eight themes that emerged and served as tentative answers to the research question. they included: how ICT is integrated in lessons, how ICT affect learning outcome, experience learned with the use of ICT integration, role of ICT technician in promoting integration of ICT, attitude to ICT integration, braille as a Primary language, other organizations that have supported integration of ICT and usability of orbit reader 20. These sub-sections were analyzed and presented as below.

How ICT is Integrated in Lessons

The main purpose of this section was to examine how ICT is integrated in lessons in special primary schools for LWVI in the Lake Region of Kenya. From the social constructivist viewpoint theory of Vygotsky, it is important to acknowledge unique needs of learners and identify ICT devices and applications that suit their needs. The findings across all the four schools show that there was an attempt by teachers to integrate ICT in lessons. However, the integration was still minimal and basic. This could be due to the fact that ICT is one of the core areas in CBE design, ICT devices are scarce and teachers didn't attain enough training. When participants were asked how ICT is integrated in their lessons, one of the head of institutions (HOIs) describe how to use some ICT devices by stating:

From where I seat I expect teacher to follow curriculum design and visit the lab to integrate ICT in the lessons. In class the teacher uses the phone, the laptops and also they can produce materials to take them to class to teach. We also have the YouTube programs that are utilized in schools, this is also useful for our learners because they use their learning very well, (H3).

During the focus group discussion with teachers, one of the teachers described how he uses ICT in a music lesson. The teacher said this:

An example of how I integrate ICT in class, when teaching music, I can download a patriotic song and go and play to learners. I use a phone to download it from YouTube then I come and connect it and play for children and children will pick it from there, (T2).

Another teacher hinted how she integrated ICT in agriculture lesson.

We integrate ICT in agric, for example on the topic of soil erosion, the CBC curriculum will provide a link so the learners can go to the lab and they use laptop or computer to get to the link and a video will be played and they learn further in soil erosion. In this case some will do it successfully and some will have challenges, (T4).

Similarly, another teacher reported how ICT is infused in a Christian Religious Education lesson.

In CRE especially I have wordings of the story I can send learners to the lab to go and download and listen to it. This morning I was teaching CRE grade 3 and it was about Moses and burning bush story, I played to them today so those who could see saw the burning bush and those who couldn't, heard the God speaking to Moses. So the teaching became so real. I used the chrome book to download and teach the lesson on the call of Moses, (T1).

Subsequently, another English teacher stated this:

In English for example the meaning of words, you can allow learners to go and search their meanings in lab using ICT devices like laptops and desktops and during the lesson they can report their findings, (T5).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Again, another Kiswahili teacher added this:

I also teach Kiswahili for example kusikiliza na kuzungumuza, I record two learners talking and listen to each other and when I play it comes more real and interesting. I use voice recorder to do this, (T6).

Likewise, in revision of an already taught topic, another teacher informed the investigator as follows:

I can also use ICT devices to enforce the lesson I had already taught; I can download the lesson in ICT device then they can listen. If there is an area I have already taught in class I can download the area and then they can listen and become interesting for them, (T3).

One of the teachers acknowledged the importance of devices with sound to a visually impaired learners and reported this:

ICT integration is more effective with the use of digital sound for example when you are teaching a folk song to learners who are visually impaired, you can download a folk song and let the learners listen, (T7).

One of the teachers explained that there were some subjects that necessitated the use of technology at all cost like science and technology. The teacher stated this:

Personally we do integrate ICT because there are some other subjects that needs you to use the gadgets for example subjects like science and technology, there are some areas that needs you to use ICT and you cannot avoid it, (T14).

Similarly, another teacher added how ICT could be applied to extend an already taught lesson.

In English we can use ICT to teach pronunciation of sounds. And also there is other links provided so that we can use them to teach. Those links we use as extended lessons so that we can go to those links at free time and use them to reinforce our teachings, (T13).

Going by the above statements, the teachers demonstrated how they integrate ICT in subjects like Kiswahili, English, Agriculture, Music, Science and Technology and religious education. The teachers also stated how ICT could be integrated in Guidance and Counselling, revision and enforcing a lesson and for examination purpose. Again, teachers also acknowledged the importance of ICT resources on entertainment. Whereas technology cannot replace a teacher in the instructional process, it forms an essential and additional resource for both the teacher and the learner, towards a more practical and learner-centered approach, (Onejeme, 2017).

During focus group discussion with learners, when the investigator probed how ICT is used in their lessons, one of the learners responded:

The teacher downloaded what is leisure time and after downloading he gave learners who are low vision to read to the visually impaired who could not be able to see what leisure time is, (L3).

In addition, another learner assigned the aspect of motivation to integration of ICT and relayed this:

When teacher have downloaded some video in class and display for us, we are motivated to learn and nobody sleeps, (L6).

Yet another learner associated the aspect of time limit to integration of ICT and reported that:

One day the teacher told us to go and search the president of South Sudan, we didn't manage to search it well because the lesson was only 35 minutes and before we finished the teacher told us to go to the next lesson, (L4).

Amutabi (2021) established that with the integration of technology, teachers frequently left out students who were thought to be slow learners Due to the short length of a lesson. Some of the teachers who were interviewed stated that they were unable to assist students who were having academic difficulties.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Moreover, one of the learners confirmed a teacher having come with a smart phone to teach them physical education. The learner said:

This was a lesson in P.E. this was a lesson on how to play volleyball so those with low vision could see how people are playing volleyball and the visually impaired could hear the sound how it is being played, (L12).

It is important to note that application of ICT in a lesson does not necessarily ensure meaningful learning outcomes (Hatlevik, 2017; Uluyol & Şahin, 2016). Therefore listening to the volleyball being played by learners who had severe or total blindness indicates a difference or inconsistency between the technical capabilities of ICT and the understanding of effective pedagogical methods. Another learner mentioned some of the subjects where ICT was integrated.

Teachers sometimes teach us with ICT devices in subjects like science and technology and social studies and Kiswahili, (L14).

Relatedly, Keitany, Muthee & Ondigi, (2023) confirms that it is a complicated task to integrate ICT into the teaching, learning, and evaluation of learners with disabilities, and just having technology in the classroom does not guarantee that it will be used effectively. In view of the undermentioned, it would be paramount for teacher training institutions to acquaint themselves with the use of modern ICT devices for LWVI and subsequently train teacher's trainees on how to effectively integrate ICT in their lessons. This is due to the findings which pointed out that although teachers attempted to integrate ICT in their lessons, it was too minimal and simplistic.

Effects of ICT Integration on Learning Outcome of LWVI

From the statements across the four schools, the effect of ICT on learning outcome was defined as making learning motivating, interesting, enjoyable, and understandable among others. To some extent, it had also improved performance to some subjects like Kiswahili. Again in school **A** it has been reported to have improve the mean grade of learners that were introduced to ICT from grade one. Another schools have accepted that ICT have improved performance but they have said that it may not be attributed to ICT alone. Related to this sub-theme, one of the ICT technician mentioned an improved mean grade and attributed it to enhancement of ICT integration activities in the school. The informer explained:

I think there are some effects in academic performance because last year but one they really performed well, this cohort was the first to be trained using ICT. With availability of ICT resources this cohort of learners really benefited and used these particular devices to study. The cohort started training with ICT in grade 1 and got a mean score of 266, one of the best in ten years, (IT1).

Majority of teachers agreed that ICT can improve academic performance. One of the teachers explained:

Yes, I believe that if ICT is well implemented it can improve performance, for example there are so many books that have not been published in brail, and so if they can access them on ICT gadget and access internet to research, they can do well and that one can further their education, (T22).

Another teacher mentioned Kiswahili and explained how technology improved its mean grade. .

In Kiswahili you can download some lesson with a good teacher "msamiati" and you bring to learners to listen to it and they get motivated. And I believed that it has improved on performance to mean grade and slightly above 50% like 51% which is the previous results. The other result is slightly below that. This can attribute to other factors and ICT is one of them, (T4).

Again, one of the teachers' shedded doubt whether integration of ICT could improve academic performance and stated:

We are not sure whether ICT integration has improved performance, (T7).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Most of the learners agreed that the use of ICT especially chrome book has contributed to better understanding and motivation in the classroom. One of the learners relayed this:

Chrome book if you write your notes in it you will revise and it will help you to pass exams, (L1, L4, L2).

Other learners also appreciated the role of ICT on academic performance. For example, one of the learners said this:

We normally understand more when we are taught with ICT devices, (L14).

On the other hand, some learners denied utilizing ICT gargets. One of them said:

We mostly use slate and stylus, (L10).

One of the HOIs negated the contribution of ICT to improved learning outcome. The respondent reported this:

At the moment we cannot attribute performance with ICT integration, we don't have any evidence towards that, (H2).

Relatedly, a study conducted by Allahi, Bakhtiarvand, and Dehzireh, (2019) revealed that the instruction through the virtual networks has a positive impact to the increase of learning rate in students with visual impairment. However, its success highly depended on the ICT integration level to LWVI. Contrary to this, The study by Morogo , (2022) concluded that learners miss ICT opportunities because; KICD didn't effectively provide digitized content, the government had failed to provide facilities, no follow up and the teachers were not competent to use adapted ICT content. Contrary to the study by Morogo the current study established that education stakeholders provided inadequate ICT devices but they were not accessible to LWVI, the training of teachers was minimal and basic and the goal of DLP had not been properly attained.

Role of ICT Technician in Promoting Integration of ICT

The narratives across Case 1 2 and 3 have revealed some specific roles of ICT technicians like repairing and maintenance of devices, training of teachers and learners, safe keeping of devices among others. On the same note, some of the technicians admit that they were not trained of their roles but just gained these skills by experience. Others were teachers in charge of ICT and therefore were not experts to repair and maintain devices. Case 4 school did not have either ICT technician or a teacher in charge of ICT. In relation to this sub-theme, one of the ICT technician described his role as far as ICT integration is concerned as follows.

My role range from providing technical assistance that is making sure that gadgets are okay, helping teachers and learners in the skills, for instance making sure they can use gadgets with ease and be able to use them independently. In this school we have those lessons allocated specifically for computer. The training of teachers and learners is located in the time table. At end of each term learners do computer studies exams but teachers don't, (IT1).

Another teacher in charge of ICT reported his role as follows:

My role is being the custodian of the devices, distributing the devices, and whenever teachers need ICT support I chip in to assist them. I don't train teachers in use of ICT but is based on one on one support, whenever teacher needs assistance in specific area I do help them, (IT3).

During the interview, the ICT/resource room personnel explained this:

One of my role is to repair brail machine and orbit reader. I have been trained on how to *repair the machines by Kilimanjaro. I use the laptop to type exams then I connect laptop to embossing machine and print the exam in brail version, (IT2).*

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

The HOIs also shaded light on the roles of ICT personnels in their institutions. One of them said:

I encourage all teachers to be trained on ICT in our labs. All teachers paid Ksh 500 for training however you cannot know how much an individual has gained. The instructors are always there to train teachers on ICT skills, (H1).

Another head of the school admitted not having ICT personnel and stated this:

We have not been privileged to get any ICT technician. We are a new school and we believe we may acquire one in future, (H4).

One of the learners clarified this:

When we have a lesson in ICT we normally go to the lab to be taught by ICT technician especially the computer lessons, (L1).

Similarly, Ofori, Atta, Teye, & Awini, (2023) recommended that students with visual impairments should be given access to computers and training by competent ICT professionals who understand the technological needs of students with visual impairments. Likewise, Mishra warns that the presence of ICT resources without on-site technical assistance may result in financial and time losses caused by technical failures. Therefore, to achieve successful integration of ICT, schools require professionals who possess broad skills in the installation, operation, and maintenance of both hardware and software, as well as expertise in network security and network administration.

Orbit Reader 20 as a Refreshable Braille Device IN PROMOTING ICT Integration in Kenya

From the findings across all the four schools it was clear that orbit reader 20 as a refreshable braille device has been promoted by Kilimanjaro Blind Trust of Africa (KBTA) and is developing momentum among special schools for LWVI in Kenya. Similarly, the participants revealed that Orbit reader 20 has a lot of function abilities including writing, storage, and translation of braille in to print among others. One of the ICT technician described the function ability of the Orbit Reader as follows:

Orbit reader 20 is a refreshable brail device capable of writing both brail 1 and 2. It is capable of storing files. Text books and written materials can be stored in it to help the learner review whenever they want. It can also be used to administer exams or assessments. It is possible for teacher to send assessment and learners to do assignment and send it back to teachers. Orbit readers can also chat through a software called orbit chat. It is a device that can be connected to a desktop, laptop and therefore you can talk to each other. Orbit reader is a very useful gadget and therefore for anybody who can intercept it with laptop or phone can be able to benefit a lot. Orbit reader has also capability of translating brail to be converted to print and vice versa through translation software. The learners and teachers have started using orbit reader on part time basis, this means that they are still in the level of learning how to use it but not full usage in class or lessons, (IT1).

The Head of institution informed the investigator that both teachers and learners had already underwent Orbit Reader training. The informer narrated:

Teachers were trained on orbit reader for around one week. Learners from grade 3 to 8 have also been trained to use orbit reader. We have the chairman of orbit reader in the school, (H4).

The teachers also highlighted importance of Orbit Reader 20 on learners with visual impairment during focus group discussion with them. For example, one of them described its function ability and elaborated:

The aspect of orbit reader brought in a new zeal that is, the dots could pop up, you could be able to save your work, and you can be able to navigate your work through your files. This aspect gives the learners a new zeal how to handle ICT gadget, (T11).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Yet another teacher highlighted the need of developing an ICT policy in guiding the use of orbit reader. The teacher narrated this:

When orbit was brought to the school it was first targeting the lower grades. This gadget should be age appropriate and therefore calling for the need of school ICT policy, (T6).

During focus group discussion with learners on the usage of Orbit Reader, one of them explained the preconditions observed before handling Orbit Reader. The learner said:

Before we use orbit reader we wash our hands, then we leave our hands to dry then you put the wrap around your neck, (L16).

Other learners described the shape and function ability of orbit reader.

Yes, I know Orbit reader. It is small like a radio and light.

Yet another learner artistically described the device as follows:

The dots come out and in and it makes a beautiful sound, (L9).

Furthermore, another learner stated a challenge of orbit reader. The informer stated:

The disadvantage of orbit reader is that it must be charged for it to work, (L1).

In this regard, Mishra, (2015) holds that advancement in braille systems has reached its milestone through development of refreshable braille like Note takers, Braille Note Apex and Orbit Reader. Similarly, Rana & Rana (2020) reported that some of the ATs involve the use of computer options, Personal Digital Assistant, refreshable braille displays among others. It is important to note that there are different types of Orbit Readers including Orbit Reader Plus, Orbit Reader 40 and Orbit Reader 20 being the simplest and less costly among them.

Braille as a Primary Language for LWVI

It was also recognized that the primary language of a blind learner is brail. Therefore, there should be a gadget that the blind learner can learn brail within and outside class. Likewise, the study established that all the four special schools under study over relied on slate and stylus to write braille, a situation that really disadvantaged learning in this digitally oriented generation. The informer elaborated:

The primary language of a blind learner is brail. Therefore, there should be a gadget that the blind learner can learn brail within and outside class. At the same time with advancement of technology it seems mechanical brail is being faded out, even Kilimanjaro that used to promote brail have now ventured in technology and they have stopped dealing with parkins. This means people are now running from brail and getting into technology. In this case I don't understand why government should procure embossers. In addition, assuming that school have orbit readers and chrome books they can be able to learn effectively because one can integrate easily to the other. We need to change on how we think on technology and blind learners, because if we talk about knowledge of the brail the orbit will provide. The brail is not necessarily to be a hard copy; it can be provided in soft copy through refreshable brail devices. And because learning is going digital, there is possibility of doing away with hard copies even with a regular society, in this case the blind learner should also migrate. Instead of purchasing embossers, can the government see how to establish good internets, purchase orbit readers and the laptops to be used by learners with visual impairment, (IT1)

Ashraf, Hasan, Lewis, Hasan, & Ray, (2017) raised other fundamental concern included teaching of Braille and AT, whether AT is to be taught as a curriculum or enrichment subject, and whether the integration of AT is overlooked.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Attitude to ICT Integration

In terms of attitude, it emerged that there is a relationship between the use of ICT and age. That is, older teachers have been reported to have technology phobia. Again, the implementation of T-PAD by the government have compelled teachers to use ICT. Further, the multiple disability among ICT users affect manipulation of ICT devices and ultimately effectiveness of ICT integration. The use of some ICT devices like Chrome book have been mentioned by learners to have edutainment advantage. In relation to this sub-theme, one of the ICT technician mentioned phobia with the use of ICT devices among elderly teachers.

There is some phobia of technology especially with older teachers, some of these teachers have been teaching without technology for over 30 years and now bringing technology to them is a challenge. At some time, we have to quarrel with them until they agree that they should come to lab to learn technology. Those who are not ready to come for training or have phobia, I am normally hard on them until they agree that they have to start coming for trainings, so I help them sometimes but not always, (IT1).

During the interview with head of the institutions, one of the HOIs confirmed that T-Pad compelled teachers to acquaint themselves with technology. The informer remarked:

The expectation of the government to fill some data like T Pad has forced some teachers to visit the computer room. In a way they are now compelled to use ICT, (H4).

Another HOI specified that only two of her teachers had negative attitude with the use of technology, and among the two, one had multiple disability hindering effective use of ICT devices.

I am also happy to report that among all the teachers only two have a problem with learning ICT, but again among the two there is one with multiple disability and therefore is challenged to use laptop however the teacher can use smart phone more effectively. Therefore, there is only 1 teacher that is having the phobia although the attitude is changing slowly, (H1).

The focus group interview with teachers also revealed some aspects of attitude towards ICT integration. One of the teachers reported this:

There are also learners who come from the lower grade with negative attitude of technology that they can't do it. So however much the pressure you exert on them to learn these gadgets they believe they can't do it, (T6).

Again, another learner had negative perception towards slate and stylus and remarked that they should not be considered as technological tools. The learner said:

We think slate & stylus are not ICT because you use your hands and a lot of energy to write, (L2).

According to Ojok, (2018), the existence of ICT infrastructure in a school will indeed spark curiosity and prompt even the most technophobic teachers to take action.

Experience Learned With the Use of ICT Integration

In connection to the experiences and lessons learned on ICT integration a cross the four Cases, the participants shared several opportunities related to assistive technology including making LWVI become independent in their learning, reducing bulkiness of braille system of writing, making learning enjoyable and friendly to learners. However, some disadvantages were also aired like challenge in class control and difficulty in teaching abstract concepts like emotions and values with the use of ICT devices. The informer stated:

We have experienced that technology is enhancing experience of our learners for example with access to information from internet, the learners with the assistance of screen reader is able to do his or her research with this gadget. In the olden days the visually impaired learner would depend on a sited learner to do some research on printed material, (IT1).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

Subedi (2021) established that adaptable ICT software enables students to access material from the internet, similar to those who have sight. One of the HOI recognized that the deployment of ICT motivated learning but was also quick to say that it posed a challenge on class control. The respondent said

We have experienced that relationship between teacher and learner has improved. The class control has also become a challenge though it is more of positive than negative because learners are motivated during the lessons, (H3).

In regards to class control, Critics of social constructivism theory like Merill (1997) argues that social constructivism is often destructive for introverts, as they don't relish the social pressure. Similarly, for extroverts, who perhaps relish the social contact too much, social learning can disrupt progress for not only for themselves but others too. Taking of pictures was popular with CBE curriculum and subsequently effective with the sighted learners, this was not true with LWVI according to informer's experience. The teacher reported:

We have experienced that area of taking pictures and videos in CBC curriculum is very popular but not relevant to learners with blindness, so it is very hard to explain to the learners that this is what that is happening, (T9).

One of the teachers with visual impairment was proud of the status of autonomy brought by technology and expressed this:

As a blind teacher I can be able to go online and get the materials that I need without involving a sited reader. This has also made it easier to access internet that is not in brail format, (T5).

Other Organizations that Supported Integration of ICT in Schools for LWVI

On organizations that have promoted ICT integration in schools for LWVI, the findings a cross all the four schools acknowledge the role of KBTA in donating, training and repairing Orbit Reader 20. Apart from the KBTA, Inable was tremendously recognized for provision of chrome books, laptops, desktops, iPads and three full time ICT technicians to Case 1 School. Simultaneously, Inable had also renovated, designed and furnished two computer laboratories in the school. Relatedly, Kenya Institute of Special Education (KISE) has been acknowledged for having send their teacher trainees for teaching practice to Case 3 School. In relation to this sub-theme, one of the HOI mentioned three of the development partners stating their specific contribution in connections to ICT integration promotion. The HOI explained:

INABLE they have provided laptops, desktops, I-Pads, renovated 2 computer lab, provided 3 ICT technicians that train both teachers and learners. KILIMANJARO provided orbit readers, trained teachers on the use of orbit reader, repair and maintenance of orbit reader. JAMBO JET donated embossers, (H1).

Another Head of Institution reported two of the development partners and even acknowledged human support as far as integration of ICT is concerned.

KISE have brought students for teaching practice and therefore have provided expertise to us. So whoever are doing practicum here are also useful to our school. We have had Kilimanjaro, these orbits are from Kilimanjaro, (H3).

Yet another teacher acknowledged maintenance role played by the KBTA. The teacher remarked:

When Orbit Readers are broken, we normally take them to Nairobi to be repaired by KBTA, (T12).

The findings in the current study suggested that provision of ICT resources were made by either the government of Kenya or non-state actors. This findings concurred with the study by Mwanza, Simalalo & Simui, (2021) which gathered that parents needed social and financial support from well-wishers like donor community and government to support them with ICT devices specifically designed for children with visual impairment. In conclusion, it is apparent that school for LWVI may not go very far with ICT integration if they

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VII July 2025

depend on government alone but should seek backup from other organization of goodwill to join in this endeavor.

CONCLUSION

In light of the findings, it is therefore concluded that:

Although the government of Kenya have been implementing ICT integration program in all primary schools since 2014 to date and have included ICT Skills as one of the core areas in CBE design, the results of The research established that special primary schools for LWVI in the Lake Region of Kenya are not adequately prepared in ICT integration in terms of teacher training in assistive technology, developing ICT infrastructure and coming up with policies that can promote integration of ICT. This has consequently limited their ability to adapt and integrate ICT as a pedagogical tool for teaching LWVI. This status is very worrying since the use of technology by regular population is advancing tremendously coupled with the fact that organizations that used to provide braille machines and materials like CBM and KBTA are no longer doing so.

RECOMMENDATIONS

Based on the strength of the findings and conclusions arising from this study, the following recommendations may be considered to enhance the effectiveness of ICT integration in order to improve academic performance for LWVI in special primary schools in Kenya.

The government should work closely with other development partners like KBTA and Inable to train teachers on how to use ICT resources specific to learners with visual impairment, develop ICT infrastructure in special primary schools for LWVI and design policies that can promote ICT integration for these learners.

The government and other stakeholders needs to invest heavily in employing ICT technicians and deploying assistive ICT devices by ensuring that they are adequately stocked and with appropriate accessibility features that suit learners with visual impairment. Most specifically, the government, schools for LWVI and other stakeholders should direct their efforts towards acquiring refreshable braille devices and computer technology with internet in order to compete favorably in this global era.

There is an urgent need for government of Kenya to restructure curricula for teacher-training institutions and universities so that focus is not only on imparting general ICT skills in teacher trainees in their formative stages as teachers but preparing them to adapt and use ICT as a pedagogical tool in the teaching of all students but specifically those with sensory disability like those with visual impairment in Schools.

Suggestions for Further Research

Based on the findings of the study and the recommendations, we hereby suggest that:

A study should be carried out in the mere future to explore how best refreshable braille devices in combination with computer technology can be used in the teaching of LWVI, given the fact that Orbit Reader 20 and Chrome book had been mentioned to be having some function abilities that addresses significant limitations of mechanical braille system.

Further investigation is needed to determine how best special needs teacher trainees can be trained on the use of assistive technology since the findings of the research pointed to the fact that Integrating ICT to learners with visual impairment requires competent teachers, both technological and pedagogical.

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