# The Role of Assistive Technologies on Quality Educational Outcomes of Student with Visual Impairment in Kisumu County, Kenya

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***Abstract:*** *This study sought to establish the role of assistive technologies on quality educational outcomes of students with visual impairment in Kisumu County, Kenya. The study adopted a mixed methods research design. The target population constituted 743 students, 11 principals, 11 deputy principals, and 19 Special Needs teachers making a total of 784. Purposive sampling was used to select 11 principals, 11 deputy principals, 19 SNE teachers and 120 students with visual impairments yielding a total sample size of 161 respondents from secondary schools in Kisumu County. The main research instruments were questionnaires for students and principals and interview guidelines for SNE teachers. Piloting was conducted to determine the validity of research instruments. Quantitative data and later qualitative data were collected in conformity with the chosen mixed methods research design. Quantitative data were analyzed with the assistance of the Statistical Package for Social Sciences (SPSS) Computer programme version 20. The SPSS generated descriptive and inferential statistics. The qualitative data were analyzed thematically and represented in direct quotes and narratives in line with the study objective. The study revealed that most of the students with visual impairments were taught by SNE teachers who were highly qualified with long teaching experience. The majority of the students with VI largely relied on the use of obsolete assistive technologies such as the Braille and mirror magnifiers. The modern technologies had not penetrated into the study locale and as a result most students with visual impairments hardly benefited from the advantages inherent in these technologies. Nearly all SNE teacher interviewed concurred that the use of modern assistive technologies by students with VI was a very critical requirement for enhancing learning, independent study and active learner-teacher interaction that was a prerequisite for enhanced academic performance. The overall conclusion was that use of modern ATs by students with VI was quite low and hardly facilitated effective attainment of quality school outcomes such individualized learning and enhanced academic performance in internal and national examinations. The study made several recommendations mainly directed towards the Ministry of Education to give priority to learners with various disabilities, especially those with VI, by increasing budgetary allocation for the purchase of modern ATs and on in-service training of SNE teachers on use of modern ATs not only in the study locale of Kisumu County but other counties in the country experiencing similar challenges. [389 words].*
***Keywords:*** *Assistive Technologies; Quality Educational Outcomes, Student with VI, Kisumu County, Kenya*

## I. Introduction

**Background to the study**

Today, the education of students with disabilities appears to be "everybody's business (Jackson, 2009)." In an era of inclusion and collaboration, educators on all levels need information about the myriad ways in which technology can enhance the performance capabilities of these students, facilitate participation in instructional activities, and improve scholastic achievement (Jackson, 2009). Yet, a century ago, most students with disabilities were uneducated or stood remote chances of education (Jackson, 2009; Republic of Kenya,2010). When they began receiving education, they attended separate schools and learned in separate classes. Today, it is common to have students with disabilities learn beside "other" students in inclusive classrooms (Torreno, 2012). As a philosophy, inclusion urges schools, neighborhoods, and communities to welcome and value everyone, regardless of differences. Central to the viewpoint of inclusions is the belief that everyone belongs, diversity is valued, and we can all learn from each other (Renzaglia, Karvonen, Drasgow & Stoxen, 2003). Holding such an attitude can greatly impact on the participation of students with disabilities in inclusive classrooms.

An assistive technology device is described as any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities. An assistive technology service means any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. The term includes the evaluation of the needs, selecting, designing, fitting, customizing, adapting, applying, retaining, repairing, and technical assistance for a child with a disability, family members or, professionals (Sah, 2013) Technology can increase productivity and independence by facilitating the performance, simplifying tasks, allowing greater speed and less physical energy to a person with visual impairment. Technology has many important applications in teacher education in general or special education in particular. The integration of new technologies and multimedia materials in teacher education programs at the pre-service and in-service levels can improve the quality of training and increase competency in best practices (Sah, 2013). If the society in which the child with visual impairment lives want to see changes, they should use assistive technology more and more. Then we have to inculcate a technology based approach in the individuals with visual impairment from a very early stage of education and training. Hence, it demands the proper and compulsory training in relevant and modern assistive technologies among children with visual impairment. Sah (2013) argues that advances in computer technology have a very positive impact on the education of children with Visual Impairments.

Students with disabilities should be prepared for further education, employment and independent living, Individual with Disability Education Act (IDEA) (2004). Considering that visual impairment is perhaps the disability area in which the most technological advances have been made, it is therefore imperative that the visually impaired students have an effective level and quality of access that is essential to full participation in new ways of learning especially in an inclusive setting. Currently computers can turn text into speech, enlarge print and translate text into Braille, opening the door to books, articles and data that have previously been available only at great expense and difficulty (Sutton, 2002). African countries should therefore see into it that this important innovation is incorporated in their annual budget to improve and encourage people with VI to be included in community activities. Through research, it has been discovered that there exists a high level of 'technology pessimism' among persons with visual impairments. It is reasonable to infer that this cynicism is also present as people with visual impairment deal with a variety of technology-related barriers in education (Marx, 2011).

According to the American foundation for the blind (2014), assistive technology has removed many barriers to education and employment for visually impaired individuals. Students with visual impairments can complete homework, do research, take tests, and read books along with their sighted classmates, because of the use of computers and other devices. These include: Assistive technology programs that run on off-the-shelf computers can speak the text on the screen or magnify the text in a word processor, web browser, e-mail program or other application. Stand-alone products designed specifically for people who are blind or visually impaired, including personal digital assistants (PDAs) and electronic book players provide portable access to books, phone numbers, appointment calendars, and more optical character recognition systems scan printed material and speak the text. Braille embossers turn text files into hard-copy Braille. However this is not the case in African countries as AT remains out of reach in most educational systems (Belay, 2005).

A report compiled in Kenya by Kareri, Riungu, Mutai (2009) shows that Kenya Union of the Blind in conjunction with Sight Saver international has enabled education to be accessible to persons with VI and professional skills like teaching, with a view of coming up with youths who have the capacity to carry out training in the use of assistive technology in secondary institutions. Within a period of one year the Kenya Union of the Blind was able to reach at least 30% of the secondary schools and ensured that both the student and the teacher had obtained skills, knowledge and positive attitude to enable them achieve better results. In the programme, effective use of gadgets such as the Dolphin pen was taught and other assistive software such as jaws, NonVisual Desktop Access (NVDA) and thunder. In as much as these technologies are available for use they are expensive and may be unaffordable to many. Lack of power installation to many schools and houses makes it difficult for the use of these devices in the learning process and domestic use. Student with VI should be given every opportunity to participate in school activities to the same degree as any other typically sighted student. In the past, most visually impaired children were educated in special residential schools. Today in developed countries, a majority of this population is educated in mainstream public school programs in their own communities; a move that has been greatly aided by technological advancements. It is on this backdrop that this study was conducted, to find out the effectiveness of AT devices in the education of learners with Visual Impairment in Kisumu County, Kenya.

**State of Art Review**

To date, little is known about the intersection of large-scale assessment, technology, and students with visual impairments. Five studies published between 2002 and 2007 investigated the use of computer

administered tests for students with a variety of disabilities, but no consistent findings emerged (Johnstone, Altman, Thompson, & Thurlow, 2006; Zinesky & Sireci, 2007). Studies indicated that test validity may be compromised under certain accommodated conditions because of interaction effects for students with some disabilities (Fletcher, Francis, Boudousquie, Copeland, Young, Kalinowski, & Vaughn, 2006), or because accommodations had a positive scoring effect for all students (Leseaux, Pearson, & Siegel, 2006; Kettler, Niebling, Mroch, Feldman, Newell, Elliott, Kratochwill, & Bolt, 2005), thus negating the equalizing effect that technology-based accommodations are supposed to produce.

Despite the inconclusive nature of accommodations research, exploratory research on technology-enhanced assessments may provide some insights into future directions. Hansen, Lee, and Forer (2002) conducted a preliminary evaluation of speech output technology for tests for individuals with visual impairments and found that 'self-voicing' testing systems (systems that provide audio cues on demand) have potential and may be capable of replacing human readers in certain testing situations. Likewise, researchers from the Center for Applied Special Technology (CAST) studied impact on student scoring when computer-based read-aloud testing accommodations were used (Dolan, Hall, Banerjee, Chun, & Strangman, 2005). Results of the study indicated a significant increase in scores when students read passages greater than 100 words using technological aids.

Higgins, Russell, and Hoffman (2005) demonstrated a possible trend in assessment using computer-based technology. Higgins et al. found that there were no significant differences in reading comprehension scores across testing modes compared to paper-based assessment. Another approach of accommodating students with visual impairments using multi-sensory approach aids was studied by Landau, Russell, Gourgey, Erin, and Cowan (2003). The Talking Tactile Tablet (a math tool with speech output) had a positive impact on the mathematics performance of students who were visually impaired or had difficulty visualizing graphics and diagrams. This study also found that students performed better on five of the eight items when using the Talking Tactile Tablet, and performed the same on the remaining three, indicating that a multi-sensory approach may be an effective approach for assessing students with visual impairments.

With regards to the kinds of assistive technologies used in schools by learners with visual impairments, literature indicates that there is a wide range of assistive technologies for people with visual impairment that provides plenty of choice for users at all stages of sight loss. There are several categorization made by leading institutions in the field as per the nature of the task to be performed, kind of technologies or, place of use. According to Royal National Institute for the Blind (RNIB 2014) some of the most important assistive technology for the visually impaired includes:-

> Screen readers, Screen magnifiers, Speech recognition software Text-to-speech (TTS) software, Optical character recognition (OCR) software, Large monitors ,Closed circuit Magnifiers, Dictation devices and transcription; Scanners ;Standalone reading machine, Refreshable Braille displays , Braille embossers, Braille writers ,Braille translation software , Alternative keyboards, and Digital books( RNIB,2014).

However there are different types of assistive technology in various countries. According to a research conducted in Ontario by Sider & Maich (2014) on Assistive technology tools, they noted that a wide range of assistive technology including interactive white boards, text- to- speech software and classroom amplification system were being used by teachers to benefit both students engagement in the classroom and their independence in completing class activities and assignments.

Regarding the role of assistive technologies currently used by visually impaired students, literature indicate that whether technology should be used in classrooms is no longer the issue in education. Instead, the current emphasis is ensuring that technology is used effectively to create new opportunities for learning and to promote student's achievement (Kelly & Stacy, 2009). It is important to find out the prevailing situation in inclusive secondary schools in Kisumu. There is growing recognition that a person with disability can do equally better in classroom and workplace if equipped with the necessary adaptive and assistive technology (UNESCO, 2007).

Siligo (2005) in his study on teaching non academic students with visual impairment focused on many of the practical tools and information that can make this experience possible. The tools and information discussed by Siligo were intended to enable music educators to fully include students who are visually impaired in the ensemble experience. Therefore, conforming to the general acceptance that assistive technology has a positive impact on the lives of individuals with visual impairments. However, most of the assistive technology devices are considered effective since they have practical application on the usage. The assistive technology devices develop and build the talents among children with visual impairment in performance arts such as music.

Assistive technology devices facilitate social inclusion and enhance quality of life by helping persons with disabilities to become capable, independent and live a more satisfactory life (Ring, 2008). In order for the

above to be achieved, professionals in the field should strive to evaluate the effectiveness of the devices in an effort to provide consumers with the information that will allow them to have the highest quality experience possible when using the technology. This is due to the fact that most devices used in schools are complicated thereby reducing the students' morale to use them. Teachers should be competent and encourage students to learn and use the assistive technology in their learning.

### Statement of the Problem

Despite the fact that there is various assistive technology devices in the market that can aid in the education of students with visual impairment, not so many people can easily access and afford them due to their high prices and lack of electricity connection in some parts of the country. The critical question to this study set to grapple with was: How do we decide what assistive technology is appropriate for an individual student? In all areas of education, coordinated teamwork is critical. When considering assistive technology for a student, the importance of a team approach cannot be overemphasized. The other problem is that although studies have been conducted on the role of assistive technology in other countries especially the more developed ones, in Kenya such studies are limited.

### Purpose and objective of the Study

The purpose of this study was to find out the effectiveness of assistive technology in the education of children with visual impairment in selected inclusive secondary schools in Kisumu County, Kenya. The study was guided by one objective namely: To examine the kinds of assistive technology currently used in inclusive secondary school in Kisumu County by visually impaired students.

### Theoretical framework.

The theoretical framework of this study was premised on the critical theory propounded by Kincheloe and McLaren (2008). According to Kincheloe and McLaren (2008), a criticalist is a researcher whose work seeks to critique certain oppressive aspects of a culture. Therefore a critical theory approach to research pays attention to the marginalised in the society. Prasad (2005) argues that critical research should seek to empower individuals and confront injustice in the society. The natural understanding is that because disabled people are human beings, they are entitled to all rights that human beings enjoy. However, people with disabilities are not treated equally in many spheres of their live including education. The 'Convention on the Rights of Persons with Disabilities' (CRPD) entitles its beneficiaries with rights to assistive technology to ensure their full and equal enjoyment of all human rights and fundamental freedoms. United Nations Convention on the Rights of Persons with Disabilities (2007) in article 21 talks on the rights of the people with disability to get access to information in an accessible formats and technologies appropriate to different kinds of disabilities in a timely manner. It further states in article 24 that every person have a right to education. In regard to education, LaNear & Frattura (2009) cited by (Omoke, 2011) contend that students with disabilities have undeniably and consistently occupied the role of "others" in schools. This position of "others" taken by children with disabilities is unjustified and therefore injustice. It means children with SEN may require strong advocacy in order to enjoy their rights. By investigating the effective use of assistive technology this research project seeks to examine and address issues of poor education services for these children so as to enable them access appropriate education regardless of their disability.

## II.     Research Design And Methodology

### Research Design

Research design is a plan of activities the researcher takes during the period of study and constitutes the blue print for the organization, collection, analysis and interpretation of data (Orodho, 2009a, 2012). Kothari (2004) also defines the design as the plan and structure of investigating so conceived as to obtain answers to research questions. These scholars agree that the design is a plan of all activities, procedures and techniques employed to implement the study. The study recognized that there are three main designs, which comprise qualitative, quantitative and mixed methods. Based on these considerations, this study adopted mixed methods design, which for the sake of this study was taken to mean designs that include at least one quantitative method designed to collect numerical data and one qualitative method designed to collect qualitative data in the form of words (Creswell, Vicki & Clark, and 2011: 2). Tashakkhori and Tedlie (1998) have similarly defined mixed methods as the combination of quantitative and qualitative approaches in the methodology of a study. Incorporating these diverse perspectives, Jonson, Green and Kluever (2000), has ended with a composite definition of mixed methods research as:
The type of research in which the researcher or team of researchers combine elements of quantitative and elements of qualitative research approaches ( e.g. quantitative and qualitative view points, data collection,

analysis and inference techniques) for the purpose of breadth and depth of understanding and corroboration (p.125).

The study specifically used the explanatory Sequential Design (Ivankova & Stick, 2002), as described by Creswell et.al, 2011). This explanatory design was implemented in two distinct phases. The first phase involved collecting and analyzing quantitative data. The quantitative component involved an ex-post-facto research design. An ex-post-facto design is the type of design whereby the investigator does not manipulate the independent variables because they are either inherently not able to be manipulated or have already occurred ( Orodho, 2009, 2012) and the researcher merely examined their nature of influence on the dependent variable. Based on the need to further understand the quantitative results, the researcher implements a second phase. The second phase involved qualitative approaches designed to explain the first quantitative results (Creswell, et.al, 2011:119). The qualitative component chosen and implemented was an ethnographic approach the researcher to interpret the results of the ex-post facto through in-depth interviews, as suggested by Brooks,( 2013). The mixed method thus provided an opportunity and the requisite data for triangulation of data sources and methods (Orodho, 2012

**The Study Locale**

The study was conducted in Kisumu County which has a population of 968,909 (2009 National Census) covering an area of 2085.9 $Km^2$. The county also has a total of 7 constituencies and 35 county assembly wards. The economic activities within the county include fishing, agriculture i.e. animal and crop husbandry, industrial activities including service industry, transport, communication and tourism. The county has a total of 179 registered secondary schools. Out of these, 12 are private and 167 are public.The justification for the selection of the study locale of Kisumu County was based on several considerations. First, Kisumu County has several schools for students with various disabilities, including visual impairments compared to any county in the Republic of Kenya. Secondly, Kisumu County was selected because it is a cosmopolitan town and there are many inclusive schools within the county. Thirdly, the county has a good road network and this attribute would make the process of data collection more convenient and fast. Finally, as is argued by several ethnographic researchers, familiarity with the study area makes the respondents reveal and open up to local people than to strangers (Orodho, 2009b). Thus, because, the researcher teaches at Jaramogi Oginga Odinga University of Science and Technology which is located within a county neighbouring Kisumu County, the element of familiarity became a justified consideration for the choice.

**3.3 The Target Population**

Target population, according to Orodho (2012:37) is a combination of all items or people under consideration in any field of inquiry or research. It is from this target population that a sample, which is a smaller and representative portion of the population is drawn (Kerlinger, 2007, Orodho, 2009a).The target population usually constitute a sample frame which is a complete listing of all the sampling units or elements that can adequately represent that population (Brook, 2013). However, there is no such a complete formal list that can adequately satisfy a researcher as a sample frame (Brook, 2013; Orodho, 2012). In such instances, a researcher develops a sample frame that produces a representative sample of the population elements with the desired characteristics or attributes (Creswell, 2005, 2007; Orodho, 2009a). The target population for this study was comprised of 743 students (412 males and 331 females), 11 principals, 11 deputy principals and 19 (11 male and 8 female) SNE teachers in all the 11 inclusive schools in Kisumu County. The entire target population was 784.

**Sampling techniques and Sample Size Determination**

The quality of any research is influenced by the appropriateness of the methodology, suitability of research instruments and the suitability of the sampling strategies employed (Cohen, Manion & Marrison, 2007).Warwick and Lanninger (1975) and Orodho (2012) summarizes that the sample size depends on what one wants to know, the purpose of the inquiry, what is at stake, what will be useful, what will be credible, and what can be done within available time and resources. These sentiments form an important basis for the sampling. Sampling is the process of selecting smaller portions of the larger population to be studied in order to draw conclusions from the sample to the population from which the sample was drawn (Orodho, 2009a). In this study, purposive sampling was used to select all the 11 special needs education teachers due to their specialized knowledge on the problem of assistive technology being investigated. Similarly, all the 11 principals and their deputies were selected due to their wide knowledge on management issues in these institutions. Finally, stratified random sampling using a table of random numbers was applied used to Select 296 students comprising 164 male and 132 females. The entire sampling matrix yielded a sample size of 337 depicted in table 3.1.

**Table 3.1:    Target Population and Sample Selected**

| Subject | Target Population | | | Sample Selected | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| **Students** | 412 | 331 | 743 | | | 120 |
| **Principals** | 7 | 4 | 11 | 7 | 4 | 11 |
| **Deputy Principals** | 7 | 4 | 11 | 7 | 4 | 11 |
| **SNE Teachers** | 11 | 8 | 19 | 11 | 8 | 19 |
| **Total** | 437 | 347 | 784 | 189 | 148 | 161 |

The chosen sample of 161  respondents (120   students, 11 principals, 11 deputy principals and 19 SNE teachers) constituted 42.98% of the 784 target population of 11inclusive secondary schools in Kisumu County, was  used in the study. This percentage of the target population is usually considered by some researchers to be representative of the entire population (Brooks, 2013, Orodho, 2012b).

**3.5.0. Research Instruments**
The main research instruments used were questionnaires and interview schedules. The questionnaires for School Managers contained both structured and unstructured questions. Section A had three general questions that will collect background and personal demographic information on the respondents. Interview schedule is a set of questions that the interviewer asks when carrying out interview (Orodho, 2009). It was chosen to enable the researcher probe during the second phase of study to enable the researcher to get further information and corroborate what has been gathered during the first quantitative phase     through the questionnaires. It was conducted for the 19 SNE teachers since the number is smaller compared to the other respondents. The content of the interview protocol was grounded in the quantitative results from the first phase of the study (Creswell, 2003).

**Validity of Research Instruments**
According to Orodho (2012) and Brooks (2013), validity is the extent to which the instrument measures what it purports to measure. It is concurrent with the soundness and the effectiveness of the measuring instrument (Creswell, et.al. 2011).  In this study, the instruments were given to the two university supervisors for appraisal and amendment since they are the experts in this field (Orodho, 2009a). The researcher used the comments and suggestions made individually by these experts in the field to construct the final research instruments. These assessors were approached individually to make comments on the suitability of the developed instruments and their views incorporated in the final version of the instruments. The suggestions that were provided during a panel of experts during the initial oral proposal defense were also incorporated to further enhance the validity of the instrument.

**Reliability of  Questionnaires**
Brook (2013) and Orodho (2009a) concur that reliability of a research instrument is a measure of the consistency or stability of the instrument in measuring what it is supposed to measure every time the instrument is used in various circumstances. The various methods proposed by Orodho (2009a) include test re-test, equivalent forms, split − half and Kuder -Richardson. This study adopted the split half method which does not require the researcher to get back to the respondents.  This method, which involves splitting the   questionnaire items in the school managers questionnaire into odd and even components and analyzing their reliability by comparing the totals of the two dichotomies  and conducting a  Pearson's Product Moment correlation followed by a modified Brown Prophesy estimate formula. This yielded a correlation coefficient of .845.  A value greater than .70 for the correlation coefficient of any instrument is usually considered high enough to declare the instrument reliable ( Orodho,2009b).   Therefore, the questionnaires designed for School Managers were considered high enough to declare the instrument reliable.

**Data Collection**
The data was collected from multiple sources to provide the richness and the depth of data in line with the explanatory design procedure which is a variant of mixed methods research that was carried out in two phases (Creswell, et.al, 2011).  For the first quantitative phase, the ex-post facto  design was  found to be convenient and appropriate for the kind of study and hence adopted for  used (McMillan, 2000).The data collection strategy was implemented in two phases, starting with the implementation of the quantitative strand. Phase one therefore involved the implementation of the quantitative strand and through administration of questionnaires to school Managers and teachers. The questionnaires were hand delivered to the respondents, with a copy of the research permit from the National Council for Science, Technology and Innovation

(NACOSTI) . The itinerary for this phase of data collected was organized in consultation with the school principal of the respective schools selected for the study. The respondents were requested to complete the questionnaires, and when through alert the researcher to pick them later and within a period of one week. The data was analyzed as described fully in the next section and the significant findings emanating from the quantitative data noted. These findings were used to construct the qualitative interview protocol for the second phase of the study.

The second phase of the study was then implemented on completion of analyzing the results from the first quantitative phase of the study. Using the quantitative results, the researcher identified the teachers and school managers who had displayed sound knowledge of the use of assistive technologies in the teaching and learning of learners with visual impairments for further scrutiny. A qualitative evaluation research was undertaken to investigate the teaching and learning of visually impaired learners in selected secondary schools for VI. Holliday (2002:24) says, 'Getting into qualitative research is very often about grasping opportunities which address a good idea or longer-standing preoccupation'. Qualitative research allows one to find out the social realities in the natural settings. The researchers then conducted a detailed and in-depth one-on one interviews for the special needs education teachers and selected school managers. The interviews lasted for between 30 minutes and one hour, depending on the range and depth of information generated through the process.

**Data Analysis**

According to Brayman(2000) , Creswell (2011) and Orodho (2009b), data analysis can be defined as the process of bringing order to raw data by organizing what is there into patterns , categories and descriptive units and looking for relationships between them. Both quantitative and qualitative data analytical techniques were utilized according to the chosen mixed methods design. Thus, the study used mixed methods involving quantitative and qualitative approaches to analyze the data collected through questionnaires and interview schedule respectively (Creswell, et.al 2011). The analysis of quantitative data from questionnaires involved data editing and cleaning as well as coding to develop a codebook for analysis. Using a developed codebook, date was entered into a statistical Package for Social Sciences (SPSS) Computer Program Version 20 to assist in generating both descriptive and correlation statistics (Orodho, 2009b). The descriptive statistics used included measure of central tendencies and variability and charts. The correlation statistics involved mainly measures of central tendency and measures of variability, correlation using Persons Product Moment Correlation Coefficient (r) , Chi-Square ($x^2$) test of independence and homogeneity as well as Multiple Regression Analysis ( Orodho,2009b).

The importance and nature of assistive technologies were determined using in-depth interviews with special education teachers who are assumed to be highly trained and exposed to the use of assistive technologies by students with visual impairments.

## III.    Findings And Discussion

**Educational Level of SNE Teachers in Kisumu County**

The only demographic variable considered was the educational level of SNE teachers. It was argued that,  the education subsector this is very critical as education promotes literacy and provides quality teaching. The respondents were requested to indicate their level of formal schooling of the SNE teachers in the sampled Kisumu County. The results indicate that majority of SNE teachers, constituting 78.95%   are graduates. The rest constituting 15.79 % had postgraduate level of training, indicating that they had formal educational level beyond  first bachelor's degree. In fact, the minority of the teachers sampled had less than first degree of academic attainment. The overall finding is that a majority of SNE teachers who handle students with visual impairment in Kisumu County  were well qualified with over 9 % holding a bachelors degree or higher.

**Types of assistive technologies currently used by VI in Kisumu County, Kenya**

The main objective was to examine the kinds of assistive technology currently used in inclusive secondary school by visually impaired students in Kisumu County. The school managers and students were first requested to indicate the types of assistive technologies currently used by visually impaired students in their respective schools. The school principals and students were requested to indicate SD for strongly disagree, D for disagree, NS for not sure, A,  for agree,  and SA,  for strongly agree in the given questionnaires for principals and students questionnaires, respectively. This was followed later in an interview during the second qualitative phase of the study to have a clearer explanation of the actual situation of current use of assistive technologies in schools. The results of the principals' responses are indicated in Table 2

**Table 2: Current use of Assistive Technologies by VI students in Kisumu County**

| Types of ATs used | Strongly Disagree | | Disagree | | Agree | |
|---|---|---|---|---|---|---|
| | f | % | f | % | f | % |
| Screen reader scan | 13 | 61.9 | 4 | 19.0 | 4 | 19.0 |
| Portable note taker | 13 | 61.9 | 5 | 23.8 | 3 | 14.3 |
| Digital book reader | 13 | 61.9 | 5 | 23.4 | 3 | 14.3 |
| Braille books | 13 | 61.9 | 4 | 19.0 | 4 | 19.0 |

The results carried in Table 2 indicate that over 80 percent of school principals were in agreement that schools in which students with VI were learning hardly used any modern assistive technologies such as the screen reader, the portable note taker, the digital book reader and Braille books. It was also evident the only modern assistive technologies used exclusively, by approximately 20% by the SNE teachers were the screen reader scans and Braille books. These results were consistent with over 90 % of SNE teachers who reported that although they had heard of the availability of assistive technologies, they had not even interacted with them .The students with VI on their part maintained that they over- relied on the less modern technologies such as the Braille , spectacles, and magnifying machines.

During the second phase of the study, the teachers and students were probed further regarding their knowledge in the use of assistive technologies. The results revealed mixed results with some few teachers having a good knowledge and having interacted with the ATs either during their training or teaching. The rest had very limited knowledge and had never had opportunity to interact with the ATs.

Some of the SNE teachers who had interacted with the ATs had the following to say:

Yes, I have interacted with white cane, the reading stand, magnifying glass. I have also come across the computer although this was not very specific for visually impaired learners. The other stated that I have interacted with JAWS and NVDA, talking mobile phone, talking calculator , of course the Braille machine and the basic writing slate and of course mobility white cane( Respondent No. 11 & 17)

The foregoing indicates that learners with disability need exposure to a wide array of assistive technologies, depending on the nature of disability. For instance, because listening is an important part of the classroom experience, some students need assistive devices for hearing such as hearing aids, personal FM units, or closed-captioned TV. Special listening systems can help a learner with a hearing loss "tune in" to the teacher's voice from a distance. Many students rely on their vision as a primary mode for learning. Technology can be used to help these students by increasing contrast, enlarging stimuli, and making use of tactile and auditory modes. Devices that help with vision include screen readers, screen enlargers, magnifiers, audio books, Braillers, light boxes, and scanners. The findings of this study is in tandem with the Royal National Institute for the Blind (RNIB,2014) who contend that there is a wide range of assistive technologies for people with visual impairment that provides plenty of choice for users at all stages of sight loss. There are several categorization made by leading institutions in the field as per the nature of the task to be performed, kind of technologies or, place of use.

The other SNE teachers reported contrasting experiences with the use of assistive technologies:

…In school we used computers that are the talking computers. They are called the talking computers because they use certain software that make students who cannot be able to see, at least to hear……I have interacted with some, for example, when I was I Thika School for the Blind, I could see the students with VI interact with computers. For them to use the computers they incorporated the talking software put on headphones and as they typed the key board talked back. ….Then the computer is also installed with dictionary so that if some words had misspelling, they could tell them back and instruct them on the incorrect ones by offering options (Respondents No. 5 & 10).

The foregoing citation indicates that with more modernized facilities; the students with VI could be exposed to more effective modes of teaching using ATs as was the case with the Thika School for the Bind. In contrast, the following SNE teachers felt that the assistive technology is not targeting the teachers as is expected. The other teacher felt that some of these innovative gadgets malfunction, hence rendering their use problematic.

….Once when I was in Kibos School for the Blind, there was a group of people, I don't know where they came from, they took some of our students , they wanted to train some of these students on how to use I-pads. Personally, I did not have the opportunity to see the I-pad because the students were the ones being trained…..I only saw students use them but as teachers, we were not trained on how to use the I-pads…So when it comes to these aiding machines, they are not much readily available. Some of them malfunction and render their use difficult (Respondents No.9 & 12).

According to the Royal National Institute for the Blind (RNIB, 2014) some of the most important assistive technology for the visually impaired includes:

Screen readers that converts electronic text to speech; Screen magnifiers that presents enlarged screen content; Speech recognition software that allows input of data using voice rather than a mouse or a keyboard, Text-to-speech (TTS) software that converts written text into audio files that can be played on a wide range of

devices; optical character recognition (OCR) software which scanned text and converts the scanned image into an electronic text file; Large monitors that make on-screen reading easier by providing more space on-screen and are helpful for persons with low vision; Closed circuit television (CCTV) which are devices that use cameras to magnify large format printed materials and objects; Magnifiers which are smaller optical devices and are placed on objects to magnify smaller items or text and are available with or without light sources; Dictation devices and transcription which allow people to record meetings or take notes that can be transcribed from the recording made; Scanners- Scanners that convert images from printed material to a computer file. Standalone reading machine which is an integrated machine with a scanner, OCR, and speech software, which functions without the need for a computer; Refreshable Braille displays which is an output device which displays Braille reading interface by connecting to computers from what is on-screen; Braille embossers which are specialized printers that produce Braille embossed documents; Braille writers- Braille writers that can be either manual or electronic devices that are used for Braille input ; Manual Braille writers produce Braille onto paper and electronic Braille writers input Braille directly into a computer and Digital books- Digital books are available via handheld devices or tablets and use a variety of formats, many of which are specific to the device being used.

From the foregoing list given by the Royal National Institute for the Blind (RNIB, 2014), it is evident that students with VI in the study locale of Kisumu County, Kenya have not been adequately exposed to the use of assistive technologies available in the market. This may not be a totally heartbreaking finding since literature review had established that there are different types of assistive technology in various countries. According to a research conducted in Ontario by Sider & Maich (2014) on Assistive technology tools, they noted that a wide range of assistive technology including interactive white boards, text- to- speech software and classroom amplification system were being used by teachers to benefit both students engagement in the classroom and their independence in completing class activities and assignments. It is most likely that Kenya will soon join the many developed countries that have embraced the use of assistive technologies to teach learners with visual impairments.

## IV.     Conclusions And Recommendations

The overall thrust of this study was to assess the effectiveness of assistive technology in the academic performance of students with visual impairments in Kisumu County, Kenya. The general argument behind this study was based on the conceptualization of assistive technology as any item, piece of equipment, or product system, whether acquired commercially off-shelf, modified or customized, that is used to increase, maintain or improve the functional capabilities of learners with disabilities. In other words, as assistive technology service means any service that directly assists the learner with a particular disability such as visual impairments , to select, acquire and use the devise not only for academic purposes, but also in extra-curricular activities and general survival in the environment .In fact, the central argument that flows through this paper is that in the current era of inclusion and collaboration, educational managers , SNE teachers and students with various sheds of disabilities should not be left behind in the acquisition of quality education and life-long living. Against this conceptual background, it can be concluded that this research study revealed mixed results in terms of the effectiveness of using the modern assistive technologies to enhance scholastic achievement of students with visual impairments in the study locale of Kisumu County Kenya.

The general conclusion is that most of the students with visual impairments were taught by the SNE teachers who were very qualified to teach learners with the disability.. There was a gender balance amongst the teachers with males outnumbering the females.  Although the sample for school managers was equally skewed in favour of the male gender, it was noted that female administrators were more qualified in terms of holding higher academic credentials than their male counterparts .Nonetheless, going by the results of this study, these teachers lacked requisite knowledge of handling various assistive technologies. Both the SNE teachers and students with visual impairments were not accessible to these modern assistive technologies.

With regard to the main study objective that set out to examine the kinds of assistive technology currently used in inclusive secondary school by visually impaired students in Kisumu County, based on the findings of this study, it can be concluded that students with VI hardly used any modern assistive technologies such as the screen reader, the portable note taker, the digital book reader and Braille books. Nonetheless, it was evident that the only modern assistive technologies used by a minority of the SNE teachers who participated in the current study were screen reader scans and Braille books. These results were echoed by a huge majority of SNE teachers who reported that although they had heard of the availability of assistive technologies, they had not even interacted with them .The students with VI on their part maintained that they over- relied on the less modern technologies such as the Braille , spectacles, and magnifying machines. The dominant tone of this finding leads us to conclude that the modern technologies have not been embraced in the study locale of Kisumu County.

From the findings and conclusions made, the following recommendations are made:

Firstly, SNE teachers in school schools with IV learners lack professional development exposure in teaching the VI using modern assistive technologies. In a similar vein, it was concluded that the SNE teachers as well as students with visual impairments relied heavily on obsolete technologies that were not in tandem with modern developments. Based on this finding, it is recommended that:

1. Appropriately selected assistive technologies should be made available the VI learner to enable them participate effectively in curriculum and extra-curriculum activities in the study locale of Kisumu County, Kenya , as well as other counties in the Republic of Kenya experiencing similar constraints.
2. Teachers should be exposed to the use of modern assistive technologies, especially for learners with visual impairments. Logistical and professional support should be given to such teachers to able them learn from each other's strengths and weaknesses regarding the teaching and learning of students with VI. There is little doubt that the degree of a successful change in schools is 'strongly related to the extent to which teachers interact with each other and others providing technical help such as selection and use of relevant assistive technologies.

Secondly, it was concluded that SNE teachers as well as students with VI hardly used any modern assistive technologies such as the screen reader, the portable note taker, the digital book reader and Braille books. Based on this, it is recommended that:

1. The students with VI should be assisted not to over- relied on the less modern technologies such as the Braille, spectacles, and magnifying machines. Instead, the wide range of modern assistive technologies currently in the market should be made available and teachers as well as students trained on how to use them effectively.
2. The training on the use of modern technology should target both SNE teachers and students with visual impairments.

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