ASSISTIVE TECHNOLOGY AND ACCESS TO QUALITY INSTRUCTION FOR BLIND AND VISUALLY IMPAIRED STUDENTS: A COMPARATIVE STUDY OF KENYATTA UNIVERSITY, KENYA AND SYRACUSE UNIVERSITY, USA

By

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A research thesis submitted in fulfillment of the requirements for award of the degree of Doctor of Philosophy (Educational, Communication and Technology) in the school of Education of Kenyatta University

July 2013
DECLARATION

This thesis is my original work and has not been presented for the award of a degree in any other university.

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DEDICATION

To my late father Luka, my mother Eunice, to my wife Bancy and our two children Wangui and Mugo.
ACKNOWLEDGEMENT

This work would not have been possible without the assistance that I received from various dignified people and institutions that I wish to indebted. I would like to express my deep gratitude to my supervisors Dr. Edwin Ndichu Gitau, Prof. Ted Groenewegen and Prof, Alan Foley whose knowledge and generous support helped guide my work in a way that was pivotal to my growth as a scholar. My deep thanks also go to my guider Prof. Zaline Makini Campbell. Your mentorship motivated me to pursue my research with confidence.

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<tr>
<td>ACAIMPESD</td>
<td>Advisory Commission on Accessible Instructional Materials in Postsecondary Education for Students with Disabilities</td>
</tr>
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<td>ADA</td>
<td>Americans with Disability Act</td>
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<td>ADCET</td>
<td>Australian Disability Clearinghouse on Education and Training</td>
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<td>AFB</td>
<td>American Foundation for the Blind</td>
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<td>AIM</td>
<td>Accessible Instructional Material</td>
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<td>AHRC</td>
<td>Australians Human Right Commission</td>
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<td>AT</td>
<td>Assistive Technology</td>
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<td>CAST®</td>
<td>Center for Applied Special Technology</td>
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<td>DCL</td>
<td>Dear Colleagues Letter</td>
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<td>DDA</td>
<td>Disability Discrimination Act</td>
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<td>ETD</td>
<td>Electronic Transfer of Data</td>
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<td>IDEA</td>
<td>Individual with Disabilities Education Act</td>
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<td>ICT</td>
<td>Information Communication &amp; Technology</td>
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<td>KU</td>
<td>Kenyatta University</td>
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<td>McREL</td>
<td>Mid-continent Research for Education &amp; Learning</td>
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<td>NCLB</td>
<td>No Child Left Behind</td>
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<td>NCTD</td>
<td>National Center for Tactile Diagrams</td>
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<td>NFB</td>
<td>National Federation for the Blind</td>
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<td>RNIB</td>
<td>Royal National Institute of Blind</td>
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<td>NVDA</td>
<td>Non Visual Desktop Access</td>
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<td>PDA</td>
<td>Persons with Disability Ac</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<td>SU</td>
<td>Syracuse University</td>
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<td>SWD</td>
<td>Students with Disability</td>
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<td>UD</td>
<td>Universal Design</td>
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<td>UDL</td>
<td>Universal Design Learning</td>
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<td>UN</td>
<td>United Nations</td>
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<tr>
<td>VI</td>
<td>Visually Impaired</td>
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<td>WAFB</td>
<td>World Access for the Blind</td>
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University students who are blind and those who are visually impaired (VI) need to access quality instruction just like their sighted peers. Accessing quality instruction is a necessary first major step to success in their education and hence their independence. Due to the deterrent nature of blindness, students who are blind or VI require specialized and meaningful utilization of Assistive Technology (AT) for them to benefit from the instruction. With the advancements of technology, computer adapted hardware, software and other AT devices for the blind and Braille printout can make a great improvement to the education of these students. The AT for example can support active process of interactive data exploration non-Visually. Braille printout can be used as external memory aids to prevent high mental workload levels and speech synthesis can be used to access detailed information on demand. By offering both tactile and audio techniques to extract overview information efficiently, the students with blindness will function independently and effectively. Universities should therefore seize the opportunity brought by the rapidly evolving communication technologies to create flexible methods and materials that can reach the blind and VI students. This study sought to establish the extent to which the blind and VI students in universities accessed quality instruction through assistive technology available for them in the world. The study’s specific objectives were to: (i) Establish the assistive technology available for the blind students in Kenyatta University and in Syracuse University, (ii) Establish the awareness of the students about the assistive technology available for them. (iii) Determine legal policies predetermined to guarantee access of quality instructions by these students (iv) Examine how the assistive technology was employed to ensure quality instruction for the blind students in both KU and SU and (v) Establish measures taken by KU and SU to improve the utilization of the assistive technology for the blind. This research adopted a comparative case study design. The comparative study of universities in the developing countries and developed countries in this issue led to fresh, exciting insights and a deeper understanding of this phenomenon which was of central concern in these countries. In essence, the study led to the identification of gaps in knowledge about the use of the assistive technology and pointed out to possible directions that could be followed. The study interviewed 22 students who are blind and those who are visually impaired and 8 university staff who provided AT services for the students. The data for this study was gathered through the use of Questionnaire, interview protocol, Class observation guide, checklists and documentary analysis guide. These instruments were piloted in the University of Nairobi. The data that was obtained from the research instruments was analyzed manually and presented descriptively. In summary the study found out that there was a serious scarcity of AT for the students. Some of the major suggestions the study made were: enough AT be provided to the students and lecturers be in-serviced in the instructional technology and methods for the blind. Further studies in this field were also suggested. It was envisaged that the findings, recommendation and suggestions of this study would be helpful to Blind and VI students, their teachers, curriculum developers and policy makers in the area of education.
CHAPTER ONE
INTRODUCTION

1.1 Background of the Study
Accessible top quality education for the blind and visually impaired (VI) students in universities is essential. Any effort to ensure that these students receive a quality education which can prepare them to compete in the demanding high technology economy and society of the 21st Century ought to be encouraged. In this era of education inclusion and collaboration, educators of students with disabilities at 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). Technology can support much of the effort toward instruction access, participation and progress. It can facilitate the kinds of interactions that occasion instruction (Jackson, ibid). For students, technology increases independence, personal productivity and empowerment. MacCuspie (2002) affirms that many forms of technology, both “high” and “low,” can help individuals with learning disabilities capitalize on their strengths and bypass, or compensate for their disabilities.

There can be no question that the technological developments of the last few decades have dramatically increased access to information in all formats for students who are blind or visually impaired (MacCuspie 2002). However, in
higher institutions of learning, much research is needed to assist both students and teachers in making decisions about the best application of the technology to support the students acquire knowledge and skills and be able to transfer the same in their daily life (Moore, Fowler and Watson, 2007). Perhaps for the purpose of clarity in this issue, it would be important to commence by exploring consecutive development of the assistive technology for the blind and to find out the extent to which the technology has benefited the students who are blind or visually impaired in their academic work. By doing so one would be justified to pin point a gap that requires bridging.

Ever since the development of visual literacy to bridge communication gaps in space and time, the education of students who are blind and those who are visually impaired (VI) has been subject to various successive adjustments in the development of visual literacy. The earliest breakthrough in non-visual literacy was the invention of Braille that enabled the VI students and those who are blind to access content for example in written texts. The need for high dependency on memorization of the audio information was therefore reduced (Groenewegen, 2005).

In spite of this development, one major shortcoming of Braille reading is that it is slow; a problem that stems from the fact that finger reading is slower compared to visual reading. Furthermore Braille reading is linear. A major limitation of the linear approach is that it imposes upon the reader the need to trail individual words in a successive or sequential manner. This slows down
the reading–to–learn process by the learners who are blind and those who are visually impaired. Additionally, this reading approach contrasts sharply to that of visual readers (AFB, 2008). For instance, Groenewegen (2005) observes that normally in reading of pictorial presentations, sighted readers rely heavily on the constant movement between the general and the particular, the overall picture and the detail. Carney and Levin (2002) noted that the movement from a particular point to the general picture and from the general picture to a particular point is particularly important for the creation of the overall mental picture of content presented to the learners. In this case, the persons who are blind are often not able to move beyond the linear approach that is typical of spoken language and its mimicked Braille language.

The development of radio and telephone technology was a particularly important advent for the students who are blind. This audio-based technology was embraced with a lot of enthusiasm as it facilitated the development of talking books which was viewed in many respects as a more feasible alternative to Braille. The later discovery of film and television though important for persons with blindness, for them catered only for the audio channel of communication just as it were the case of radio discovery. Unfortunately, these technological inventions did not compensate fully for the lack of the visual channel and touch reading therefore remained important for the students.
Current advances in information, communication and technology (ICT) has contributed enormously in making information more accessible for users who are blind or visually impaired. According to Kildal (2008), the advent of screen reading technologies and the democratization of information through the internet created a scenario in which data are more accessible non-Visually. In addition to text display on computer screens, recent developments have availed speech input and output most importantly emanating from innovation in assistive technology (AT). This technology especially which is primarily designed for the people with blindness has assisted in enhancing the student’s spatial perception which is essential for reading in general and therefore for effective learning (Galajdova, Majeník and Simsik, 2005).

In essence, AT has special significance for both audio and tactile reading and learning in general. Whereas Braille reading prior to the advent of the assistive technology restricted readers to words only this invention creates tools that enable pictorial illustrations to accompany the Braille words. In the context of reading even for the sighted illustrations play a very important role (Curney and Levin, 2002). Moreover, Galajdova et al (ibid) stipulate that the central principle considered in education is that the visually impaired students have a right to information in an appropriate form and without facing excessive changes and/or long time delays.

In spite of the technological revolution and the policies governing accessibility of information through this technology now in force (UN, 2006, IDEA, 2004,
AT Act, 1998, ADA, 1990 and Section 504 of the Federal Rehab Act, 1973), there still exist significant instructional barriers for the learners who are blind to access quality education. Groenewegen (2005) observes that while such Information, Communication and Technology (ICT) developments are encouraging and promising for the education of visually impaired, there are also good reasons for dissatisfaction: (i) the modern technology has made little difference to the instruction of learners who are blind at all levels particularly in Kenya so far and (ii) the use of modern technology has not yet led to the learners being able to move beyond the linear approach that is typical of spoken language and its mimicked Braille digital language.

Furthermore, Kildal (2008) observes that the computer-internet revolution has relied much on and has greatly boosted the development of visual literacy compared to the tactile literacy. In case of sighted users, highly specialized data visualizations (designed to exploit human vision and visual information processing) provide quick and easy access to overview information. Additionally, it helps with the performance of various aspects of information analysis such as identifying trends, pattern and features that might be of interest. Nothing so far of this nature has been invented to enable the persons with blindness to access the information in the same way.

Research has also shown that use of tactile data as external memory aids to prevent high mental workload levels while speech helps in accessing detailed information on demand (Galajdova, 2005). Additionally, tactile pictorial
presentations enhance representation, interpretation (clarification of difficult text) and enhancement of memory. Carney et al, (2002) and Kildal, (2008), affirm that this aspect of learning is still lacking for the students who are blind. Furthermore, the challenges are enhanced barriers to the provision of a wide array of online material as well as the traditional paper-based material for the blind students. Securing original material in time for other production for example in braille format is still a great challenge (AHRC, 2002).

In addition to these AT barriers, research has shown that by its nature blindness presents obstacles that might greatly affect access to quality education. For example, understanding of information and application of the lessons derived from the information requires a developed cognitive ability. In their study about cognitive education for the blind, Gauzman and Kozulin, (1998) found that the learners who are blind are faced by major cognitive problems. They observed that the first of the cognitive problems is related to the difference between the concurrent character of visual perception and the successive character of tactile perception. The authors also assert that the second problem stalks from the process of concept formation in learners who are blind which is dominated by two extremes: (i) extremely abstract verbal notions that have minimal support in the learners' experience, and (ii) extremely concrete tactile images of every-day life objects that hold little potential for generalization.
Due to this, the everyday concepts that possess a certain degree of generality are normally under-represented in the cognitive range of the learners who are blind. It was also noted that the third cognitive problem is directly related to the principal methods of instruction for the learners who are blind that virtually exclude two-dimensional schematic representations of objects and processes such as diagrams, charts, plans and maps (tactile graphics). It is therefore arguable that many of the cognitive tools used by sighted students remain underdeveloped in the learners who are blind or visually impaired.

Due to the aforementioned apparent lack of access of AT for the blind, the learners’ cognition problems and the inadequacies of instructional practices by their instructors, Barfield (2003) observes that productivity for these special needs students often suffers and lags behind other students in the learning situation. One would argue that students who suffer most are those in University and other colleges of higher learning because they are often subjected to learning situations where they are expected to work intensively and independently. The long-term effect of this is the apparent lack of employment of the graduates who are blind which has for a long time been invariably blamed on lack of relevant and quality university education of the graduates and the skills required in the labour market (Alade and Eni-Olurunda, 2005). This eventually leads to social inequality; increased dependence, lack of security, inequality of opportunity and low quality of life for the students who are blind or visually impaired.
Efforts have been made to address this problem. To begin with, it is universally agreed that students regardless of their disabilities be educated to the highest level of their ability. In the United States of America (USA) for example, there are several laws that strongly advocate that all learners with disabilities should be given equal opportunity as their fellow non-disabled students in learning situations. One of the laws is the Individual with Disability Education Act (IDEA, 2004) which states that students with disabilities be educated alongside nondisabled students in the general education setting to the maximum extent appropriate. This law emphasizes the use of assistive technology to ensure that every student with disability is given equal opportunity to learn together with others in an inclusive setting.

However, the IDEA grants equal access to education to students with disabilities and further provides additional special education services and procedural safeguards. Another current law which further emphasizes this aspect of educating the people with disabilities is the No Child Left Behind (NCLB, 2002). The law stipulates that the inclusive educational institutions must be accountable for the performance of all students including those with disabilities. Also, the Assistive Technology Act of 1998 stipulates that AT should be accessible to students with disabilities and the appropriate services must be provided for the maximum use of the technology.

Under the Americans with Disabilities Act (ADA, 1990) and section 504 of the Rehabilitation Act (Rehab Act 1973), colleges and universities are
prohibited from excluding qualified persons with disabilities from their programs, services, and benefits by reason of their disability. They are thus responsible for establishing practices that allow students with disabilities to have meaningful opportunities to participate in and benefit from higher education. For this to be realized, research has shown that it requires a variety of supports. These include, “philosophy, policies, people, materials, assistive technology and curricula” (Innes, Archibald and Murphy 2004).

Apart from the American laws, the passage of the Commonwealth Disability Discrimination Act (DDA, 1992) provided a uniform legislative framework to ensure that people with disability have the same rights to participate in educational and community life. Following this, the Government of Kenya in the year 2003 passed the Persons with Disability Act (PDA). The act was predetermined to prohibit all manner of discrimination against persons with disabilities. In education matters, Section 18 of the PDA stipulates that: (1) No person or learning institution shall deny admission to a person with disability to any course of study by reason only of such disability, if the person has the ability to acquire substantial learning in that course; (2) Learning institutions shall take into account the special needs of persons with disabilities with respect to the entry requirements, pass marks, curriculum, examinations, auxiliary services, use of school facilities, class schedules, physical education requirements and other similar considerations (Kenya Law Reports, n.d).
In spite of these laws; one would argue that none of them guarantee quality of instruction for the blind and VI students in the universities. On the legal basis in the USA, IDEA requires student success. In this case curricula can be modified and outcomes varied. Unfortunately in higher education all that is required is non-discrimination. Although universities in USA are compelled by law (Section 504 of the Federal Rehab Act of 1973) not to discriminate against students with disabilities on the basis of their disability, it merely ensures that students with disabilities (SWD) have the same access to instruction “good or poor”, that their peers without disabilities have. Equally, in Kenya, the PDA provides a very general explanation of the practices that are discriminatory (Opini, 2012). Furthermore, Mugo, Oranga and Singhal (2010) argued that while there is emphasis on the admission of SWD to the universities, there is no clear directive to the universities to offer quality support and accommodations. In essence, the quality and the quantity of the students support is done at the discretion of the universities.

In a situation like this, where the laws and policies are not clear, Goffman (1963) in his Stigma Theory postulates that the dominant group which is always there in every society will dominate. He explains that the dominant group exerts their power over the group they deem inferior and hence exercise authority over them. The domination limits the groups (inferior) access to wealth, and other opportunities in society. In the case of this study Students with disabilities would be over dominated by those in authority including the university administrations, lecturers, other staff and even their colleagues who
are able bodied. At this point, a pertinent question one may ask is; which legal (or practical) requirement is so far put in place for access to or guarantee quality instruction in the universities?

Following this, many universities in the world for considerable periods of time have in their own ways endeavoured to offer academic opportunities for students who are blind and those who are visually impaired. However the quality of education offered to these students is an issue that at this point requires investigation. Majorly, the universities are required to use AT to provide learning material in accessible format for the increasing numbers of blind students studying a great diversity of subjects. According to Australian Human Rights and Equal Opportunity Commission (AHRC, 2002), with the advanced technology in publishing, broadcasting telecommunications and computing, new opportunities for innovation and creativity in the way information is gathered, processed and distributed in the higher education sector have emerged. For example new methods of course delivery are being implemented, emphasizing online and multimedia components. Moreover, academic libraries are rapidly evolving into electronic information apertures that provide users with access to vast amounts of data and information. It is also evident that publishers are using and are further exploring ways of making their products available in electronic formats (AHRC, ibid). What one may need to find out is whether the SWD are benefiting from this important development.
In terms of instruction, use of the Universal Design (UD) has proved to a large extent an effective way to offer quality instruction for all students in primary and secondary levels of education in USA (CAST, 2010). Rose & Meyer, (2002) assert that the three principles of Universal Design for Learning (UDL) are important in guiding the designing of flexible curricula by the use of options that support differences in recognition, strategic, and affective networks. They call for: (i) provision of multiple and flexible methods of presentation to support recognition learning, (ii) provision of multiple and flexible methods of expression and apprenticeship to support strategic learning, and (iii) provision of multiple and flexible options for engagement to support affective learning. They argue that by using these three principles, one is able to meet and make flexible all aspects of the curriculum which are: goals, methods, materials, and assessments.

Further, Rose and Dolan (2000) observed that a variety of media, formats, and response options should be used so that a student’s knowledge and skills are not perplexed by his or her ability with the medium. One would at this point argue that the UD approach to instruction has proven useful. It could therefore be suggested that the UD based instruction for students with visual impairments could benefit other students at the university level of education. To this extent, one realizes the need for a study to find out how the universities are managing the challenge of utilizing the AT for the blind to ensure quality instruction. In essence, this study is aimed at investigating challenges facing
the universities’ students and faculty members in the utilization of the assistive technology for the instruction of the blind and the intervention measures in place to address these challenges. It was then apparent that in order to get a wider and clear picture of this phenomenon for this study to make a comparative case study between the developing countries and the developed countries. Since this would be a very wide geographical area for a study, for the purpose of in-depth data the study selected one university in developed countries and one university in the developing countries. In this context the study was conducted at Syracuse University in USA and Kenyatta University in Kenya.

Syracuse University (SU) has a long tradition of leadership in the field of special education and is recognized nationally and internationally. The university offered one of the first comprehensive programs of its kind in the United States and continues to be recognized for its leadership and vision in inclusive education. Throughout its fifty years of history, faculty and students in the program have engaged in critically important educational issues and concerns. Syracuse University was among the first universities in the world to bring attention to the educational needs of students with disabilities and to effectively develop and refine assessment and educational strategies for the diverse learners (School of education, 2012). Due to its status in the history of special education in USA and in the world, the university was envisaged to offer rich information for this study.
On the other hand, Kenyatta University (KU) which is situated in Nairobi Kenya has a similar history in the area of special education to that of Syracuse University. It led in the establishment of special education among Universities in Kenya and in the whole of East Africa. The department of Special Education was established in the University in 1995. However, KU has a history of educating students with disabilities since its inauguration in 1985. KU continues to lead in the education of students with disabilities in East and South of Sahara Africa. The University houses the largest number of students with disabilities among the universities in the region (Deans Office, School of Education, 2012). Due to its history of handling the students with disabilities and by the fact that the University has a well-established special education program, the University could be a rich ground for this study.

In concluding this discussion one would in summary highlight four major points from the discussion. First, Assistive technology is very important for the access of quality instruction for the blind students in universities. With the changing mode of content delivery through instructional Technology (ICT) by lecturers in universities and due to the deterrent nature of blindness, students who are blind and those who are visually impaired require specialized and meaningful utilization of the technology for them to benefit from the instruction. Furthermore, the students must be equipped with an array of skills to use the AT for them to reap maximum benefit from instruction in the university.
Second, utilization of assistive technology for the blind has encountered and continues to be faced by challenges which have denied the students opportunity to participate fully in their education. The challenges are not exclusive of the developed countries but it is a problem facing the higher education for the blind and visually impaired all over the world. Third, the development in modern technology has made little difference to the education and training of visually impaired learners at all levels especially in developing countries Kenya included. For example, so far the technology has not yet led to learners who are blind being able to move beyond the linear approach that is typical of spoken language and its mimicked Braille digital language.

Fourth, in the context utilization of AT in instruction, the importance of a Universal Design and in particular the (UDL) is overwhelming. The implication here is that the learners who are blind for them to receive top quality university education must be instructed following UDL principals and the instruction has to be governed by legal and institutional policies to guarantee the quality of instruction.

These points lead to the following research insights: (i) The extent to which the blind and visually impaired students in universities access quality instruction through assistive technology available for them needed to be investigated. (iii) A comparative study of universities in the third world countries and first world countries in this issue would lead to fresh, exciting insights and a deeper understanding of this phenomenon which was of central concern in these
countries and (iii) it was envisaged that the study would lead to the identification of gaps in knowledge about the use of the assistive technology and would point to possible directions that could be followed.

It is therefore against this background that this study aimed to explore ways in which assistive technology combined synergistically with instructional practices, would ensure that the blind and the VI students in the universities access quality instruction and gain educational experiences that are of as high quality as to those of their sighted counterparts as possible.

1.2 Statement of the problem

Students who are blind in the universities miss the opportunity of getting quality instruction. They face many and varied difficulties in their studies especially in accessing information for their studies. In the university, students are expected to interact with large amounts of information and most of the time independently. Due to the deterrent nature of blindness, these students require specialized and meaningful utilization of assistive technology for them to benefit from the instruction in the university. Studies have shown that the universities have been facing challenges in the utilization of the assistive technology (Smith, 2010; Galajdova et al, 2005; MacCuspie, 2002). As a result, the students lag behind their sighted peers in terms of education.
Appropriate utilization of assistive technology would lead to quality instruction for the blind in the university and hence rescue the students from deprived education and possibly from redundancy and poverty. This would be possible when the assistive technology is available, the curriculum is well designed and policies appropriate for the utilization of the Technology are put in place and strictly followed to enhance accessibility. Moreover, students should be equipped with the knowledge and skills to use the technology. Given that there are currently noticeable and accessible assistive technological devices and software (Jackson, 2004) it is imperative that the universities seize the opportunity brought by the rapidly evolving communication technologies to create flexible methods and materials that can reach the blind and visually impaired students. A study to determine the extent to which the technology forestalls the problems faced by the students in their learning in the universities was therefore viable. This study was therefore set to find out the extent to which universities utilized the Assistive Technology for the blind to ensure quality instruction for the students.

1.2.1 Purpose of the Study

The drive of this study was to examine the challenges facing utilization of assistive technology for the blind in universities and to identify measures being taken to ensure quality instruction for the blind and visually impaired students in developing and in developed countries. The study compared
Syracuse University and Kenyatta University to learn more about how the universities provided technology and instruction to the blind and VI students.

1.3 Objectives of the study

This study was guided by the following specific objectives:

i. (a) To investigate the assistive technology available for the blind students at Kenyatta University,

(b) To investigate the assistive technology available for the blind students at Syracuse University,

ii. (a) To establish the level of awareness of the students about the assistive technology available for them,

(b) To establish the awareness of staff about the assistive technology available for their use,

iii. (a) To investigate how the assistive technology is being employed to ensure quality instruction for the blind students in KU,

(b) To investigate how the assistive technology is being employed to ensure quality instruction for the blind students in SU,

iv. To establish policy and practical requirements primed to guarantee quality instruction for the blind and visually impaired students in the universities, and

v. To explore the ways in which university lecturers design and conduct their instruction to ensure the blind and the VI students learn best in the universities.
1.4 Research questions

The main questions for this study were; which challenges were facing the universities’ students and faculty members in the utilization of the assistive technology for quality instruction and how were these challenges being addressed? To answer these major questions, the study was by guided by the following subset questions:

i. (a) Which assistive technology is available for use by the visually impaired at KU?
   (b) Which assistive technology is available for use by the visually impaired at SU?

ii. (a) Which existing assistive technology are the students aware about for their use?
    (b) Which existing assistive technology are faculty members aware about for their use?

iii. (a) How is assistive technology being utilized to ensure access to quality instruction for the blind and visually impaired students in KU
    (b) How is assistive technology being utilized to ensure access to quality instruction for the blind and visually impaired students in SU?

iv. Which institutional policies are put in place to guarantee quality instruction of the blind and visually impaired student in the universities?

v. How do the lecturers design and conduct their instructions to ensure the blind and the VI learn best in the universities?
1.5 Justification of the study

The goal of enrolment of learners who are blind or visually impaired into university courses in Kenya and in USA is that the students acquire knowledge and skills which, though somewhat different perhaps from the students who are sighted, enables them to be as competent and as efficient as their sighted counterparts. The people who obviously should first realize this requirement are lecturers. They should have the knowledge of course(s) they offer and more so they should be able to competently use special pedagogic and andragogic strategies with the learners to enable them acquire new dispositions, master concepts and be able to use what they learn in their daily lives.

The lecturers, however, often find themselves confronted with the presence of a few students who are blind among a large group of sighted students. When the lecturers find themselves in this challenging situation, what perhaps they reasonably are expected to do is (i) to consult some research reports or probably some well-informed articles of professionals employed to give services for the blind students to give them guidance and (ii) to effectively design flexible and accommodating instruction and utilize the existing assistive technology with the blind and the visually impaired students. For this to be done effectively, legal practical and even precise institution policies ought to be in place to guarantee quality instruction for the students. The laws
and policies would prohibit any discrimination, stigmatization or negligence in provision of service and instruction for the students.

Unfortunately, research has shown that there exist problems that have for quite some time slowed down access to quality instruction for the blind students especially in universities. According to Groenewegen (2005), the development of research into instructional technology that is most appropriate and effective for the teaching of the visually impaired learners in Kenya over the last decade has stagnated especially in light of significant developments in information and communication technology (ICT). Moreover, there has been an outcry in both developed and in the developing countries that utilization of the AT and quality of education for the blind is compromised in universities (Smith, 2010). This study was therefore done at a time when there was dire need for quality instruction for students who are blind and visually impaired in the universities. The study explored how the technology in particular assistive technology for the blind was being utilized to enhance the education of these students in Universities both in developing countries and in the developed countries. Particularly this study explored this phenomenon by comparing Syracuse University and Kenyatta University.
1.6 **Scope and Limitations of the study**

The scope and limitations of this study were as follows.

1.6.1 **Scope of the study**

This study confined itself to the education of students who are blind and those who are visually impaired in universities. The touch readers especially are affected severely in the acquisition of knowledge, skills and values, and more so in gathering information for their academic work. The study focused on intervention measures through assistive technology and instructional approaches that would assist the visually impaired students to acquire quality instruction in the universities. In essence, the study endeavored to establish effective ways of enabling the students reap maximum benefits from instruction in the universities.

1.6.2 **Limitations of the study**

The following were limitations of this study:

i. While there are many universities in both developing and developed countries, the study gathered data in only two universities. This would determine the extent to which the findings of this study could be generalized.

ii. The research was limited to only assistive technology for the blind and instructions for the students in universities while there are other students with different disabilities studying in universities.
iii. The study was based in education for the blind and visually impaired students in the universities while the education of these students at lower levels of schooling also requires quality instruction especially in the developing countries.

1.7 Theoretical and Conceptual framework

The theoretical and conceptual frameworks presented here were used to enable deeper understanding of the central phenomenon of this study and to guide the aim of the study.

1.7.1 Theoretical framework

The theoretical framework underpinning this study was Goffman’s theory of stigma. Goffman, (1963) postulates that in every society, some persons have greater power than others and that those with power generally impose their norms, values, and beliefs on those who lack the power. In the case of this study, those with power (able bodied) set the standards that are to be expected of everybody within a given culture. If an individual does not correspond with the set standards the individual is perceived as being “deviant” (Goffman, 1963). In his theory, Goffman identifies three forms of stigma: (i) abominations of the body or various physical deformities, (ii) blemishes of character or weak will, domineering or unnatural beliefs, values and attitudes, and (iii) tribal stigma or race, nation and religion. Individuals who possess any
of these three occurrences of stigma are labeled as having “undesired differentness.” and hence are less powerful and unwanted.

In essence, (Goffman, 1963; Ainlay, Becker, and Coleman, 1986) postulate that dominant groups construct stereotypes which stigmatize groups that they deem inferior and thus facilitate the exercising of authority over them. For example, (Tompkins, 1996, p. 38) noted that terms such as ‘‘cripple’, ‘crip’ and ‘gimp’ and descriptors such as ‘victim’, ‘unfortunate’ and ‘helpless’ are used, wittingly or unwittingly, to reinforce the status of people with disabilities in society”. This goes further to stigmatize and even deny opportunities for the people with disability. In support of this, (Titchkosky, 2003) contends that the presence of disability within inaccessible environments is a clear message that the environment was not intended for the disabled individuals.

Goffman’s theory does not provide further explanations as to why society negatively responds to people with disabilities (Oliver, 1990; Titchkosky, 2003). However, his work still informs the promising field of disability studies in the social sciences (Garland-Thomson, 1997). Goffman’s theory shows that disability is a result of complex intersecting social and cultural relations. It hence provides an understanding of the ways power relationships between the people with disabilities and those without disabilities are structured. The domination limits people with disabilities’ access to wealth, and other opportunities in society. Further, this theory promotes a critical engagement with the relations of power embedded in institutions/structures in the society.
that serve to reproduce and maintain social discrimination and inequities (Vicki, 2012). Considering this viewpoint in understanding obstacles students with visual impairments face in accessing quality education in universities was imperative.

1.7.2 Conceptual framework

The essence of educating persons who are blind and visually impaired is to increase their independence, security, equality of opportunity and quality of life. Teachers of the visually impaired are therefore concerned with helping their learners to acquire knowledge, skills and values just as is the case for the sighted students. Furthermore, in order to assist these learners to effectively apply their knowledge and experiences from the education in their daily life, several factors must be considered. Some of the main factors were considered in this study. This study was therefore conceptualized as presented in the following framework.
Figure 1.1 Conceptual framework: Enhancing Education for Learners who are Blind and those who are Visually impaired.

![Conceptual framework diagram]

Source: Researcher designed

Education of visually impaired students is influenced by several factors some of which operate independently (independent factors) and others dependently (dependent factors). For the purpose of this study, the independent factors were lack of sight or deficiency in both audio and tactile channels of communication, Availability and quality of the AT for the Blind and legal policies set to ensure quality education for these learners in the universities. These factors influence the acquisition of information, interpretation of the information and application of experiences by the Blind and the VI students.
(proximate factors). The proximate factors when proper intervention is done through for example utilization of a wide range of assistive technological applications and the use of well-designed and flexible instructional approaches to the teaching of the learners who are blind or VI would determine subsequent effects on the acquisition of knowledge, skills and values and the gathering of information by the students. This would then ensure quality education for the blind and the VI students. The quality education definitely leads to increased independence, security, equality of opportunity, and quality of life for the blind and the VI graduates.

1.8 Operational Definition of Key Terms

Assistive technology for the blind: This is an interdisciplinary field of knowledge comprising products, resources, methodologies, strategies, practices and services that are set to promote functionality for visually impaired people with regard to autonomy, independence, quality of life and social inclusion.

Assistive technology service: means any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device

Andragogy: This term refers to instruction and learning of adults. It slightly differs from pedagogy in that the concern of pedagogy is with transmitting the content, while in andragogy, the concern is with facilitating the acquisition of the content.
Explore: implies a stronger sense of powerful search. It involves having some kind of objectives and it leaves room for having a strategy to accomplish that objective.

ICT (information and communication technology): is an umbrella term that includes any communication device or application, encompassing radio, television, cellular phone, computer and network hardware and software, etc. as well as the various services associated with them such as videoconferencing. The importance of ICT lies more in its ability to create greater access to information and communication rather than the technology itself.

Pedagogic or andragogy strategies: this phrase refers to plans (strategies) of instructions, or a style of instruction.

Proximate factors: those that are not distant and abstract but close to the phenomenon one is trying to study. They mirror the particular context in which the phenomenon occurs and deal with people experiences of that context.

Tactile reading: reading by touch: in broader sense reading involves accessing, recognition and interpretation of text where text means words or pictorial presentations.

Touch readers: Persons with severe visual problems or those without sight at all who read by touching for example reading of Braille using fingers. This term is used synonymously and interchangeably with blind and visually impaired in this research proposal
Visually impaired person: Refers to a person who has impairment of visual function which cannot be improved by the use of corrective lenses to a level that would normally be acceptable for reading without a special level or kind of light or who is unable through physical disability, to focus or move his eyes to the extent that would normally be acceptable for visual reading.

1.9 Chapter Summary

This chapter has explained cogently what prompted this research study. It also clearly stated the problem of the study and the objectives of the study showing what the study was set out to achieve. The justification of the study was also evidently outlined as well as the scope and limitations of the study. The theoretical framework underpinning this study has also been explained as well as the framework of how this study could be conceptualized. The scope and limitations of this study were also highlighted as well as the basic assumptions of the study. Finally in this chapter the operational definition of terms used in the entire study has been done.
CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The previous chapter introduced the topic of the study and laid out the research questions. This chapter will review the literature relevant to the study. The literature presented here focuses broadly on research done worldwide in support of the education of visually impaired students. It examines challenges facing their education. The focus will be on the following questions: (i) Which assistive technology is available for use by the visually impaired students (ii) Which existing assistive technology are the students and faculty members aware about for their use? (iii) How is assistive technology being utilized to ensure access to quality instruction for the blind and visually impaired (VI) students in KU and in SU? (iv) Which institutional policies are put in place to guarantee quality instruction of the blind and visually impaired student at the universities? (v) How do lecturers design and conduct their instruction to ensure the blind and the VI learn best in the universities?

The literature is organized in the following sections: (i) Comparison between three major channels of communication in the facilitation of learning by visually impaired, (ii) Effects of blindness on mastery of concepts and understanding of relationships, (iii) Use of Braille as a system of communication, and (iv) Instructional approaches in education for the visually impaired.
impaired. (v) Assistive technology and communication for visually impaired, its impact on education and work opportunities, (iv) Provision of Assistive Technology for the blind and visually impaired, (vii) challenges facing teachers or learners in the use of assistive technology and the chapter ends with a summary of existing gap in the literature.

2.2 **Comparison between channels of communication in the facilitation of learning by the blind and VI students**

Considering the scenario in which the teachers facilitate learning to their blind and visually impaired students, it is imperative to attend to the sensory channels commonly used in facilitating the acquisition of new dispositions by the learners (Groenewegen, 2005). Even though the learners who are blind and those who are visually impaired lack the visual ability, to make a precise comparison in the way the sensory channels transmit information, it is an obvious act to access the benefits of the visual channel which for a long time has been advanced to cater for sighted students. In addition, it is important to analyze the implication of the lack of this channel by the visually impaired students.

The first phenomenon to be considered in this case is probably the rate of transmission characteristic of the visual, tactile and the audio channels. In the real sense, the visual channel in most of its modalities has a transmission rate that is receiver determined. A person who is pictorially literate can read
pictures with a considerable speed understand diagrams at a glance and thereby grasp fairly abstract and very concrete communication at a very high speed. Koenig (1996) asserts that a person who has a well-developed literacy skill can, by reading take in ideas at a rate of 300 to 400 words per minute and may have learnt to scan texts for ideas even faster. Contrary to this, other sensory channels and especially the hearing channel transmit at a rate determined by the sender. Or if they are determined by the receiver, such as touch in reading Braille, the rate is much slower. Gordon, Madison and Mansfield (2000) observed that Braille readers can take in ideas at a rate of 90 to 120 words per minute. Although it is technically possible for touch readers to “read” pictures and diagrams that are tactile and feel special Braille text layout, according to Groenewegen (2005), in Kenya this basic literacy education does not feature significantly in the development of these skills.

The second phenomenon that attracts attention in the teaching/learning situation is the permanency of learning stimulus. In considering the permanency of the visual stimulus, we refer to the fact that in the context of instructional technology most of visual aids are potentially lasting stimuli to the learners. For example, when the teacher displays a map or a diagram or even draws a sketch on the chalkboard, this visual aid stays on display throughout the lesson and keeps working as a stimulus to the learner. With the fast growing human reliance on visual symbols, the tactile channel which tends to imitate the visual channel should be enhanced in order to bridge the spatial concepts that come about due to lack of sight. The tactile channel tends
to have much more permanency compared to audio channel. However, the tactile channel is linear in that a touch reader can touch only one spot at a time. It is therefore difficult for the touch reader to rapidly get a comprehensive understanding of pictorial presentations. Compared to other sensory channels, the auditory channel tends to generate fleeting stimuli with little permanency (Galajdova et al, 2004).

Another phenomenon that can be highlighted in the use of sensory channels in the teaching-learning situation is the comprehensiveness or linearity characteristic of the processing of messages. The visual channel is capable of presenting information in both a linear and comprehensive way. For example, the visual symbol channel and the audio symbol channel are tied to the linear approach whereas the visual realia, visual picture and the visual diagram channels are capable of seeing a comprehensive picture instantly. According to Scherer (1993) the tactile channel could be made to mimic picture and diagrams hence presenting a comprehensive picture, but the fingers are only capable of touching one detail at a time. In this case the comprehensive view is not instant but has elements of linearity. It is important to realize that in most learning situations we constantly move from the general to the particular (deduction) and from particular to general (induction). In essence, we keep alternating between linear approach and general picture. We can then conclude that visually impaired students have no problem with the linear approach but are at serious disadvantage regarding the comprehensive picture.
Capacity for abstraction is another characteristic of the sensory channels that should be highlighted. Groenewegen (2005) asserts that words lend themselves to abstraction while realia for example tend to be the opposite. To be precise, let us rank the four modalities of these channels from concrete to abstract. Realia refers to the phenomena and events that we observe and experience in life. They are concrete and give rise to direct experience. Pictures represent these real concrete things by resemblance. Actually the closest resemblance we get is from photographs which are a very accurate record of reality. Diagrams certainly are really abstract representation of reality although they still have elements of resemblance. Diagrams can be made tactile and can also be labeled. Actually visual practice in use of diagrams is that parts of diagrams are labeled. This means that the diagram modality and the symbol modality are combined. The diagrams designed for the visually impaired learners are less detailed compared to those designed for the sighted because Braille characters take bigger space compared to regular lettering (NCTD 2003).

Perhaps the last modality to attend to in this concept is symbol modality. Symbols are the most abstract ways of representing reality. They represent reality by pure convention. It is not typical of symbols that there is such physical resemblance they represent. This means one has to learn to read and write the symbols and the level of mastery will obviously determine the rate at which one can process messages with them. With the tactile sense having less
physical capacity in taking in information as compared to the visual channel, the visually impaired is left at a disadvantage.

In considering public transmission capacity of communication of the sensory channels, both sound and visuals lend themselves to public transmission. The tactile channel is different. According to Groenewegen (2005) tactile pictures, diagrams and even Braille text can be mass produced but the reception of such communication is an individual affair. Although computer technology is currently able to combine tactile presentations with sound and thus gearing them towards public transmission/reception, the problem in this technology is the rapidly growing number of new symbols that have no Braille equivalents.

The last perspective we could highlight is attention option available in different channels. The attention option largely depends on the physical capacity of the various channels. For example, the sense of sight has the physical capacity of taking in three million bits per second from the 180 degree angle that is physically visible in the environment (Fuller and Applewhite, 1997). A person is not able to process the enormous amount of information and therefore focuses the attention or attends to some details. This means that the person with sight has more options to choose from. We learn more and accurately master skills and information by paying attention to a particular thing and inclining to think of all the other options as potential distracters. The physical capacity of the ears to take in information is not even one percent of that of the visual sense. This means there are far fewer options
to choose from and fewer distractions. More so, the physical capacity of tactile sense is only a fraction of that of the sense of hearing (Fuller, 1997). One can then conclude that persons who are visually impaired though having the same capacity to process information have fewer options compared to the sighted when it comes to choosing to attend to specific things. Also, the person has fewer distractions.

To compensate for the limitations of the audio and tactile channels and lack of sight by the Blind students in education, research has been conducted on the best way to offer instructions to these students. The research which catches the eyes of any educator could be that which emanated from the concept of Universal Design (UD) from the architecture and product development in 1980s. Traditionally, the focus was on helping an individual through assistive technology to adapt themselves and overcome their disabilities (CAST 2011).

The multisensory approach to the education of the blind was hence used where the AT was used as a compensatory tool and skill building software to assist the students to adapt themselves to a fixed curriculum. According to CAST, it was later realized that “environment determines who is and who is not disabled”. Further research led to the shifting of burden of adaptation to the curriculum rather than on the students with the disability. The research eventually led to the Universal Design for Learning (UDL) principles which go deeper than merely focusing on physical access to the classroom; but they also focus on access to all aspects of learning.
The research described here could be said to offer great solutions for the students with disabilities and also to all other students. As CAST put it, the goal of education in the 21st century is not simply the mastery of content knowledge or use of new technologies. It is the mastery of the learning process. Education should therefore help turn novice learners into expert learners.

It is true that if the students with disabilities are assisted to obtain the tools that will enable them learn better and independently throughout their lives, these learners would not only benefit more from their instructions in the learning institutions but they would also lead more independent and wealthier lives after schooling. This contemporary approach of educating the students with disabilities could be said to be very fruitful but a pertinent question one would ask at this point is how the approach is being implemented in the education for the blind and visually impaired (VI) students in the Universities in both the developing and in the developed countries. Even when this is to be done, the knowledge of how blindness affects learning by the educators is essential.

The literature reviewed in this section is important for question five of this study. The section gives some directions on what professors in support of the Assistive technology service providers in universities should consider in their endeavor to ensure that the students benefit fully from their instructions. Although the literature suggests use of the best teaching practices through the Universal Design for Learning (UDL) there is no study that has been
conducted on how this is being practically done in real classes. This study will therefore observe in the real classes to establish how the professors practically accommodate the blind and the visually impaired students in their instructions to ensure that they get the best of the instructions.

For the observation to be fruitful and for the instructions to be beneficial to the blind and the visually impaired students, it would be imperative to find out the effect of blindness on learning. The following section explores literature about this issue.

2.3 Effect of blindness on mastery of concepts and understanding of relationships

Lack of sight is an obvious barrier to the acquisition of new dispositions by the students who are blind or visually impaired (Barry, 1997). Perhaps to conceptualize this affirmation, the pertinent question that one needs to ask is: how does someone who is congenitally blind get intellectual access or clear descriptive relationship to objects and experiences from the real environment? Unfortunately, the visually impaired and especially those without sight at all, have a great problem of spatial concepts and this hinders their orientation to the environment (BATS, 2008; Barry, 1997). This means that especially the congenitally blind lacks enough knowledge of objects and experiences from the real world. Conceptualization of that which does not have a clear descriptive relationship to objects and/ or experiences in the world is only
possible through the creation of imagination. Cowenfeld (1951) asserts that
the ability to give object form to the creation of the imagination does not
wholly depend on the capacity to see and observe things. What it depends on
ultimately are the types of experiences the person has of his/her world. To gain
the experience of the world, the persons who are blind or visually impaired
need to have the ability to navigate space independently, safely and efficiently.
This could be made possible through enriched instruction where a variety of
AT and flexible pedagogical methods are employed.

The ability to navigate space independently, safely and efficiently is a
combined product of motor, sensory and cognitive skills. This ability has a
direct influence on the individuals’ experience of the world and hence quality
of life. Mental mapping of spaces, and of the possible paths for navigating
through these spaces, is essential for the development of efficient orientation
in the environment. Most of the information required for this mental mapping
is visual information (Barry 1997, Lynch 1960). People who are blind lack this
crucial information, thus facing great difficulties (i) in generating efficient
mental maps of spaces, and therefore (ii) in navigating efficiently within these
spaces. A result of this deficit in navigational capability is that many people
who are blind become passive persons, depending on others for continuous
aid. As a result a person who is blind is may be left behind in terms of
environmental experiences.
Spencer (1996) indicates that support for the acquisition of spatial mapping and orientation skills should be supplied at two main levels: perceptual and conceptual levels. At the perceptual level, the deficiency in the visual channel should be compensated with information perceived via other senses, for example, touch and hearing. Touch sense information appears to be essential for appropriate spatial performance (Way and Barner (1996). In a broader sense, Hill et al. (1993) observes that, touch encompasses tactual as well as kinesthetic information, or a sense of position, motion and force. He asserts that for people who are blind, physical environmental information is commonly supplied by the cane for low-resolution, scanning of the immediate surroundings, by palms and fingers for fine recognition of objects' form, textures, and location, and by the legs regarding surface information. Hill notes that the auditory channel supplies complementary information about events, the presence of other people (or machines or animals) in the environment, materials which objects are made of, or estimates of distances within a space.

At the conceptual level, the focus therefore should be on appropriate strategies for an efficient mapping of the space and the generation of navigation paths. Research shows that two main scanning strategies used by people are route and map strategies. Hill et al (1993) explains that route strategies are based in linear (therefore sequential) recognition of spatial features while map strategies, considered to be more efficient than the former, are holistic in nature, comprising multiple perspectives of the target space. In this sense, Hill
et al. assert that people who are blind use mainly route strategies while recognizing and navigating new spaces. Kitchin and Jacobson (1997) affirm that the supply of appropriate spatial information through compensatory sensorial channels, as an alternative to the (impaired) visual channel, may contribute to the mental mapping of spaces and consequently, to visually impaired people’s spatial performance. Key (1984) had observed that with the advent of sonar technology, use of sensory aids for orientation and mobility for example binaural sensory aids which include obstacle detector, mowat sensors and autistic imaging sensor for example laser cane enhanced the environmental orientation by the people who are blind.

The problem here is that the technology is focused in compensating for the lack of loss and therefore helping the blind person to adapt to the environment. Equally, the environment should be adapted after all; according to CAST many barriers to learning emanate from the environment. Johan, 2008 finds out that in spite of these technological innovations there still exist significant barriers for the learners who are blind and those who are visually impaired to access most of the common types of information.

This brings one back to the concept of UDL. To help the student effectively master concepts, it will definitely require proper use of AT in the instruction of the blind and the VI students. This is more so when the instruction is guided by the UDL principals as discussed in the section of strategies for teaching the blind students in this review. These learners for instance need to be assisted in
accessing overview data, to explore as well as to analyze complex information for them to benefit from the education. With a well-planned instruction of courses aided by the use of the AT, these students will benefit more from the education.

This section dealt with the three questions of the study. Which available AT are faculty and students aware of for their use, how is the AT being utilized in the instructions and how do professors plan and deliver information to the students. The glaring finding is that despite the development of the AT students who are visually impaired still lag behind their sighted peers. In this case this study is justified to gather information from the students, faculty members offering AT services in the universities and to observe what goes on in the classroom. This will go a long way in attempting to bridge this gap of knowledge.

Also at this point one would be eager to find out more about the instructional practices that research has found promising for these students. However even before reviewing the instructional approaches that have been employed for the blind and VI over time, it would be imperative to know how braille impacts on the learning for the blind students. This is because braille has been believed to be vital in the instruction for the blind students. The following section reviews the literature about braille as system of communication for the blind.
2.4 Use of Braille as a system of communication for visually impaired Students

Braille is a tactile code that is used instead of print as a reading and writing medium. In other words, it is a system of reading and writing for people, who are blind or visually impaired in which a varied arrangement of raised dots representing letters and numerals are identified by touch. All kinds of material can currently be put into Braille that is both digital and graphics (Cooper 2008). The braille code comprises a rectangular two-dot cell that is three dots high and two dots wide, with up to 63 combinations using one or more of these six dots. Dots are numbered from top to bottom in a Braille cell—one, two and three on the left and four, five and six on the right. Braille has only one set of letters. A Braille letter is assumed to be lowercase. To indicate that a letter is uppercase, another cell (the capital sign dot six) must precede it. To show an uppercase word, two capital signs are put in front of the word. The letters of the alphabet, numbers and basic punctuation marks are written as follows:
Note that letters ‘a’ to ‘j’ are used to make numbers. The number sign dots three-four-five-six preceding a letter makes it a number (Cooper, 2008).

Closely looking at this system of writing, one can easily identify several problems. One of the problems is that Braille is bulky. The space occupied by a single letter cannot be reduced. In other words it is not possible to reduce or enlarge the size of the writing like one would easily do with the regular writing. In addition, a single number in Braille must occupy two Braille cells. The bulkiness reduces portability of Braille material and hence restricts accessibility of information by the visually impaired students. To reduce the bulk, Braille uses contractions or abbreviations. This means that a word is not spelt out fully but represented by particular letter signs. The Braille has up to 63 combinations using one or more of the six dots cell. Memorizing all these constructions makes Braille a difficult writing to learn as compared to the print writing. Many more symbols are in print than the 63 Braille symbols can present. For example, most computer systems have 96 different symbols (Cooper 2008). Lack of equivalent symbols in braille poses a serious problem
to the students who are blind or visually impaired in terms of acquisition of new dispositions.

The most successful method of communicating complex pictorial concepts for the learners who are blind or visually impaired is use of tactile diagrams or raised images (Howell and Porter 2003). Unfortunately, Howell and Porter point out that initially Braille was only concerned with digital work. The work of creating tactile pictures, diagrams and maps (collectively ‘graphics’) especially using computer technology is a later development in which few creative educationists have the skills. This means that the students require additional skills in order for them to understand the graphics.

Training in interpretation of pictorial presentations is not only confined to the blind students. Even the sighted students may require this. However, the mastery of the skills is slower among the visually impaired as compared to the sighted because the sighted person is able to relate the pictorial representations to what the persons see in the real environment. It can also be argued that since the blind student is able to touch only one spot at a time, then exploration through the graphics will still be slower compared to that of the sighted student. Further, creation of equivalent quality graphics to those easily found in print requires high technology skills and machinery which currently is really expensive.
Because of this, the accessibility of these graphics to students is difficult. According to ADCET (2011) learners who are blind have all through been routinely provided with text materials in braille, and audio, but the graphics which accompany the text materials are often omitted or only very briefly described. In developing countries for example, the educators might not be aware of this development. Groenewegen (2005) affirms that even though technically it is possible for the visually impaired learners to ‘read’ pictures and diagrams that are tactile and to feel a special layout of braille text, in Kenya their basic literacy education does not feature the development of these skills. The students in the Universities suffer even more in comprehending concepts especially where they are required to comprehend content related to the simultaneous space and depth (Barry, 1997). This further shows that the students in the universities still undergo strenuous moments in understanding contents presented to them.

This section reveals that despite the availability of braille which actually mimics print as a system of communication, the students who are blind and those who are visually impaired continue to have barriers to access information. The research questions about the availability of AT, utilization of the AT and instructional approaches and methodologies still arise in this section. A study to help the students benefit fully from the instructions in the university is therefore required. The following section looks at what scholars and researchers have said about the instructional approaches for these students.
2.5 Instructional Approaches in Education for the Blind and visually impaired Students

Research shows that despite many decades of worthy and charitable intentions, poor education and rampant unemployment continue to leave most visually impaired people without the skills and resources to emerge from isolation, poverty, and restriction. (WAFTB, 2011). There is therefore need to ascertain the type of pedagogical and andragogical approaches that will facilitate learning, improve performance and ensure success. Education for the blind and VI students should therefore be designed in a way to put a decisive end to over dependence on their sighted counterparts. In this sense, the students should be helped to become active, self-directed and productive participants in the world. Perhaps it would be important at this point to explore the changes that have taken place in the world in an endeavor to improve the education of the blind and the VI students.

For years research has been conducted on how best the blind and the visually impaired students can learn. This is more so in the developed world led by the USA. In the past 30 years for example, research was focused on helping the students with disabilities including the blind students to adapt themselves to the environment and to the curriculum hence overcoming their disabilities. CAST (2011) concludes that the endeavor was to help the students especially to fit within the general curriculum. The assistive technology was therefore focused on compensating for the loss emanating from the disabilities and in
building up skills. This is still an important aspect of the AT in today’s education. Through research it was further found out that focusing on helping the blind and the VI or generally students with disabilities to adapt to the general curriculum was a narrow view. According to CAST, on realization that environment played a critical role in determining “who is and who is not disabled” the shift was focused towards the curriculum and its shortcomings. Research was then focused in finding out how the curriculum limitations created barriers to learning by the students with disabilities. This was a great step forward since the burden of adaptation was then placed on the curriculum and no longer on the student.

Connell et al (1997), assert that research conducted in architecture, which was on drive to design constructions with all possible users in mind and incorporate at the onset access features, inspired the adaptation of further research in education. The result of this Universal design was the establishment of the Universal Design for Learning (UDL). Rose and Meyer (2002) assert that UDL theorizes curriculum design by first considering the students’ diversity and backing up the design of the curriculum that is flexible and accommodating diverse students’ needs. In this sense, UDL emphasizes that the designing of the curriculum should consider the needs of all students at the designing stage and must construct features that support full accessibility. Moreover, the concept of UDL incorporates features that not only ensure access to information but also access to learning (Rose and Meyer,
In this aspect, Technology plays a vital role in enhancing accessibility of information and in supporting the teaching learning process.

Studies conducted in the field of neuroscience further informed the principals of UDL. For example, Rose and Meyer, (2002) found that Neuroscience research advises on the existence of three broad neural networks in the brain that superintend three ultimate facets of learning including the recognition of patterns, the planning and generation of patterns, and the selection and prioritization of patterns. UDL defines these three components as recognition, strategic, and effective networks (CAST, 2011). These also coincide with Vygotsky’s (1973 in review; Rose and Mayer, 2002) theory of learning prerequisite which are: (i) recognition of information to be learned, (ii) application of strategies to process that information and (iii) engagement of the learning task. Consideration that students differ in ability by the proponents of UDL makes it distinctive to all the previous research and theories.

The UDL principles which guide flexible design of the curriculum and which could be suggested to support quality instruction for the blind and VI in the universities, suggest implanting options that support differences in cognition, strategic and effective network. The principle describes how to go about these options. That is, to support recognition learning, the multiple, flexible methods of presentation should be employed. In the case of supporting strategic learning, multiple, flexible methods of expression and apprenticeship should
be used. Finally, to support affective learning, provision of multiple, flexible options of engagement should be ensured (Rose and Meyer, 2002). With these principles, aspects of curriculum, namely goal, methods, material and assessment are flexibly done.

Just like it is the case with all other learners, it would be argued out that quality instruction should be aimed at not simply the mastery of content knowledge and use of technology to compensate for the loss or malfunctioning of body organs. It should be mostly aimed at mastery of the learning process. In essence, the instruction should make the learner want to learn, help the learner to know what to learn strategically and give the learner the urge to learn throughout their lives. In teaching the blind and VI therefore, the teachers’ interest in this case should be more than meeting the minimum requirements for functioning and life satisfaction. They should believe in mutual respect, consideration, and accommodation of the blind or visually impaired and sighted people by the society. The educational approaches should see the blind and the VI population rise to levels of productive participation and achievement to equal that of sighted people. According to World Access for the Blind (WAFB, 2008), there is a need to develop and demonstrate the effectiveness of a modern, holistic approach to the blind and the VI students based on knowledge of human perception, and a philosophy of No Limits.
The key to effective living is how well we adapt to maximize our access to ourselves and our environment (WAFTB 2008). The first duty of the teachers of visually impaired learners is therefore to help foster students' ability to gain fully functional and esthetic access to their environment. To do this, the teachers should use perception based instruction so as to focus on a student's ability to perceive the environment more completely, process what is perceived with more sophistication, and act on the environment with greater facility. It is through optimized perception that visually impaired students can be most aware of their options, and be able to exercise them to maximum effect. With this in mind, WAFTB (2008) asserts that instructional practice for the visually impaired students should be fused with the following principals:

2.5.1 Respectful Commitment to the Needs of All Students

According to WAFTB (2008), it would not be appropriate to adapt the curriculum and the instruction rendering to the very specific needs of the students. Perception based program should not be tailored “according to the "specific" or individualized" needs of students but on the belief that all students have the same basic needs - to gain full access to their environment in order to participate fully and in a self-directed manner in society, within cultural imperatives.
WAFB (ibid) observes that traditionally the individualization requirement of educational and rehabilitation legislation has been misunderstood to mean that different students have different basic needs. These individualized needs are often determined by assessments, and written into individualized plans as outcomes. This interpretation leaves huge margins for allowing "needs" and "outcomes" to be determined according to variables not related to the student - administrative imperatives, budget, personnel availability, and teacher qualifications. By this interpretation, it can be decided that some students just don't "need" as much access to the world as others, or that meeting this need is too much trouble for some. Sufficient instruction, technology, and support required to meet these basic needs has become confused with the basic needs themselves (WAFTB 2008).

The best approach is to begin with the assertion that all students have the need to participate equally in society at all levels, according to informed choice (CAST, 2006). According to WAFTB (2008) these needs are broken down according to access to the physical, symbolic, social, psychological, and physiological environments. Full access to these environments optimizes self-directed participation in society, and quality of life. The goals and objectives of a teaching approach should not be about what a student needs, because the needs are already self-evident. The goals and objectives should be about strategies for meeting these needs. It could be assumed that these needs can be met for all students who are conscious, motivated, and capable of learning, regardless of their extent of visual impairment, given the appropriate
strategies. It is further assumed that most students are capable of learning when the learning style is understood, and that the motivation of most students can be encouraged or triggered by a respectful recognition of the student's potential, and commitment to their need for full access. When we maintain sight of the basic need, our strategies remain true to those needs, and are not obscured by factors irrelevant to the student (WAFB, 2008).

2.5.2 Self Directed Discovery

According to this principle, effective teaching is about helping a student develop a dynamic means of establishing a relationship with the world for themselves based on their direct awareness of the environment through their own senses. In this way, they form their own comprehension of what is correct, what is effective, what is adaptive, what gives them the best access to what they want and need. This experience based teaching process necessitates facing students with situations that are uncomfortable. Challenging situations typically are uncomfortable. Neuroscience studies have shown that the nervous system undergoes a period of disequilibrium when facing a novel situation until the new information is assimilated, and the individual becomes familiar with the factors of the challenge - bringing it back into equilibrium (WAFB, 2008). This brings us to a third principle.
2.5.3 Good Rapport

This principle is based on the fact that there is a necessity for rapport based on trust, respect, and amiability. This is imperative, because this provides the students with the security to help them face challenges with improved adaptation. Studies in neuro-psychology have shown that there is a difference between tension and stress. The healthy tension of facing challenge can help us access the psychological and physiological resources to assimilate new information in order to meet challenges. Stress or distress can impede access to these same resources. In other words, a distressed organism tends not to be able to adapt to a novel situation and regain equilibrium. When there is good rapport, the student can tune into the relative stability of the teacher, and learn to access these resources by a kind of empathic modeling. The teacher can also scaffold the discovery process and provide reassurance where appropriate. By providing a kind of security through camaraderie, the teacher frees the student to engage the equilibration process to face the challenge more constructively. (WAFTB, 2008) While it is certainly necessary at times for the teacher to take the lead in the instructional process, possibly facing students with challenges against strong disinclination, this is always done with a solid respect for the increasing quality of the student's access to the world. The fourth principal is thus here indicated.

2.5.4 Teachers Are Learners First

As the saying goes, the best teachers are the most willing learners. One way for a teacher to help in maintaining respect for the student's learning is to see
him or herself always as learner first, and to be open to learning from the students as much as possible. The teachers should remain always engaged in the discovery process with their students, rather than conducting the process for them.

With respect to the studies reviewed in this section, one would argue that the researchers in the area of UDL have come up with instructional approaches that could enable the blind and the VI to benefit more in their education. The efficacy of the AT is not an issue because research has proven that utilization of the AT is beneficial to the learning by the blind and the VI students. The issue here is how it is being utilized by both the student and the professors/lecturers and further which legal policies are in place to ensure that the best practices in the education of these learners are guaranteed to enable them benefit fully from the instructions. It would therefore be interesting to find out the extent to which the blind and VI are being instructed in these universities and the extent to which they are benefiting from these instructions. The following section reviews what scholars and researchers have found in the utilization of the AT for the blind.

2.6 Assistive Technology and Instruction for visually impaired students

Blindness has a significant impact on access to information. According to Groenewegen (2005), some visually impaired learners, for instance, those who
have been blind from birth will have no image grasp of visual and spatial concepts. This definitely leads to restricted acquisition of knowledge and skills and even technical expertise by the students who are visually impaired which eventually leads to their lack of jobs.

In education therefore the visually impaired students require alternatives to standard print materials to ensure these students have access to the same information as their sighted peers. This is possible through the use of assistive technology for the blind. For example, Smith (2010) in his research on the “Assistive Technology Competences of individuals with Visual Impairments” observed that for centuries blind students relied upon assistive technology (AT) to access information, travel independently, and participate in a variety of experiences. The study was conducted in universities in US and investigated the university programs for teacher preparation in readiness to the teaching of blind and visually impaired students in secondary schools. The major finding of the study was that although AT for the blind is very important, little was done in the universities in preparation for teachers to use the AT to teach the visually impaired and the blind students in secondary schools level.

The major recommendation of this study was that due to the effectiveness of assistive technologies for individuals with visual impairments, it is imperative that university training programs that prepare teachers of students with visual impairments (TVIs) incorporate assistive technology training into their
programs. This clearly shows that the utilization of the AT for the blind by the teachers and the students requires more attention. Moreover, the research found that accessibility of AT for the blind is a great deterrent in the preparation of the teachers. Smith observed that a comprehensive set of assistive technology competencies that universities can use to plan pre-service and in-service professional development did not exist.

Another study which was conducted by Kelley (2008) investigated the assistive technology use of students who are visually impaired in the U.S. The study estimated the level of assistive technology experience with text-to-speech devices and screen reading software nationwide and some of the contextual circumstances that may have contributed to the use of this special technology for the blind. The major finding of the study was that the vast majority of students with visual impairments in the U.S. were not using enough assistive technology. Instead, majority of the students used braille.

With the changing technology in education, use of braille alone might not be enough to enable the students acquire quality dispositions for their academic work. This is due to the fact that there are a lot of changes in content delivery by the lecturers that requires the use of the AT. D’Adrea (2010) in her study on Correlate of AT use by students who are visually impaired in the US observed that an increased emphasis on the use of technology and the focus on “multiliteracies” in the classroom has great implications for both teachers and students regarding the expectation that all students will become skilled and
critical users of computers and other technology for literacy-related tasks. She observed that those students who are braille readers use assistive technology not only to engage in literacy tasks but also to access the general curriculum. However, despite its acknowledged importance, there is little research on the ways the technology is being used in the instruction of the blind and the VI in the universities.

The challenge of accessibility and usability of AT for the blind is evident. In fact, D’Andrea (ibid) asserts that much of the general educational software and other technology devices available in schools are not accessible for students who are visually impaired. For example, the fact that text-to-speech is incorporated into some software, especially for younger students, does not mean that the menus and settings provide audio output, so students who cannot see the screen are unable to use the programs independently. In essence, generalized response to providing assistive technology is not appropriate for students with visual impairments. In view of these research studies, one can tell that the blind and the VI suffer in the case where their instruction is not supported with AT. CAST (2011,) asserts that instruction must be supported by the use of the AT.

Accessibility and utilization of AT for the blind is a glaring variable in research conducted in US in this section. It is further shown that there still exist great barriers of utilization of the available AT. So far no research has been conducted on the utilization of the AT in the instruction of the blind and
the VI in universities in developing countries and in this case in Africa. It would be interesting to find out whether the same barriers of utilization of AT affect universities in the developing countries. This the case of this study it will then be imperative to conduct this case study to investigate further the status of access to quality instruction by the blind and the VI in Kenya and USA and make a comparison on this issue.

Availability of AT has been mentioned various times in research on the education for the blind and VI students. It would be important at this point to explore the general availability of the AT that support the blind and the VI to access instruction in the Universities. The following section attempts to do so.

2.7 Some of the Assistive Technology available for the blind and VI

Research shows that advances in technology have extended communication options available through the use of touch (Braille text and graphics), speech and residual vision (Alves et al, 2009). To some of the blind and visually impaired students the assistive technology has made it possible for them to perform a greater variety of jobs.

The advent of access system has to some extent paved the way to full integration and equality of performance in educational institutions and in the work place. There are various hardware and software available for use by the
blind and the visually impaired students. Some of these that have been assessed and used in the education of the visually impaired students especially in the developed countries include the use of a computer that have been made to talk via synthesized speech or shown on a Braille display unit. To do this one requires screen reading software that allows users to instruct the computer how to read the information. According to NCTD (2011), there is a variety of computer software that is available for the use by the visually impaired students. They include the Duxbury Braille translator, graphic designers, and speech output software which include Jaws for windows, dolphin pen, Non-visual desktop access (NVDA) et cetera. There are also other AT for example screen readers which are kind of scanners and a computer with specialist text reading software which allow users to scan text into a computer that is then read via a speech synthesizer.

Other AT items includes the optacon which is a tactual system of reading print material. The user scans across the print with a small hand held camera which produces the print images on a rectangular array of vibrating pins. Braille embossers and Translation software sometime called Braille printers, embossers print Braille from a computer by punching dots onto paper. They connect to the computer in the same way as text printers but before text can be embossed it has to be converted to Braille format by ‘translation’ software. Some advanced embossers are able to produce both digital, tactile diagram and pictures. The embossers can also be connected to note takers and other devices. Note takers are other devices that can be very helpful. These are
portable specialist computers available for visually impaired people. They come with their own screen readers and have either speech, Braille or both Braille and speech feedback. Another device which is very helpful is the Braille sense which is an assistive technology device designed to allow individuals who are visually impaired access to personal applications (including word processing, address management, schedule management, email, and web browsing, digital audio and wireless technologies) through simultaneous refreshable Braille and synthesized speech output.

The user can also listen to live radio broadcasts via the Internet through Braille Sense's built-in speakers. There is also an MP3 player for listening to music and audio books, or learning from an audio workbook. With an innovative LCD window, Braille Sense users have the unique opportunity to collaborate with sighted people, increasing productivity in rehabilitation, academic, and personal pursuits. Another simple but very effective technology is a Tactile Talking Tablet whereby a tactile map, diagram or picture and so on is placed on to the tablet and held firmly in place. The tactile is explored in the usual way but when the user presses down on a particular location associated audio data is given. Through this method vast amounts of data can be supplied on an as needs basis, and more complex programs can be built up through the hierarchical menu system. Talking calculators, braille watches, talking watches, Braille machines magnifiers, and iPhones among others are other AT devices that are available for students.
One would infer that with the availability of the AT discussed here and probably with the creation of more hardware and software, the education of the learners who are blind or visually impaired in Universities could be improved to equate that of their sighted peers. Further the improvement of the education would be possible if these assistive technologies are accessible to the students. This study therefore will go a long way to establishing the existence of the AT in universities and the extent to which the AT is utilized to ensure quality instruction for the blind and the visually impaired students.

2.8 Challenges facing teachers and learners in the use of AT for the blind

Research shows that there have been numerous problems facing the use of AT for the blind in learning institutions. One of the problems emanates from lack of technical skills to use some of the AT devices and software. D’Andrea (2010) affirms that despite the federal regulation that AT services should be provided in learning institutions, half of high school students with visual impairment are not provided AT services. Groenewegen (2005) observed that the students in Kenyatta University where he taught did not have skills to use most of the AT.

Apart from lack of skills on the part of the users of the AT, inaccessibility of the AT poses a great challenge to the utilization in universities. DCL, (2010), called for colleges and universities to refrain from using e-books that were not
accessible to the students who are blind. It was argued that, “It is unacceptable for universities to use emerging technology without insisting that this technology be accessible to all students”. The Advisory Commission on Accessible Instructional Materials in Postsecondary Education for Students Disabilities, (ACAIMPESD, 2011) recognizes that students in the universities are not accessing most of the AT based resources and services. The Commission called on the universities to make sure that individuals with visual disabilities have equal opportunity and discrimination-free access to full participation and success in university education. The commission further stipulated that all postsecondary disability staff should be sufficiently trained in relevant technologies to (a) support the accessible instructional material (AIM) needs of students with disabilities and (b) interact effectively with sources of AIM. This definitely shows that even the staff that is supposed to train the visually impaired students on how to use AT for the blind is also not well trained. This further creates a challenge in the utilization of the AT for the blind.

Cultural beliefs on the part of the user could be another deterrent to the utilization of the AT. D,Andrea (2010) found that the students with blindness have preferences of some technological based material over others. In her study on the use of AT for the blind she observed that some students would prefer using braille while others would rather use audio material. To this extent, one would infer that the challenges of utilization of AT for the blind
ranges from inaccessibility of the AT based resources in terms of physical availability and lack of user technical skills to students preferences.

In spite of the outcry by the commission and the studies discussed here, there has been no study to find out the extent to which the blind and the VI students in the universities are accessing the AT. Again the issue of accessibility alone will not fully solve the problem of accessing quality instruction for these students. The main issue is for them to have the AT and then the guarantee of the accessible quality instruction. The study to investigate these two important aspects of education for these students in the universities is therefore justified.

2.9 Summary of existing gaps in the literature

In concluding this chapter it was imperative to present in summary form the major findings and comments of research that have been reviewed and then highlight the major gap that this study endeavored to bridge. To begin with, research on the comparison between learning capacity of various sensory channels and their modalities and in particular visual, audio and tactile channels reveals that persons who are visually impaired though having the same capacity to process information have fewer options compared to the sighted when it comes to choosing to attend to specific things. Also, the persons have fewer distractions. This makes it difficult for them to acquire knowledge and experiences in the environment and hence deters learning.
Research on the effect of blindness on mastery of concepts reveals that persons who are blind find it difficult to understand relationships and that their speed and intensity of gathering information is limited. Another gap that was identified in the review of literature is that Braille which is the main system of communication for people with blindness has got lower speed of reception compared to other channels of communication. The literature reviewed on the approaches in the education of the student who are blind clearly shows that majority of teachers of these students do not have enough knowledge to enable their students to be active and self-directed in the teaching/learning process. The research conducted in the field of assistive technology revealed that there exist challenges in accessibility on the part of students of the assistive technology and that there is lack of skills on the use of the technology by both the students and some of their teachers.

On the issue of best practices to teach students who are blind, research has shown that this could be well done through the UDL principles and practices. However, for this practice to be effective one requires legal support. There is so far no law put in place to guarantee access to quality instruction for the blind and the visually impaired students in the university. The ADA and Section 504 of the Rehabilitation Act 1973 states that all the learners including the visually impaired access education just like other non-disabled students. This means that the accessibility of education would be of quality or poor.
There are so far limited researches conducted to establish the provision of assistive technology and access to quality instruction for the blind and VI students in universities in both the developing and the developed countries. This is the gap this study endeavoured to bridge. It was imperative to receive views of students and staff who give AT services to the students on what need to be done for better utilization of the AT in the universities. Moreover, the assistive technology and quality instructional practices are envisaged to enable the students who are blind to conveniently gather information and gain experience in their educational life. They should be able to apply what they learn in their daily lives. This will in the long run make them capable contributing members of the society and increase their independence.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter reviewed the literature relevant for the study and identified the main gap of the study. This chapter gives a description of the methodology applied in the study. The sections of this chapter include the study design, study locale, target population and sampling procedure and sample size, research instruments, pilot study and data analysis.

3.2 The Study Design

The paramount premise of this research was that provision of AT and effective utilization of the technologies in instruction for the blind and VI students in universities is a critical empowering factor for the students to access quality education. Numerous unified propositions are dominant to this study. First, this study assumed the position that universities have surrogate responsibilities for ensuring quality education for the students. Subsequently, the universities take on both moral and legal imperative to account for this activity. This accountability relies to a large extent on quality instruction of the students. Finally, there is need for legal (or practical) requirement for access to or guarantee of quality instruction for the blind and VI students in universities. For in-depth investigation of this phenomenon, this study adopted a
comparative case study methodology to explore the extent to which the blind and VI students in the universities accessed quality instructions. The data was gathered for a duration period of nine months.

Two sites (Kenyatta University in Kenya and Syracuse University in USA) were selected for the research. As a result, in order to facilitate collection of detailed data at each of the two locales this case study was primarily exploratory and descriptive.

Case studies have been successively used in educational research including doctoral dissertations in various topics (Marshall, 2006). Case studies can be of either single instances or of comparative cases (Yin, 2009). The case studies apposite methodology for research which explore fashionable phenomena within their real life contexts. This is especially when the researcher has diminutive control over the phenomenon under investigation. Moreover, qualitative case research takes place in a natural setting so that the information collected reflects accurately what is happening in reality. Further, case studies are used as methods to facilitate understanding of a complex social phenomenon (Creswell, 2012; Yin, 2009). The studies in this form draw data from various resources and employ different methods (triangulation) of data collection and analysis. The studies are flexible in that they can incorporate other research strategies for example content analysis, observations and interviews. This is particularly when the method is designed to contribute to a better understanding of the phenomenon under study. According to Merriam
“(1988), “….a qualitative case study is an intensive, holistic description and analysis of a single instance, phenomenon, or social unit” (p. 21). Moreover, case studies are examinations of bounded systems and researchers focus on the processes in context rather than on outcomes of specific events (Creswell, 2012; Merriam, 1998). Owing to this, this study collected many forms of data including direct observation, document analysis, and interviews from multiple informants.

The research design was used for this study since it was found appropriate in ensuring that substantial and accurate data were collected. It would also enable proper analysis of the findings. In this study, data was collected to find out the extent to which blind and visually impaired students accessed quality instructions in the universities. The data collected enabled the researcher to describe and compare two groups of participants (KU and SU). Based on differences and similarities in the participant’s experiences, conclusions were made and recommendations and suggestions for further studies were given.

### 3.3 Factors that were considered in this Study

The independent factors of this study were lack of visual channel by who are blind or visually impaired, Availability of assistive technology, and legal or institutional requirements to guarantee the quality of instructions for the Blind and VI students. The dependent factor was access to quality instruction and hence achievement by the graduates in their life after the university education.
It was theorized that the dependent factors would be highly affected by utilization of AT for the blind and the manner in which instructions for these students were designed and conducted.

### 3.4 The Study Locales

This study was carried out in two universities namely Kenyatta University in Kenya and Syracuse University in USA. Kenyatta University is one of the seven public universities in Kenya. The university is situated at a distance of 20 kilometers East of Nairobi the capital city of Kenya. Currently, the university has seven campuses namely Ruiru campus, Mombasa campus, Parkland Campus, Kitui campus and Pwani campus, City Centre campus and the Main campus (Kenyatta University 2012). The majority of the blind and visually impaired students who are the major target of this study are enrolled in the main campus. In this case, this study was conducted in the main campus. This University was selected for the study since it houses the largest number of these students (62) compared to other universities in the country. In addition, the University has a relatively long history of educating the blind and visually impaired students. Additionally, since it is located in Kenya which is ranked among the developing countries, Kenyatta University would offer rich information for this study (Student affairs office, 2011).

Syracuse University (SU) on the other hand is located in Syracuse City which is in the New York state in USA. The University has a long tradition of
leadership in the field of special education and is recognized nationally and internationally. SU was among the first universities in the world to bring attention to the educational needs of students with disabilities and to effectively develop and refine assessment and educational strategies for the diverse learners. The university offered one of the first comprehensive programs of its kind in the United States and continues to be recognized for its leadership and vision in inclusive education (School of education, 2012). Due to its status in history of special education in USA and in the world, and due to its location in developed countries, the university would offer rich information for this study.

3.5 Target Population of the Study

The study population comprised the students who are blind and those who are visually impaired in KU (62) and in SU (25) who had enrolled in the universities in the period this study was being conducted. Additionally, Staff including Personnel in office of disability services in SU (10) and KU (5), those involved in AT for the blind: training of the students to use the devices and offer other relevant services to enable fruitful utilization of the technology were targeted for the study. This population was targeted since it would enable an in-depth exploration of the central phenomenon of this study (Creswell, 2012; Maxwell, 2012).
3.6 Sampling Procedure and Sample Description

For the purpose of interview, personnel who offer AT services to the blind and the VI in KU and in SU and students were purposively sampled. The students were also followed in classes where several classroom observations were done particularly in the courses which these students attended. Inventories at each of the universities and resources of each universities, faculty development opportunities and analysis of Universal Design for Learning were of concern for this study. Unlike in the case with the SU in KU the researcher managed to quickly identify and interview the thirteen (13) students who had enrolled for the semester this study was being conducted. The Research participants at KU were recruited by first contacting the office of disability services. The researcher gave out the student’s letters of consents that requested the students to participate to the staff at the office of the disability services for distribution. The students upon receiving the letters come forward ready to participate in the research.

The case was relatively different from SU. Although the researcher first contacted the office of disability services with the aim of obtaining the names and contacts of the students, the university student protection policy did not allow this. The researcher therefore submitted to the office the participant recruitment flyer and the student’s letters of consent for distribution. Two students came forward expressing their interests in the study. However, after interviewing these initial students, the snowball sampling approach to
recruitment was adopted henceforth (see Table 3). Participants after the interview and through informal conversations were requested to recommend other individuals who could be interviewed (Creswell, 2012; Trochim, 2002). A total of 13 students and five personnel from KU were interviewed while a total number of nine students and four personnel were interviewed from SU.

3.7 Research instruments

This research used a multi-technique approach to data collection in order to obtain a holistic or total view of the research. In this study therefore, data were generated through semi-structured interviews, class observation schedule, document analysis, and a supplementary questionnaire conducted by the researcher. The aim of the supplementary questionnaire was to gather demographic data about the study participants and was distributed at the end of each interview (Creswell 2012; Maxwell, 2012; Opini, 2012; Mwiria and Wamahiu, 1995).

3.7.1 Interview protocol

Two Semi-structured interview schedules (Appendix B and C) were utilized to collect data from the students and from the faculty and staff members offering AT services. One–on-One Interviews were used with the staff and faculty members with the aim of gathering information on the AT services they provided to the blind and VI students and on their knowledge of policies governing the utilization of the AT in their university. In the same way,
students were interviewed regarding their experiences in the university including challenges, coping strategies, and policies relating to visual disability in the universities.

The findings from these documents were compared with information generated through the interviews regarding ways in which the universities supported the students with visual impairments to access quality instructions. The interviews commenced with general discussions about daily happenings so as to create rapport with the interviewees. Then the interviews proceeded as conversations but guided purpose conversation (Began & Bigden, 2006; Najarian, 2006). This allowed for maintenance of some order in the interviews and further facilitated asking of similar questions to each respondent allowing participant to discuss their experiences freely. This enabled deeper and more comprehensive understanding of their experiences. Further, during the interviews Probes were used to elicit more information whenever participants raised useful points that needed elaboration (Creswell, 2005; Vernon, 1996). The interviews were tape recorded and later transcribed verbatim. Member checking was done after transcripts or initial thematic analyses were done.

However, due to time limit on the side of the researcher, instead of offering braille copies to the students who are blind the transcribed transcripts were read to them. This had been explained to the participants during the interview process and the participants gave their consent. Semi-structured interview is
3.7.2 Documentary Analysis Guide

For the purpose of establishing the provision and utilization of AT for the blind to guarantee access of quality instructions from the sampled universities, document analysis guide was used for the data collection (see appendix D). The document analysis requires the collection and review of documents that are specific to a particular group in terms of the characteristics of the individual group members. In this study therefore, documents including statements of philosophy, strategic plans, policy documents, inventories, websites of the universities in question as well as a copy of Universal Design guide to the education of students with disabilities were reviewed to examine the stated policies and support systems set up to address the needs of the students with visual impairments. Sarsedt, (2011) defines document Analysis as a technique used to gather information in research that describes the act of reviewing the existing documentation of comparable processes or systems in order to extract pieces of information that are relevant to the study.

3.7.3 Observation Checklist

An observation checklist for this study contained relevant AT devices and software that would be used for instruction across courses in universities (see appendix F). The list was obtained from the Internet, industrial publications
and from journals. The goal was to compare the AT with what was used in instruction in KU, with what was used in SU and generally in universities in other countries worldwide. The research mainly used the observation checklist to ascertain the AT that was available in the sampled universities and to compare this with what the participants said they were aware of and what was accessible to them.

### 3.7.4 Class observation protocol

This guide contained questions which were divided into three categories: Content knowledge; learning/ pedagogy or andragogy; and environment/creating culture. For each of these categories there were questions about what the students were thinking and doing and the teacher was thinking and doing on the other side (see Appendix E). Out of the 22 student participants, thirteen students; six from SU and seven from KU were followed in classes. The researcher managed to observe three times in the classes which each student attended. In total 39 classes were observed. The major focus of the observation was the utilization of AT and strategies of the instruction in accommodating the blind and the VI students.

### 3.8 Pilot Study

Before commencing on the study, pre-testing of the study instruments was conducted. The pre-testing assisted in determining accuracy, clarity and suitability of the research instruments and also checked their validity and
reliability. The pilot study was conducted in the University of Nairobi. The pilot study involved a total of five students with only two of them being partially sighted. Two staffs from the university employed to offer services for the blind and the VI students in the university were also involved in the pilot study. For the purpose of testing the classroom observation protocol, three classes were observed in the Parkland campus school of law of the university.

From the pilot study some questions in the interview protocols which were found ambiguous were reframed and some were completely restructured. Also additional content was added into the classroom observational protocol to capture more practices during the instructions.

3.9 Validity and Reliability

3.9.1 Validity

The validity of data in this study was ensured through the use of four strategies: (i) Expert opinions. Experts on qualitative research (Supervisors) were requested to evaluate the research instruments to ensure their validity. (ii) Member-check. Pilot interviews were conducted and the questions that were found ambiguous were reframed and those that were found irrelevant to the study were reconstructed, (iii) multiple research instruments (triangulation) was used to collect data and (iv) with the consent of the subject informants, interviews were recorded for effective analysis. Various researchers and
scholars have defined validity using different terms but a close look of these definitions brings one to the same meaning of the term validity. In essence, the term validity simply means the degree to which the conclusions of a research study are supported by evidence and can be trusted (Golafshani, 2003). Mugenda and Mugenda, (2003) define validity as the degree to which results obtained from the analysis of the data actually represents the phenomena under study. Further, Orodho, (2005) defines validity as the degree to which empirical measure or several measures of a concept, accurately measure the concept.

3.9.2 Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. In other words it is the extent to which a measuring instrument produces consistent results when it is administered again under similar conditions (Mugenda and Mugenda, 2003, Creswell, 2002). One way to ensure that the instruments are reliable in a qualitative study is to pre-test them. In this sense the research conducted a pilot study on the instruments prior to the collection of data. This ensured proper refining of some items. In addition, reliability was based on the triangulation of methods (Creswell and Miller, 2000). Different methods of data collection facilitated the gathering of similar and different types of data. Different informants allowed the researcher to obtain information from multiple perspectives (triangulation) hereby enhancing the accuracy and credibility of findings (Creswell, 2012).
3.10 Data Collection Procedures

Data were collected through self-administered research questionnaire and interview protocols at KU and SU premises. The researcher collected data from respondents on their opinions and feelings on the utilization of the AT for the Blind in pedagogy. The researcher first sought the university authority before contacting the respondents. This was followed by seeking the respondent’s consents before the actual collection of data. The researcher worked with both the staff who provided the AT services and the Blind and the VI students. After creating rapport with the participants of the study, the researcher commenced his study by using the class observation protocol to observe in the classes. This was followed by interviewing student participants and then the staff that offered AT services to these students and to their lecturers/professors. During the interviews with the staff, documents including the laws and the institutional policies documents were requested for the analysis. A list of the AT that was available in the Universities was also obtained from the staff.

Due to the distance between the two study locations, the researcher used two research assistants. The researcher personally held training seminars for the research assistants, regarding the handling of the research instruments and the ethical issues. The research assistants were taken through the two sets of interview protocols and exposed briefly to the overall purpose of the study. The training of the research assistants was done for two days.
3.11 Data analysis

Qualitative descriptive studies normally follow six analytic strategies (Bolyai et al 2005; Miles and Huberman, 1994). In analyzing the data, this study followed these same strategies as described in the following process.

(i) Code data collected from observations and interviews;

After conducting the formal interviews the audio recorded information was transcribed into print word for word. Then the researcher read these transcriptions three times before writing notes on the margins. The researcher then proceeded to code words or phrases that seemed to capture ideas that emerged among the data by using the exact words the participants said. During the coding, analytic pattern of categories that followed specific questions during the interview was noticed. After repeating this process for each interview, the researcher decided to reverse the coding process by coding the content regardless of questions that were asked. The reverse coding highlighted some positive aspects about utilization of AT for the blind and access to quality instructions in the universities but others described the negative aspects. The result of these two procedures led the research to create codes that felt true of the data.
(ii) **Record insights and reflections on the data;**

In the entire period of data collection the researcher kept a journal that was specifically used for reflections about the data. Additionally, the thoughts he wrote on the margins of the transcriptions were continued in this journal. The journal demonstrated how ideas stood out from participant to participant helping the researcher to realize when he reached saturation. For example, when the participants talked about the provision of AT and access to instruction, topics of discrimination and lack of knowledge and skills to use the AT were most common. The journal also assisted the researcher to maintain an open standpoint to the emerging themes during the data analysis.

(iii) **Sort through the data to identify similar phrases, patterns, themes, sequences and other important features;**

The researcher sorted through the data and identified similar key words and phrases. An example of a key phrase that was similar throughout the narratives was “Here we suffer.” This phrase captured the numerous levels of stress pertinent to the Blind and VI students. The research therefore used these specific phrases and key words uttered by the participants as they described their situation to represent the themes of this study.

(iv) **After sorting, extract commonalities and differences for further consideration and analysis;**

On extracting the commonalities among the data, differences emerged. For example, while many of the participants identified specific positive strategies on how they battled the difficult situations, one participant appeared to give
up on the battle when she stated that she didn’t care about the suffering by the Blind students since the university was not enabling her to support them. This differing perspective about an emerging theme regarding the strength led to thinking more about other differences the researcher may have overlooked in the data. After further consideration and analysis of the data, the researcher realized that some commonalities and differences could be merged into larger categories and themes. This led to the next step of the analysis procedure.

(v) **Gradually decide on a small group of generalizations that hold true for the data;**

Sorting through the various categories among the data, the researcher realized how some themes or concepts could be categorized as sub-themes to main themes. For example, when the participants described their situation with phrases such as “feeling unwanted and “they say we are expensive for the university to provide for us,” this made one category where the participants felt stressed while a phrases like “One has to fight hard, I make my own technology and I fear being victimized and punished by failing in exams” make another category where the participants came up with various strategies to battle the wanting situation they were in.

At first, fifteen main themes initially emerged from the data. Further an analysis by focusing on the purpose of this study to explore the challenges facing the provision and utilization of AT for the blind to access quality education by the students, four main themes consistently stood out to capture
the participants information that reflected their experiences in the universities. The themes demonstrated the participants suffering and strengths and hence led to the conclusions about their access to quality instructions. The main themes were chosen to capture the participant's reality; a decision that was further verified by the participants themselves through the member checks procedure.

(vi) **Examine these generalizations in light of knowledge that is known.**

The researcher learned more about the situation of Blind and VI students and staff that offer specialized services to them from the participants. Additionally in the analysis, the researcher revisited previous research and other scholarly work in this field to reflect on the data gathered from the participants. This discussion might be clear in the section on presentation and discussion of the findings.

On data interactive process, Miles & Huberman (1994) suggested that data should be organized with tables or matrixes and one should maintain a visual and a contextual interpretation. Following this, the data was organized using tables and matrixes. This began with a table where various codes were organized, and then another table was created capturing the similar patterns. A third table was then developed which highlighted the chronological order of similar patterns. The final tables were then organized according to themes.
Though this process may appear linear, the data analysis was rigorous and followed a circular movement. In essence, the researcher during this process kept on going back and forth reading the tables, completing the tables and further analyzing the tables and simultaneously keeping in mind the whole text. During this process, the researcher stayed with the data, followed the data as concepts emerged, and stayed open to what the data directed. In other words the researcher used an inductive approach to the process and remained patient following to where the data would take him. Creswell (2003) calls this process "The Data Analysis Spiral." this is illustrated in Appendix E. The researcher followed the spiral movement which is actually circular moving back and forth. He moved back and forth double-checking and cross-checking ideas and concepts with the intention of getting more details form the data. For example, this interactive process helped discover two categories to the main theme of anguish and the way the participants were making sense of their suffering and struggle to acquire high level of education. The qualitative approach to the data analysis provided an in-depth understanding of the phenomenon that was investigated in this study.

In summary, Analysis of qualitative data from the interviews and from the analysis of documents was done by use of descriptive methods. For the interviews, the process included coding by putting the response on each item into specific main themes based on the response of each respondent. Findings from document analysis and those from the interviews with the student participants and university staff were triangulated to verify information
provided during the face-to-face interviews. Triangulation was followed by a refocus in the literature for further analysis and interpretation of research findings. The interpretation of data was based on the research objectives.

3.12 Ethical Consideration

Research authorization was obtained from the Research Ethical Boards of both the Government of America and the Government of Kenya. Permission was also sought from KU and SU to carry out the research in the institutions. In addition, confidentiality of all the information gathered from the respondents was highly safeguarded.

3.13 Chapter Summary

This chapter has shown the research methodology used for this study. It has explained the research design adopted, the major factors that were considered by the study, locations of the study and the rationale behind choosing the locations as the centers of focus, the description of the target population and the sample size, research instrument, the pilot study, validation and the reliability of the research instruments, data collection procedures and finally the data analysis techniques.
CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Introduction

The preceding chapter described the methodology applied for this study. This chapter presents the results of this study. The study was set to investigate the challenges facing the universities blind and VI students and faculty members in the utilization of the assistive technology for quality instruction and how these challenges were being addressed. The findings are organized in terms of the research objectives. The reporting of the findings is done in form of a narrative discussion where the findings are first described and then followed by the discussions. The research presumed that by first finding out the available AT in each of the universities under this study would lead to a more systematic way to finding out how the AT was being utilized to ensure access to quality instructions.

4.2 AT for the blind that was available at KU

The first objective of this study was to find out the available AT for the blind in KU. Considering this, the researcher obtained a list of AT available in the university from the office of disability services and went further to find out whether the AT was in functioning condition and whether it was enough to meet the demand of the students. Table 1 shows the findings of the research according to this objective.
<table>
<thead>
<tr>
<th>Type of AT</th>
<th>Number of items</th>
<th>Ratio of functional items to number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipods and ipads</td>
<td>6 -</td>
<td>6:65</td>
</tr>
<tr>
<td>Braille writers (Perkin machine)</td>
<td>74 -</td>
<td>74:65</td>
</tr>
<tr>
<td>Thermoform machine</td>
<td>1 -</td>
<td>1:65</td>
</tr>
<tr>
<td>Computers with voice output</td>
<td>6 4</td>
<td>2:65</td>
</tr>
<tr>
<td>software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnifiers,</td>
<td>3 -</td>
<td>3:65</td>
</tr>
<tr>
<td>Enhanced Vision Systems Cameras</td>
<td>2 -</td>
<td>2:65</td>
</tr>
<tr>
<td>Tape recorders</td>
<td>3 1</td>
<td>2:65</td>
</tr>
<tr>
<td>Talking calculators</td>
<td>2 -</td>
<td>2:65</td>
</tr>
<tr>
<td>Embossers</td>
<td>3 -</td>
<td>3:65</td>
</tr>
<tr>
<td>Scanners</td>
<td>1 -</td>
<td>1:65</td>
</tr>
<tr>
<td>Braille sense</td>
<td>1 -</td>
<td>1:65</td>
</tr>
<tr>
<td>CCTVs</td>
<td>6 -</td>
<td>4:65</td>
</tr>
<tr>
<td>Large print photocopier</td>
<td>1 -</td>
<td>1:65</td>
</tr>
<tr>
<td>JAWS (Screen reader software)</td>
<td>6 -</td>
<td>6:65</td>
</tr>
<tr>
<td>NVDA (screen reader software)</td>
<td>Free online</td>
<td>-</td>
</tr>
<tr>
<td>Dolphin Pen (software)</td>
<td>42 22</td>
<td>22:65</td>
</tr>
</tbody>
</table>

Note 1: The average number of students enrolled in the university per year is sixty five (65)  
Note 2: The sign + indicates that the number of items is more than the number of the students who demanded for them
From Table 1 it was evident that KU has a variety of modern AT which could be helpful in accessing quality instructions by the Blind and VI students. For example, IPods and ipads have many built in functions that help improve productivities and academic performance for these students. The inbuilt features include screen magnification, adjustable display colour contrast, refreshable braille display support, and text to speech technology which include talking alert, talking calculator and even talking watch. The text to speech technology (VoiceOver) is highly advanced whereby unlike many other screen readers for example the Jaws for window, the students can hear a spoken description of what is on the screen and can also integrate more than 40 braille displays via Bluetooth. The content that can be accessed includes spreadsheet columns, graphics and even photo captions. The students can also browse the web, chart, send and receive emails and so on (Leibs, 1999).

Moreover, braille sense note taker technology (Please get more details in Appendix H) offers the ability to perform various tasks simultaneously. Some of them provide all the functionality of a laptop computer, including WiFi, MSN chat, document processing, DAISY playback and more, in a compact, portable notetaker with a 9-Key Perkins-Style Braille keyboard and LCD display for teaching Braille beginners. The visually impaired student is also able to write email, surf the web, and even use the word processor.
Additionally, the braille embosser technology (3) has enhanced the production of braille. For example in terms of production of many copies of braille documents the technology has been advanced. The speed of the manual braille writers (74) for instance has been enhanced by the emergence of the electric powered braille writers. Furthermore, the braille photocopier that is thermoform embossers (1) has been designed to produce multiple copies of a braille document on Brailon plastic paper within a considerable shorter period of time compared to the speed of producing the copies by using the braille writers (Johnson, 2004). Indeed it was observed that the thermoform embossers were used to create tactile graphics (raised drawings and diagrams that could be felt by blind students) and also to make copies of braille texts.

The advanced computer based assistive technology has also brought about the creation of braille printers also known as the braille embosser (3). These are majorly of two types; the desk top embosser which emboss braille directly onto sheets of paper without a plate, and are therefore occasionally called text embossing device (TED) printers and the plate embossing device" or PED printers which is typically used in braille publishing where a zinc embossing plate is created using a computer and then used to emboss multiple copies (Johnson, 2004).

From Table 1, it was clear that Kenyatta University had a variety of print enlarging technology including the enhanced vision system camera (2)
which enables magnification of very small print for easy reading by the students who are visually impaired and the CCTV (6) which also enables the students to read print text easily. The other machine that enables the production of large print for the visually impaired students which the university has is the large print photocopier (1). This machine is important especially when many copies of large print text are required by the students. The screen readers which included the Jaws (6), Dolphin pen (42) and the NVDA allowed the blind and the visually impaired users to interact independently and efficiently with the computer. Some of these software for example the Jaws and the NVDA have features that enable enlargement of print text on the computer screen for easy reading by the students who are visually impaired. The special scanner (1) is used to scan texts with small font and change the image to digital form which can be enlarged and even converted into braille using the Duxbury braille converter software which is then be printed using the braille embosser for students who are blind.

According to objective one of this study, the researcher also sought out whether the AT available in the university met the demand of both the students and the university staff. Accordingly, the AT was categorized into two groups that is the single users (those which each student should have or those that the students might often demand for their academic work or in other words the products which are designed to remove barriers for the blind or VI students) and the multiple-users (those which designed to be used by a relatively small group of these students or those that were not
often be on high demand by the students (Hersh, 2012). From Table 1, the technologies were categorized as in Table 2 as follows.

**Table 2: Categories of AT according to the demand by the users in the university**

<table>
<thead>
<tr>
<th>Single User/those that were often on High demand</th>
<th>Multiple-users/those that were not often on high demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braille writers</td>
<td>Large print photocopier</td>
</tr>
<tr>
<td>IPods and ipads</td>
<td>Thermoform machine</td>
</tr>
<tr>
<td>Talking calculators</td>
<td>Enhanced vision camera system</td>
</tr>
<tr>
<td>CCTVs</td>
<td>Scanner</td>
</tr>
<tr>
<td>Braille sense</td>
<td>Computers with NVDA</td>
</tr>
<tr>
<td>Computers with Jaws for windows</td>
<td>Tape recorders</td>
</tr>
<tr>
<td>Braille embosser</td>
<td></td>
</tr>
<tr>
<td>Hand held magnifiers</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Office of Disability Services at KU and SU*

From table 2 and from the findings of the study, iPods and ipads, braille writers, CCTVs, Braille sense, talking calculators and computers with Jaws for windows screen readers were quite often used by the students for their academic work. The students used braille writers to write their notes and to do exams. They also often used the CCTVs to read the print books and computers with the screen readers to browse the web. The ipads, ipods (8 against 65 users) and braille sense (1 against 65 users) could be said to be very few compared to the number of students who wanted to use them. The
case with the braille printers (embossers) was different. Students often wanted to print their work but they did not have the skill to do so. On asking why the students were not trained to use the embosser it was found out that there were very few personnel in the university (2) with the skill to use the technology and assist the students. Only one embosser was used to make braille copies in the resource center for the blind in the university. The copies were only made if the academic staff requested. From the interview with one of the resource Centre for the blind personnel the researcher was informed that the other two embossers were not accessible to the students.

In the category of the multiusers and those that the students did not often demand, the large print photocopier and the thermoformed machine were occasionally used. From the interview with the resource centre for the blind staff the researcher was informed that the staff only used the embosser to make copies of the contents or examinations on demand. The scanner was rarely used due to the reason that the print size of most text was large enough for use with the CCTVs. In addition, in the interview with one of the office of disability services personnel, the researcher was informed that due to the policy of intellectual property rights the conversion of text to soft copies was not allowed. Further, it was reported that the enhanced vision system were very new in the university and that some staff were still learning how to use them.
From Table 2, although the computers with the NVDA screen reader software was categorized as multi-users or those that were on high demand, these computers were often used by the students. The reason for categorizing the technology this way was that the NVDA software is a free online software and therefore easily accessible by all those who wanted to use it. What created a barrier in the use of this technology was the number of the computers where the software was installed and lack of a competent personnel in the university to assist the student in terms of impacting the skill to use the software.

From Table 1 and Table 2 it was evident that the university needed more assistive technology to meet the demands of the students. Considering the category of those that were on high demands by the students in Table 2 and comparing with the ration of each technology with the total number of students who needed them in Table 1, it would be logical to claim that the university did not have enough of the technology to meet the demand of its students. For instance, only two computers with screen reader software were available for use by 65 students and yet the research found out that one of the courses known as communication skills was compulsory for the student and it was taught online. Also there were only two talking calculators that were shared by approximately 65 students. In the same course (communication skills) for example the students were subjected to some mathematics which required the use of the calculators. This means
that some of the students did not access the calculators when they so deserved them.

Further, due to the few computers available in the Universities to be used by these students, the student did not have much option to choose from apart from using mental calculation. Students with visual disability might require more time to work on the adapted computer in a day compared to their sighted peers. The computer based AT has enhanced the access of information by the blind students than ever before (Hasselbring and Glaser, 2012). According to Carney Engbreton, Scammell and Sheppard (2003), blind and visually impaired students are more dependent on the computer based AT compared to their sighted peers since they require the provision of visual simulation to effectively process visual input and also to interact through the web in search for more information which otherwise is relatively inaccessible in braille form. Going by this assertion then it would be sensible to argue that each of these students might require a computer with the adaptive software.

In consideration of this, the researcher wanted to find out why the university had less AT compared to the number of the students who needed them. On asking why the university had not purchased enough of these devices and software, the researcher was informed that the technology was too expensive for the university to procure enough to meet the demand of the students who required them. This assertion is logical given that the
Assistive Technology ranges between 700 to 2000 US dollars (Hasselbring, 2000). It would be expected in KU which is in a developing country that the scarcity of the AT was due to lack of fund to procure the technology. This made the researcher more eager to find out what SU possessed in terms of these technologies since it is in the developed countries.

4.3 AT for the Blind that was available at SU

The second section of objective one of this study required finding out which AT for the Blind was available in SU. Accordingly, the researcher obtained a list of the AT from the office of disability services in SU. Further, just as it was in the case of KU the researcher resolved to find out whether the available ATs were in working condition and whether they met the demand of the students in the university. Table 3 presents the result based on the findings in SU.
### Table 3: Available and Accessible AT for the blind in SU

<table>
<thead>
<tr>
<th>Type of AT</th>
<th>No</th>
<th>Functional</th>
<th>Non functional</th>
<th>Ratio of functional items to number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipods, ipads and iphones</td>
<td>3</td>
<td>-</td>
<td></td>
<td>3:25</td>
</tr>
<tr>
<td>Smart Board</td>
<td>2</td>
<td>-</td>
<td></td>
<td>2:25</td>
</tr>
<tr>
<td>Magnifiers</td>
<td>26+</td>
<td>-</td>
<td></td>
<td>26+:25</td>
</tr>
<tr>
<td>Tape recorders</td>
<td>6</td>
<td>-</td>
<td></td>
<td>6:25</td>
</tr>
<tr>
<td>Talking calculators</td>
<td>8</td>
<td>-</td>
<td></td>
<td>8:25</td>
</tr>
<tr>
<td>Embossers</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Scanners (with digital converter software)</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Braille writers (Perkin)</td>
<td>6</td>
<td>-</td>
<td></td>
<td>6:25</td>
</tr>
<tr>
<td>Braille sense</td>
<td>2</td>
<td>-</td>
<td></td>
<td>2:25</td>
</tr>
<tr>
<td>CCTVs</td>
<td>16</td>
<td>-</td>
<td></td>
<td>16:25</td>
</tr>
<tr>
<td>Large print photocopier</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Computers with JAWS (Screen reader software)</td>
<td>3</td>
<td>-</td>
<td></td>
<td>3:25</td>
</tr>
<tr>
<td>Magic Dictate (Dragon Naturally Speaking)</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Computers with NVDA (screen reader software)</td>
<td>26+</td>
<td>-</td>
<td></td>
<td>26+:25</td>
</tr>
<tr>
<td>Kurzweil 3000</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
<tr>
<td>Kurzweil 1000</td>
<td>1</td>
<td>-</td>
<td></td>
<td>1:25</td>
</tr>
</tbody>
</table>

Note 1: the sign + indicate that the number of items were more than the number of student who needed then per year

Note 2: In average, SU enrolled 25 Blind and VI students per year
From Table 3, it was evidence that SU had a variety of modern AT for the blind. From the Table, there were 19 types of technologies in the university and all of them were in functioning condition. As discussed earlier in this thesis, these devices and software are very helpful for quality instructions for the blind and visually impaired students. Hassellbring and Glaser (2000) stipulate that AT has enhanced, helped the blind student’s participation in learning and has helped them to become independent learners. For example, the Dragon Naturally Speaking (1) which is a speech to text dictation program allows the users to dictate to the computer and have their dictation typed out. It was observed that the more the user used the program, the more accurate it became at recognizing her/his voice and commands. The research found out that this software helped especially the students who were not quick in typing their work to do so and hence they presented their homework to their lecturers in time. Although the university had only one computer with this software, the research found out that six of the students who were blind had Mark computers with this software.

The University in addition had kruzweil 1000 and 3000. These are voice output optical character recognition devices which are designed for use by individuals who are blind or have low vision (Hasselbring and Glaser, 2000). The researcher observed that the blind students were able to scan text which the machine read aloud with synthetic speech. The devices had a camera which when is placed over print, snaps a picture and in seconds it reads the contents of the printed document in clear synthetic speech. The students were
also able to scan text discarded it, or even stored it for later reading, the text was also transferrable to a computer or braille. During the classroom observation in SU it was noted that SMART boards or the interactive whiteboard was used in various way to enable the students interact with the content. The lecturers would enlarge the print and also use the sound output. This enabled the blind students to interact with the materials that were taught in the similar way as their nondisabled peers.

In order to enhance quality instruction the AT should be accessible to the students. In considering this, the research went further to find out whether the available AT in the university met the demand of the students who needed it. To be more accurate in doing this, the ATS were categorized as shown in Table 4.
Table 4: Categories of AT according to the demand by the users in the university

<table>
<thead>
<tr>
<th>Single User/those that were often on High demand</th>
<th>Multiple-users/those that were not often on high demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braille writers</td>
<td>Large print photocopier</td>
</tr>
<tr>
<td>IPods and ipads</td>
<td>Thermoform machine</td>
</tr>
<tr>
<td>Talking calculators</td>
<td>Enhanced vision camera system</td>
</tr>
<tr>
<td>CCTVs</td>
<td>Scanner</td>
</tr>
<tr>
<td>Braille sense</td>
<td>Computers with NVDA</td>
</tr>
<tr>
<td>Computers with Jaws for windows</td>
<td>Tape recorders</td>
</tr>
<tr>
<td>Hand held magnifiers</td>
<td>SMART Board</td>
</tr>
<tr>
<td>Kruzweil 1000 &amp; Kruzweil 3000</td>
<td>Braille embossor</td>
</tr>
<tr>
<td>Dragon Dictate</td>
<td></td>
</tr>
</tbody>
</table>

Source: SU Office of Disability Services

From Table 4, some technologies could be used by more than one student in a given period of time and therefore the technologies could be said to be enough for the number of blind and visually impaired students that were present in the university. These technologies included the large print photocopiers, SMART Board, thermoform machine, tape recorders and the enhanced vision camera systems. As indicated earlier in this thesis, though the computers with NVDA could be used quite often by the blind students, the software is free online and therefore the demand from the student was not very high due it is availability.
On the other hand, there was another category of the technologies that the students needed quite often for their use in their academic work meaning that the technologies were often on high demand. The technology in this category were designed to be used by a single person to enhance his or her participation in a learning environment (Hersh, 2012). From Table 3, in this category the magnifiers (26+), the CCTVs (16) and the talking calculators (8) were found to be having less competition from the students compared to the braille sense, magic dictate, Kruzweil and ipads. The study established that SU had a number of magnifiers and CCTVs more than the number of the students who required them. Further it was found out that although the number of braille writers was less than the number of the blind students in the university they were not on high demand due to the reason that most of these students had learned how to use their laptop computers in performing their academic work.

The researcher wanted to know the reasons as to why the SU had not procured enough technologies that had high competition by the students to enhance access of the quality instruction in the university. On discussing with the Office of disability services management, the researcher was informed that the technology was very expensive for the university to purchase enough to cater for the number of the students in the university.

Comparing the AT available in KU and that available in SU, One can confidently identify some similarities and differences. For example, it is
evident that both universities did not have enough modern technology for the blind to cater for the students. The reason given by both universities was that the technology is too expensive for the universities to purchase enough to meet the demand of the students who require them. There were three identifiable differences in the availability of the AT in the two universities. One of the differences was that SU reported more types of AT (19) compared with the 16 types that were available in KU. The second difference that was clear is that some of the types of the AT that were available in SU were not available in KU. Examples of the Hardware were SMART Boards, Telescopes, Adaptable tables and Kurzweil, while the software were MARGIC Dragon Dictate. The third difference was that some type of the AT that were on high demand from KU for example braille writers had less demand in SU due to the fact that the students at SU used their laptop computers more compared to braille writers. The research also observed that at KU some of the ATs which were not functioning while in SU all the ATS were in functioning state. It would be expected of this in KU since from the office of disability office the researcher was informed that most of the spare parts of the adapted devices were not available locally.

From the findings one is able to tell that both KU and SU lacked enough ATs for their students. Lack of enough ATs and other resources for the blind for the institutions is not a new phenomenon. Research has shown that in developing countries especially, both students and their teachers
suffer due to the lack of sufficient ATs and other relevant resources. ETD (2012) postulates that a very small minority of students with disabilities get access to adaptive technology in the developing countries. Studies in the developed countries including the USA have also shown that the universities suffer from the same problem of lack of enough ATs for the blind and VI students (ACAMPESD, 2011).

Lack of enough technologies for the blind in both universities meant that the students and the staff who required these technologies shared the few that were available. In such situations research has shown that conflict might occur and people might fight over the scarce resources (Windle and Warren, 2012; Coffman, 1963). In an institution set up, this kind of conflict is reduced or resolved in various ways including establishing policies to ensure equal access to the resources, ensuring that the members who require the resources have good knowledge of what is available for their use in the institution and increasing the amount or the number of the resources by prioritizing and procuring more. Prioritizing means that one has good knowledge of what is required and where to get it. In consideration of this, the research went ahead to investigate how SU and KU enable the sharing and utilization of the significant but scarce AT. Using a semi-structured interview protocol; the researcher first interviewed both the students and the personnel whose duty was to offer the AT services to the students about their awareness of the AT in their university.
4.4 Awareness of the students about AT available for their use

The second objective of this study was to determine awareness of the students about the assistive technology available for them. Accordingly, the interview protocol was used to find out from the Blind and the VI student the knowledge they had about the AT available for them both in their university and those that they were aware of elsewhere. According to Fetterman (1998) interviews take the researcher into the “heart of the phenomenon classifying and organizing an individual’s perception of reality” (p. 40). Moreover, in ensuring better results from the interviews and especially in an explorative study, the environment of the participants is crucial to understanding their perspective (Mendez-Shannon, 2010). Therefore, the researcher using a complementally questionnaire first gathered data for the participants profile in order to be able to describe each participant’s context.

4.4.1 Demographic Characteristics of the Students Participants

This section deals with the questions aimed at establishing the respondents’ background information such as age, gender and which university they belong. The section further presents the report from the students about their awareness of ATs that were available for them. Their responses were as follows as shown in table 5:
Table 5: Student Participants in KU

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Gender</th>
<th>Visual loss</th>
<th>Program of Study/Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joy</td>
<td>Mid 40s</td>
<td>female</td>
<td>blind</td>
<td>PhD</td>
</tr>
<tr>
<td>Alfa</td>
<td>26</td>
<td>male</td>
<td>blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Hellor</td>
<td>33</td>
<td>male</td>
<td>Partially blind</td>
<td>M.A.</td>
</tr>
<tr>
<td>Garba</td>
<td>24</td>
<td>male</td>
<td>blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Tereso</td>
<td>21</td>
<td>female</td>
<td>Partially blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Tomota</td>
<td>Early 30s</td>
<td>female</td>
<td>blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Galver</td>
<td>29</td>
<td>male</td>
<td>blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Marseto</td>
<td>Mid 30s</td>
<td>female</td>
<td>Partially blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Turbo</td>
<td>25</td>
<td>male</td>
<td>Partially blind</td>
<td>B.A.</td>
</tr>
<tr>
<td>Yamaha</td>
<td>24</td>
<td>male</td>
<td>Partially blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Polera</td>
<td>22</td>
<td>female</td>
<td>Partially blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Jeep</td>
<td>23</td>
<td>male</td>
<td>Partially blind</td>
<td>B. Ed</td>
</tr>
<tr>
<td>Fiella</td>
<td>26</td>
<td>female</td>
<td>blind</td>
<td>B. Ed</td>
</tr>
</tbody>
</table>

Source: SU Office of Disability services

- Note¹: All names used herein are aliases

Table 5 shows that there were 13 participants, the oldest was in mid 40s while the youngest was 21 years old. Their age range was therefore 19 years. Out of the thirteen participants, there were six females and seven males. The number of the participants who were blind was six while the other seven were partially sighted. Also from the Table it is evident that majority of the participants (10)
were pursuing Bachelor Degree in Education with one pursuing PhD in Education, one pursuing Masters in Art and another one pursuing Bachelor Degree in Arts. The characteristics of these participants as demonstrated by the demographic data clearly show that they would be trusted to give important information for the study. The research also obtained demographic data from the students participants from SU. The responses were as follows.
Table 6: Students Participants in SU

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Gender</th>
<th>Vision Loss</th>
<th>Program of Study/Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulemani</td>
<td>32</td>
<td>male</td>
<td>Partially Blind</td>
<td>PhD</td>
</tr>
<tr>
<td>Kahare</td>
<td>40</td>
<td>female</td>
<td>Partially Blind</td>
<td>CAS</td>
</tr>
<tr>
<td>Juma</td>
<td>33</td>
<td>Male</td>
<td>Partially Blind</td>
<td>PhD</td>
</tr>
<tr>
<td>Furaha</td>
<td>23</td>
<td>female</td>
<td>Partially Blind</td>
<td>B.A.</td>
</tr>
<tr>
<td>Bahati</td>
<td>22</td>
<td>female</td>
<td>Partially Blind</td>
<td>M.A.</td>
</tr>
<tr>
<td>Rafiki</td>
<td>23</td>
<td>male</td>
<td>Blind</td>
<td>B.A.</td>
</tr>
<tr>
<td>Kipawa</td>
<td>21</td>
<td>male</td>
<td>Partially Blind</td>
<td>B.A.</td>
</tr>
<tr>
<td>Amina</td>
<td>40</td>
<td>female</td>
<td>Blind</td>
<td>CAS</td>
</tr>
<tr>
<td>Mwamba</td>
<td>52</td>
<td>male</td>
<td>Blind</td>
<td>PhD</td>
</tr>
</tbody>
</table>

Note1: All the names used herein are pennames
Note2: All the participants indicated herein only suffered from vision loss and not from any other disability

From Table 6, there were nine participants and the oldest student was 52 years while the youngest was 21 years old the age range therefore was 31 years. The table also shows that out of the 9 participants there were four females and five males. In terms of sights, there were six partially sighted and three blind
participants. This demographic data shows that the participants were capable of giving appropriate and trustworthy account of their experiences in their academic life especially in the universities.

4.4.2 Awareness of KU student participants about AT available for them

Concerning the availability of AT for the Blind in the university, the participant during the interview were first asked to identify the ATs they knew about in the university. The following seven types of AT were identified: Braille machines, Thermoform machine, Computer, JAWS, NVDA, Dolphin pen and CCTV. When the students were asked to mention the AT they knew about which they did not get access to in the university they mentioned the following: BrailleNote, Braille sense, Telescope, talking calculators and an instrument which Alfa was only able to describe as “Equipment that scans printed material and read it loudly for a Blind person”. When Alfa claimed that he had come across and had touched the machine, the researcher wanted to find more and requested him to describe more the machine and give direction of where he had found it to the researcher. The researcher found out that it was one of the voice output reading machines designed for use by individuals who are blind or have low vision by the name Alddin Ambassador. This machine uses optical character recognition (OCR) technology to convert text from books, magazines and other printed materials to high quality speech using DEtalk speech synthesis software. The participants also mentioned “Braille computer” otherwise known as DreamBraille (a laptop computer
designed for the Blind which is combined with braille display (Kindly also see Appendix H).

The researcher further wanted to find out the kind of AT services the students received from the university. Considering this, the student participants were asked to describe the services they receive. The participants reported that they were mostly served with braille machines from the office of disability services and were also allowed to use the few computers with trial version of JAWS from the university library. They also mentioned that they were normally helped to access books and other reading materials in the library. They however lamented that they have to depend on their sighted readers to read the materials for them since it was all in print. It was further reported that they were never given any formal training on how to use the modern technology. A report from Tomota that brought this issue out well was,

I wish we had personnel trained on the AT for the blind in this university to train us on how to use some of these devices and software. We are for instance currently being forced to learn online especially in communication skills and yet we don’t have the skills to access Moodle web like other sighted students. We really feel unwanted and frustrated. How do our lecturers expect us to perform?

When the students were asked whether they had reported to the university authority about this lack of services, ten of them (77%) reported that they had done so many times but nobody cared. The students also added that they feared “to be failed” in the university exams. This meant that they were intimidated by being given low grades if they complained too much. Also, during the interview, the participants explained that the resources for the blind
were not found in a central place where they could access them. For instant, Fiella lamented that,

It is shameful that it’s like there is a tug of war about who should be seen having knowledge about the AT. Instead of having these technologies put in a central place accessible to all of us, some people hide them in their offices and boast about that they have the modern technology. That is why you hear some of us claiming that they know about this technology, while others don’t. We are the ones suffering. Those who are hiding the technology are already educated and earning their salaries. After all they can see not like me here. They don’t need the technology.

True to the words of Fiella, when the student participants were requested to mention the AT they knew about that were not found in the university, they mentioned Braille Sense and talking calculators which were already in the custody of the university. It also took the researcher quite some time to verify the list offered to him from the office of disability services.

The respondents also stated that the university personnel offering services to them should be trained so that they can offer better services which should include training the Blind and the VI students on how to use the modern technologies. The students further proposed that all the ATs for people with disabilities in the university be put in a central and accessible place where services for these technologies could be offered. This is logical for some of the devices this makes sense but for those devices that are used for mass instructions like SMART Board this might not make much sense. The participants from SU were also interviewed on the same matter and the responses were as follows.
4.4.3 Awareness of SU student participants about AT available for them

Just as it was the case with KU, the SU student participants were interviewed about their knowledge of ATs that was available in the university and those that they were aware of though were not in the university. When asked to tell the ATs they were aware of in the university, the nine participant responses were as follows: ipads, ipods, CCTVs, magnifying sheets and computers with screen reader software which they described as JAWS and Kurzweil 1000. When asked to mention the technology they were aware of though were not within the university they mentioned the following: Braille Sense, Book Sense, Cicero text reader, magnifying cameras, lamps with magnifying lenses, talking clocks and watches, braille watches, and talking calculators. The participants when asked to tell how they came to know about the ATs that were not in the university the nine responded that they learned about those ATs through the internet and through visiting institutions for the blind which deal with the Technologies.

The participants were further asked to describe the AT services they received from the university. The participants mentioned various services as presented in Table 5.
Table 7: ATs services offered to students in SU

<table>
<thead>
<tr>
<th>Description of services</th>
<th>No. of response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation on how to access the university web</td>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td>Assistance with note taking during lectures</td>
<td>7</td>
<td>78</td>
</tr>
<tr>
<td>Conversion of PDF materials into JAWS readable format</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Accessing books in electronic format</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Provision of magnifying materials</td>
<td>6</td>
<td>67</td>
</tr>
<tr>
<td>Provision of braille machines and papers during exams.</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>Registration and provision of letter authorizing other stakeholders in the university to provide appropriate services to the students.</td>
<td>9</td>
<td>100</td>
</tr>
<tr>
<td>Accessing books in the library</td>
<td>9</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7 shows that there were various services offered to students in SU. The services depended on the demand from the students. For example referring to Table 4 on demographic data for the SU student participants, there were three Blind students. The three mostly use JAWS for reading and sometime Braille to do their exams. From Table 6, therefore the three (33%) required services including provision of Braille resources especially during exams, conversion of PDF materials to accessible format and provision of print books in electronic format accessible through the screen readers. Seven (78%) of the
participants receive assistance in taking notes during lectures and six (67%) enjoyed using magnifiers to read.

One thing was though not clear from the responses. The researcher had to further find out why not all the participants required electronic version of the print books. He was aware that those who were partially sighted could use their computers to enlarge the reading materials. This search triggered other important responses from the participants. From the findings, the student participants were discontented with the services provided for them in the university. This was clearly shown by comments given by the participants. For example Amina (Penname) explained that:

From my experience we receive a very substandard AT services in this university. It is often very frustrating for me especially to request for the services which the university claims to offer only to find out that no one has a skill to offer it. What I even hate most is the mask the university put on claiming how well they cater for us and the intimidation some of us have previously received when we complain……For example nobody on the campus can claim to have expertise in web accessibility and adaptive technology for the blind to provide the services.

This sentiment was received from 78% of these participants. The participants in addition revealed that they never received training on how to use the available technologies in the university. Five of the (56%) participants informed the researcher that they only hear that the university has a lot of ATs for the blind and yet they knew about only two computers with JAWS software and one with Kurzweil 1000 software. they even disclosed that they
didn’t know how to use the Kurzweil 1000. this claim is justified when the participant failed to mention some of the Technologies that were present in the university for example Kurzweil 3000, adaptable tables, Smart board, Dragon dictate and even went further to mention talking calculators as being absent while they were in the university custody.

Though it was not part of this study, the researcher on being informed about intimidation dug further into the issue by asking the participants to explain how they were intimidated and how this affected their learning. 78% of the participants disclosed to the researcher that they did not want him to interview them with the knowledge of the staff and faculty. They explained that there was a cartel headed by Musomi (pseudonym) who was very influential and ruthless and who had sharp skills to intimidate and even prove his threat by having some of them suspended or expelled from the university. One of the major ways the participant reported that Musomi used was to claim that blind students plagiarized. This, the participant said that made them to fear asking for assistance or to launch complaints due to the lack of quality services. This led them to learn about AT on their own and hence insufficiently. The result was difficulties in their academic undertakings. Rafiki reported that

……I don’t care about the AT services they claim to offer to us. I use mine. With my Mac I have learned to enlarge prints and even convert PDFs…..I mostly use electronic books and in case they are not there I have my Hand held CCTV and binocular.

The conclusion here was that the students lacked enough knowledge of ATs that were available for them both in and out the university. A great
contribution of this plight was lack of training on the availability and use of the ATs. Moreover this greatly affected their learning in the university.

The issue of lack of training to use the available AT which was a complaint by the student participants in both KU and SU is not new. As it was explained in the literature section of this study, ACAMPESD (2011) after conducting research in the USA observed that students in the universities were not accessing most of the AT based resources and services. The Commission called on the universities to make sure that individuals with print disabilities have equal opportunity and discrimination-free access to full participation and success in university education. The commission further stipulated that all postsecondary disability staff should be sufficiently trained in relevant technologies.

Moreover, the complaint about the intimidation of the participants by the people who are supposed to serve them could well be explained by the theory underpinning this study. The Coffman (1963) Stigma theory clearly explains how those who have greater power exercise their authority over those who do not have deny them opportunities. The situation in these institutions shows clearly that the students had to undergo great struggle. This could be avoided if the laws and the legal policies governing the universities could be specific and clear. More so the staff offering services for the students should be trained thoroughly in order for them to effectively and efficiently offer the services required by the blind and the visually impaired students.
4.5 Knowledge of ATs for the blind by the Service Providers

The Secord section of objective two of this research study was to establish the awareness of staff about the assistive technology available for the use by the blind students in their universities. Accordingly, the personnel whose duty was to give AT services to the students and the university staff were also interviewed. The interview was focused on the knowledge they had about the ATs for the blind and the services they offered.

4.5.1 KU Staff preparedness in offering the ATs services for the Blind

Five personnel that offered AT services in KU were interviewed on several issues pertaining to their work. First the participants were requested to explain the kind of training they had concerning the ATs for the blind. The findings showed that one of the five had a diploma in the education of the blind; one had a certificate in audio recording, the third one had a certificate in braille transcription, the forth participant had a diploma in library science and the fifth respondent had a bachelor degree in IT and a short course certificate in adaptive technology for the blind.

The researcher found out that only one of them had been trained in the field of ATs for the blind although in a small project training. Jaillo (pseudonym) one of the personnel stated that

None of us is properly trained to use the modern Technologies for the blind. The only thing we are able to do is to offer simple technical services for example brailing and de-brailing. We cannot even repair the braille machine leave alone training the blind students on how to use the modern technology like jaws and others. The students
themselves know more than I do about the technology and yet we are
supposed to serve them. It is a pity.

On asking how the students were made aware of what is available for their use
in the university, the personnel reported that “when the students visit the
resource room for the blind they are informed about the braille services and
that when they go to the library they are informed about the computer with
JAWS.” when the students reported that they were aware of Braille sense and
talking calculators that they claimed were not in the university, it was evident
that they were not well informed about what was available for their use in the
university. From the research findings, it was also apparent that most of the
personnel interviewed were not aware about all the ATs available for the blind
in the university. Jetta (pseudonym) had this to say.

Although the university might not have enough of the modern
technology for the blind, some of these technologies are not known to
us. For example I hear there are devices like Braille sense, talking
calculators and the scanners for the blind in the university. Some of
these things are neither in the resource room for the blind nor in the
library where our students can access them. They might be hidden by
some individuals in their departments and yet they don’t know how to
use them.

This sentiment was also given out by one of the students from KU when she
stated that some of the ATs for the blind were hidden in some of the university
departments. The student participants had also complained about lack of
training of the university personnel responsible for the ATs services.

When the participants were asked to tell about the ATs they knew that would
assist the blind students, four out of the five interviewed (80%) were only able
to mention only some of those that were available in the university. only one of them managed to mention at least three more which were: BrailleNote, Booksense and telescopes. This showed clearly that the participants had little knowledge about the ATs for the blind to an extent that the student had better knowledge than they did. No wonder one of them reported that they learnt more of the ATs from the students they served.

The participants upon being asked what they suggested to be done to improve the ATs services said that the university should hire an employee with expertise in adaptive technology and web accessibility to teach other employees; provide equally knowledgeable technological support for personal computers to students who use adaptive technology as for students who do not; provide training to all faculty and staff about the requirements for web accessibility and the simpler things they could do to meet these requirements for the blind and the VI students. They also added that the university should train higher level administrators about the requirements for equal accessibility of educational resources and material by the blind and the VI students.

In addition, during the interview the participants were asked to tell which services they offer to academic staff and to the students during lectures. They responded that the lecturers rarely ask for any help apart from demanding for the brailing and transcription of braille examinations. Lastly, in the interview the participants were asked to tell what future plans the university had to improve the quality of AT services. One of respondents explained that the
university was coming up with a policy that will enable equal access to facilities and resources by the students with disabilities. The rest of the participants reported that they are never included in such discussions. For the purpose of comparison, using the same interview protocol, the SU personnel were also interviewed about their awareness of the ATs for the blind.

4.5.2 SU Staff preparedness on the ATs services for the Blind

As was the case with the KU, three SU participants were asked to tell about their training for the services they offered for the Blind and VI students and the academic staff in the university. It was found out that although the three had masters’ degrees, none of them had been trained in the area of ATs for the blind or even in the field of special education. One of staff had a master degree in library science, the other one had masters’ degree in social work and the third participant had a master degree in IT.

When asked on the challenges they face when offering ATs services three of the staff complained that there were no employees on campus with expertise in web accessibility and adaptive technology to provide support. They added that the student keeps on seeking assistance but the university has to hire someone from outside to come and assist. The problem is that the person is not always available. They also lamented that the ATs available in the university were very few for the number of the student in the campus. In explaining how he
learned how to assist the blind students, Gikuyu (pseudonym) humorously stated that

…..Have you ever heard the educationists say the teachers are learners first? This is the way it goes. I am very friendly with the students. When I realize they know something that I don’t, I quickly learn from them. I’m then able to teach others who don’t know it……But I have to be careful not to boast about especially when the one who taught me is around.

This sentiment clearly showed the kind of difficulties the service providers face when offering these services in the university. The researcher was eager to know why they had not requested the university to either employ the qualified personnel or take them for further training. Two of the respondents were reluctant to give answer to this but one of them was courageous to inform the researchers that this was very sensitive information the researcher was looking for. The participant further disclosed that this kind of research cannot be entertained in the university. He explained that the university has to keep its name by saying how it caters for the special needs students. The participants went on to explain that some types of disabilities are too expensive to cater for in the university and the students were not able to fully pay for all the services they required. “ADA and section 504 have never been clear and that is why you see a lot of pretense and so many students with disabilities suffering in the institutions of higher learning.” This statement could have explained the reason why there was a cartel which was earlier on described by the student participants. It was now clear to the researcher why the participants had to demand for high confidentiality from him when handling the information they gave.
During the interview, the participants were asked to explain how they organized the training for the blind and the VI on the use of the available ATs in the university. They stated that there had been no formal training for the students. But in case a student had problem he or she would be assisted at the office of disability services. The participants when asked to tell the kind of AT they knew would help the students in university, they only stated that students should be consulted about what they feel would be best for them. Indeed Mumbi (pennname) clearly explained that, “While I do not know enough to say what would improve the education; a modern CCTV has been requested several times over several years.” When asked to suggest what should be done to improve the services they offer the participants requested the university to employ experts in the field of students with disabilities. They also added that more people in the university including the faculty should be sensitized on the need and requirements of students with disabilities and be trained on how to offer simple services to the students. They also said that the university should put more effort to purchase more ATs for the blind and the VI students. The researcher asked the participants to tell which future plans the university had to improve the quality of ATs services for the blind but they all said that they were never involved in such discussions.

From the findings, the complaint about lack of trained personnel by the student participants in both KU and SU was confirmed by the staff who had the duties to offer the AT services. This shows that the situation is really bad in the universities. One of the student participants complained that he didn’t
care about the services the staff pretends to offer to him. The word “pretense” meant that the staff camouflaged in a way that they would be seen offering the services. This was clearly demonstrated by one of the Staff participants who disclosed that he learned about ATs from the students whom he is employed to serve and humorously stated that he does not boast about especially when the student who trained him on how to use the devices or software was around.

The situation here could be explained by the fact that there is fear of breaking the law that governs the services for the blind in the universities (PDA, ADA and Section 504) and the fear of those with the power and authority in the university (Coffman 1963). It also shows that those with authority in the university have in a way been able to disrespect the laws without being noticed. This could be due to the weakness of the laws. Indeed one of the participants responded that the ADA and the Section 504 have never been easy to implement. Additionally, Mugo, Oranga, and Singhal (2010) argued, that instead of addressing education as a human rights issue, the PDA takes a charity approach.

In such a situation where there is lack of enough ATs and lack of training, creativity is a priority on the part of the user. According to Botelho (2012), what can really help in such a situation is the assistive technology strategy not devices. In consideration of this, it was imperative to find out how the AT was being employed to ensure access to the education.
4.6 Employment of ATs to Ensure Access to Quality Instructions

Objectives three section one and two of this study demanded that this study finds out how the AT was employed to enable the blind and VI students in the universities under this study to access quality education. Accordingly, two research instrument were used namely student interviews and class observation protocol. This section presents the study finding based on each of the objectives.

4.6.1 Use of ATs for the blind in Academic and Core curriculum at KU

The section one of the third objective of this research project was to find out how the assistive technology was being employed to ensure quality instruction for the blind students in KU. The AT normally is used to support all academic areas as well as expanded core curriculum in the learning institutions (Wiazowski, 2009). Following this, during the interview with the students, the researcher requested for explanation about how the participants used the AT. It was found out that the participants used the AT in various activities including writing and reading braille, Using CCTVs to read small prints, using computers to browse the internet and to send email messages to colleagues, friend and relatives, using braille watch and talking watches to check time, Using cell phones to call and receive information and though rarely they used white canes to walk. Using the classroom protocol, it was observed that the
blind students had only a single option of using their braille machines which they placed on their laps due to lack of desks in the lecture halls to write notes. The blind students had no other option apart from listening to their lecturers and write down note.

This situation was difficult given that the students did not have enough ATs especially the modern ones and again they did not have enough skills due to the lack of training. Additionally the ATs being very expensive (Botelho, 2012), it was understandable that the lecturers had no other option but to aurally lecture to their students. This situation could be controlled by sensitizing and training both the students and the staff and seeking for support in obtaining the modern ATs. This situation in a developing country could be helped through finding out what happens in developing countries and borrowing some ideas from them. This study further investigated how the AT was used in SU and the findings were as follows.

4.6.2 Use of ATs for the blind in Academic and Core curriculum at SU

The section two of the third objective of the study was to find out how the assistive technology was being employed to ensure quality instruction for the blind students in SU. The students were also asked to tell how they used the available ATs. It was found that all the participants used their laptop computers to do various things including the following: Browsing internet,
typing class work, receiving and saving reading materials from their lecturers/professors, reading notes and other text using screen readers or screen magnifiers, communicating through email messages and through Skype, calling, making purchases and calculating and listening to music. The students also used their iPhones and ipads to manage these activities.

Moreover, during the classroom observation, it was noted that out of the 25 students 13 (52%) of the students used their laptops to type notes, six (24%) Braille sense (Notetakers) to record the lectures and the rest six used note books to write their notes. This was different from KU where out of the 36 students that were observed 20 (55%) used the Perkin braillers to write their notes while 12 of them (33%) used note books to write their notes.

Further, during the classroom observation it was found that the lecturers/professors using the wall screens were able to enlarge texts and pictorial presentations for the low vision students to see. They also used computers and screens to show videos which worked very well with the students for they had both audio and enlarged visuals. Some of the lecturers were also able to produce hard copy notes in large print for the VI students.

From the findings it is evident that the students and the faculties in SU have more options when it comes to the employment of ATs for instruction and core curriculum. All the twenty five students for example have their laptop computers and are able to conduct various activities using the adaptive
software installed in the computers. It is also apparent that the student’s skills to use the ATs ware gained through their long interaction with these technologies and not through formal training in the university. The university has also managed to obtain some technologies for example the screens which can enlarge writing. The screens although not procured for the VI students are creatively used to assist them. In comparison of this situation to that of KU, one could obviously tell that the students in SU are relatively able to access instruction and the core curriculum more than those students in KU.

Being in a developed country, SU was able to purchase more ATs for the blind compared to KU which is in a developing country. Additionally, the staff and the students in SU have had an opportunity to possess the technology for a long time. Even without much training one would gain the skills of operating something through discovery which might include trial and error. The ease of engaging in various activities using the technology shows how important ATs are for the Blind and VI students. AFB (2012) observed that Students with visual impairments have unique educational needs which are most effectively met using specialized services, appropriate media as well as specialized equipment and technology. This assures equal access to the core and specialized curricula, and enable the students to most effectively compete with their peers in the learning institutions and ultimately in society.

Due to the foregoing it is therefore imperative that every Blind or VI student has access to and is able to use the ATs and receives the deserved services in
the learning institutions. Studies have shown that in a situation where these ATs and services are scarce, there is normally high and unhealthy competition for the scarce resources (Windle and Warren, 2012; Coffman, 1963). To this extent, this study went further to find out the legal and practical policies that the universities had to ensuring that the students received the ATs and the services they so deserved.

4.7 Legal Requirements Intended to Guarantee Quality Instructions

The fourth objective of this study was to establish legal and practical requirements predetermined to guarantee quality instruction for the blind and visually impaired students in the universities. Accordingly, the researcher visited the offices of disability services in both KU and SU with the intention of obtaining copies of the legal documents. The intention of getting these documents was to analyze the documents so as to learn more on how the universities ensured that the blind and the VI students received quality instruction.

The findings of the study in KU and SU were similar. Neither of the universities had their own set legal documents or even documented policies for the students with disabilities. In KU, the researcher was informed that the university was coming up with a policy document which would be used by the university to ensure that the students were not discriminated in any way. He
was made to learn that at the time the university was using the Persons with Disabilities Act (PDA) - ACT NO. 14 of 2003. In the same way, the researcher was informed that SU used the Americans with Disabilities Act (ADA, 1990) and Section 504 of the Federal Rehabilitation Act (Rehab Act 1973). Although the researcher was aware that these legal documents were available online, he was curious to find out whether these offices kept hard copies for quick access and reference by interested individuals. It was found that the Office of disability services at SU had a single hard copy of the document while the KU office didn’t have one at the moment but promised to print out some copies.

The capability of these laws to ensure equality of access to university education by students with disabilities has been challenged (Opini, 2012; AFB, 2012; Mugo, Oranga, and Singhal, 2010). From the analysis of these documents it was discovered that there was similarity in them. The laws are not specific and clear on what, how, when, where, and to who in order to ensure that the students have enough ATs and to offer the required services. For example, providing equal access to all individuals with disabilities is the key element of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992. This is also the case with the PDA of 2003. But the pertinent question one would ask is: what kind of access, by whom in particular, to what extent and in which kind of environment? For example, a Blind or VI student, who does not have access to social and physical information because of the visual impairment, is not included, regardless of the physical setting. This means that unless the student’s unique educational
needs for access are addressed by specially trained personnel in appropriate environments and unless these students are provided with equal access to core and specialized curricula through appropriate specialized books, materials and equipment, then the issue of accessibility does not apply.

With the laws and the policies not clear and with the discretion to the provision of the AT and the required services left to the institutions of learning, it was useful for this study to go further and find out how these students were being instructed.

4.8 Design of Instruction for the Blind and VI Students

The fifth and the last objective of this research study was to explore the ways in which lecturers in the universities designed and conducted their instruction to ensure the blind and the VI students learned best. According to this objective, two instruments were used to gather the data. First the researcher used the classroom observation schedule to observe in the classes and then using the interview schedule (see Appendix D), students were interviewed about the accommodations they received during the instructions. The UDL document was also analyzed to guide in finding out whether best practices in instruction were followed. The findings from the two universities were as follows.
4.8.1 Instruction of Blind and VI students at KU

After obtaining the class time tables from the student participants and requesting the lecturers to allow the researcher to observe in their classes, the researcher managed to observe a total number of 36 sessions in various classes that the students attended. In all the classes observed, the lecturers orally and systematically explained the class concepts and then dictated notes to the students. Very rarely and only scribbling few sentences they did write on chalkboards or on white boards that were available in the lecture halls. The students including the blind and the VI, on the other hand, sat quietly listening and writing down notes. The only time the students would talk was when they were requesting their lecturer to repeat some words or to slow down the speed of talking when dictating notes. It was also noted that immediately after the lectures some students would run out of the lecture halls quickly and consult with their lecturers before they left for other classes. Unfortunately, before the Blind and the VI students would get out of the hall to meet their lecturers, a crowd of other students was already surrounding the lecturer, or if not so, the lecturer had already left.

Also, in two of the sessions observed, the lecturers used power point presentations. In the presentations, the lecturers referred to the projected notes without considering the Blind and the VI students. For example, both lecturers used the following words: “As you can see there, if you look at point number three above, as we have seen in the previous slide” and so on.
Though it was not in the plan of this research to interview the lecturers, the researcher was eager to find out from some lecturers about how they assisted the blind and VI students during the lectures. The researcher got opportunity to talk to five lecturers after the classes. The lecturers expressed a lot of sympathy to the students. They blamed the huge size of the classes and their lack of knowledge on how to assist the students. One capturing statement was given by Mary (pseudonym) when she agonized that,

I really feel mercy for our students especially those who cannot see. Sometime I look at them during the lectures and I feel like crying. First our classes a very large on average 150 students and one does not know how to reach them. .....I personally don’t know how to assist them apart from just talking to them. But you see some things are better understood when they are pictorially presented or students are engaged in practical activities. .....We surely need assistance.

The researcher was also informed that that in the very big classes (over 150 students in a hall) the lecturers used the public address technology to reach their students. They only used verbal communication in form of lecturing and therefore the Blind and VI students mostly complained that they often left behind when their lecturer dictated notes.

During the interview with the students, all the 13 student interviewed expressed their dissatisfaction in the way the instruction was conducted in the university. They complained that some of the lecturers do not at all recognize their presence in the classes. Tomota for example complained that “some of our lecturers just go ahead presenting contents using whatever they call PowerPoint and use languages like ‘this one, there, that, this way, that point
The students further reported that some of the lecturers are ‘soft spoken’ and that due to the kind of noise their braille machines make the students are not able to hear what is presented. The KU students also said that some lecturers wrote on the chalkboard but never bothered to speak out what they wrote.

According to this objective also, the researcher obtained the course outline for the classes that were observed. From the analysis it was found that in the entire course outlines analyzed, the lecturer had briefly described the course (unit), outlined the subtopics in the course and briefly indicated that in the course the student’s achievements would be determined through two CAT exams and the final end of the term exam. Finally, short references were given at the end of the course outline. The course outlines did not describe the dates of classes, reading materials for the classes and the activities that students would be engaged in during the class. Also there were no directions on how and where the students with disabilities would get assistance.

From the analysis of the UDL document it was clear that its principles advocate for inclusion of the students with disabilities. For it best practice in teaching it advocates that the students be taught in a very conducive environment which is accessible to the students in all aspects. The document describes how to conduct the instruction as follows. To support recognition learning, the multiple, flexible methods of presentation should be employed. In the case of supporting strategic learning, multiple, flexible methods of
expression and apprenticeship should be used. Finally, to support affective learning, provision of multiple, flexible options of engagement should be ensured. According to Rose and Meyer, (2002), with these principles, aspects of curriculum namely goal, methods, material and assessment are flexibly done. Following this, it is evident that variety of ATs must be used in the teaching of the Blind and VI students in the university. Additionally a variety of teaching methods must be used in order for the students to benefit fully from the instruction. Considering this, it can be said that the teaching at KU did not fully meet the needs of these students. For example, the classes were large and students placed their heavy braille machines on their laps as they wrote notes. This was tiresome. They also had only one option in the instruction, the students only listened to their lecturers as they explained contents and as they dictated notes.

*Part of one of KU lecture halls with students getting in for a lecture*
Although one might argue that there was lack of modern ATs for the blind and that the classes were very large in KU, it is also true that the lecturers did not have the skills to better instruct their Blind and VI students. Given training on how to do this, the students could benefit more from the instruction. The developed countries are known to have a higher level of education compared to the developing countries. In this aspect it was necessary for this study to find out how the instruction for Blind and the VI students was conducted in a developed country.

4.8.2 Instruction of the Blind and VI students at SU

As was the case with KU, the researcher in SU observed in classes which Blind and VI students attended. However unlike the KU case, due to the preventive procedures and other restrictions predetermined to protect the students with disabilities in the university, it was only possible for the researcher to observe in only fourteen (14) sessions. The lecturers were friendly and allowed the researcher in their classes without restrictions. They first announced to the students that the researcher was a visitor in their class who was pursuing his PhD in Kenya and wanted to learn more on how to offer instruction to students. The students were always requested to allow me to observe and they gave the consent for me to observe in the classes. The researcher sat at the back of the class and only moved to join discussion groups in classes. This he did so as to minimize disturbance. The lecturers
were also kind enough to provide me with a copy of their course outline before I observed in their classes.

It was observed that the lecturers projected their notes on the screen and were able to enlarge the size of the writing to the satisfaction of majority of the students in the class.

An enlarged graphic using Power Point projector at SU

The lecturers/professors were also able to use the modern transparencies technology to enlarge writing direct from a text book and focusing it on the screen. This made it easy for them to discuss with the students in the class by sharing information from a single book.
However, some of the VI students especially those who did not use monocular would not see the writing. Due to this, the lecturers presented their contents at a moderate pace. They also engaged the students in discussion and in group discussions. Various teaching methods were integrated including problem solving. Unfortunately, all of the six lecturers that were observed extensively used visual language. For example pictures, diagrams, flow charts, and so on to present their content and they did not explain to the Blind students about these presentations. Additionally, they used words like this side, there, towards this, up this way, opposite that one, moved that way and in some instances instead of calling by name pointed at the Blind students to answer a question.

Although the lecturers were not found to discriminate against the Blind and VI students during the classes, it was observed that in many occasions, during group discussion some of the students were uncomfortable when a blind
student joined their groups. It was further observed that most of the time the blind students did not contribute much in the group discussions but whenever they did so, they were respected. From the analysis of the course outlines it was noted that the documents were comprehensive. The lecturers first described the course and clearly highlighted the objectives of the course. Further, the lecturers describe activities for every class up to the end of the semester. In every class it was clear what readings the students were expected to have read before the class. It was also clear that the evaluation of the students’ progress was continuous throughout the semester. The class discipline standards were also clearly defined including rules concerning plagiarism, and behaviors including discrimination, and stigmatization. Moreover there was a whole section urging students with disabilities to express their needs to their lecturers. In the sections also, the students were directed to the Office of Disability Services where they could get assistance.

Just as was the case with the research in KU, The researcher had an opportunity to interview two professors. They were asked on some of the worrisome challenges they faced as they instruct the Blind and the VI students. Both professors expressed their frustrations especially when they seek services from the Office of Disability services and it takes too long for what they felt was a simple thing to be done. The Professors also stated that they did not know how to deal with students with disabilities during the instruction. When asked how they felt about their lack of knowledge and skills to deal with the students, one of the professors said that he felt very sad about
it and wished he could get an opportunity to learn. The other one expressed her frustration bitterly stating that she did not care. “…even the law is not clear, the university does not care, it just complains about expenses…..I don’t also care.” she said.

The findings of the interviews with the students showed clearly that the students were not satisfied with the way the instruction was conducted in the university. The students complained that they were in many occasions neglected by their lecturers during instruction. They complained about some of their lecturers ignoring the fact that they did not see the presentations on the chalkboard/white board or the screen. “Some of our professors just present material visually completely ignoring us.” Amina reported. Also Bahati puts it as follows.

I can’t see on the whiteboard. Sometime I just hear the professor say “Yes and call my name” I get frustrated because I can’t see where they are pointing at. I don’t know what others are reading on the board or on the power point. If they use the chalkboard or whiteboard they just waste my time. So they need to speak out everything they display on the board or else they give me the notes

The participants also bitterly complained that some of their lecturers denied them permission to use ATs during instructions. For instance, one of the participants lamented that he wanted to use a recording device in class but he was at first denied permission until he had to prove by showing a letter that he is blind yet it was clear to the lecturers that he did not have eyes. Further, the participants stated that they feel stigmatized when they are occasionally forced
by their lecturers to prove that they were blind or visually impaired for them to receive their deserved services.

When the students were asked to suggest what they thought should be done to improve their access to the instruction, they suggested that the university should purchase more ATs, especially screen readers for them and that lecturers should be sensitized about their need and be given some skills of how to handle them during instruction. They also suggested that the university should offer them transport especially when the classes are off campus otherwise they failed to attend some classes when it rained and when the snow was too much for the students to move about.

The lecturers/professors of the Blind and VI students in SU could be said to have engaged the students more during the instruction. This was enabled by the small sizes of classes and the availability of more modern ATs in the university. Also, the lecturer’s skills in handling the technologies to engage learners during the instructions could be said to be better compared to those in KU. However, the instruction in SU, just like was the case with KU, did not fulfill all the UDL requirements for best practice in teaching of students with disabilities. To start with, the lecturers failed to use the appropriate language for the Blind and VI students. Moreover, they failed to appropriately use the technologies available to cater for the Blind and VI students in the classes. Although they were able to project on the screen and enlarge the writing, the lecturers were not able to fully assist the blind students who could not see at
all. Lack of skills on the part of the lecturers could have contributed a great deal to this situation. As the ACAMPESD commission of (2011) advocated, more technology for the blind and lecturers training on how to use the technology and instruct the students is needed for these students to benefit fully from the instruction.

4.9 Summary of the Chapter

This chapter has detailed the analysis and discussion of the findings of the study. The study has found that the universities do not have enough AT to enable the Blind VI students to access quality education. Additionally, the approaches and methods employed to instruct the students did not fully meet the expectations of the students. It was evident that the Blind and VI students struggle more than their sighted peers to achieve the same objectives and goals in their education. From the findings it could be true to say that the Blind and VI students upon completion of their course of study in the universities miss some important experiences that their fellow sighted graduates may possess. This means that the blind and the VI graduates might not compete equally for the job opportunities.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section of the study contains the summary and conclusion of the study based on the findings already detailed in chapter four. It also provides recommendations based on the study’s conclusions. The recommendations could lead to appropriate interventions to improve or salvage identified weaknesses in the education of the Blind and VI students in the universities. Also, stemming from the findings and the recommendations of this study are suggested areas of further research.

5.2 Summary of the Study

The summary presented here is based on the findings and it is done as per the objectives of the study.

5.2.1 AT for the blind available in KU

The study found that KU has a variety of technologies for the blind. The technology ranged from middle-age technology for example braille machines and braille papers, thermoforming machines and white canes to the modern technology including laptop computers, desktop computers, embossers, magnifiers for example CCTVs and modern software like JAWS, dolphin pens
and NVDA. It was however found out that the AT was not enough to meet the
demands of the number of the enrolled in the university. The study also
revealed that the university is aware that the students are suffering and that it
is working hard to procure more modern ATs for the students. These
technologies are extremely important for the instruction of the Blind and the
VI students and therefore it will require that proper mechanisms be put in
place to purchase the technology.

5.2.2 AT for the blind available in SU

The study established that SU has in its possession a variety of the modern
theology for the blind. The ATs includes the desktop and laptop computers,
talking calculators and the modern software including the JAWS, Kurzweil
3000 and Kurzweil 1000 and variety of magnifiers including CCTVs, and
Deluxe framed sheets. Unfortunately just as was the case with KU, the
technology is not enough to meet the demands of the students in the
university. Although the university has more ATs in terms of numbers, unlike
KU, the study found that the university is not very enthusiastic to purchase
more technology. The major reason that was given for this was that the
technology was expensive. Despite the reason, there was a lot of pressure from
the staff and the students for the university to purchase more ATs since the
number of the students enrolling in the university was increasing every year.
Additionally the change and level of education demanded that the university is
equipped with the technology to meet the requirement of the ever improving quality of instruction in USA.

5.2.3 Awareness of the students about the AT available for them

This study found that the students who are blind in both KU and SU had little knowledge of the AT that was available for their use. The students, apart from being aware of all what was available in their universities, were not fully able to use some of the devices and software that were in their possession. This was blamed on the lack of training of the students in both universities and apparent inaccessibility of the AT that was available in the universities. The situation was blamed on the lack of putting the ATs in a centralized and accessible place for the students and also due to the scarcity of the ATs in both universities.

5.2.4 Awareness of the staff about the AT available for the blind Students

It was established that the staff whose duty is to work with the students and the faculties in the provision of ATs services were not specifically trained in this field. It was also noted that the staff did not have enough knowledge of the ATs for the blind already available in the market. The findings of the study revealed that the staff was learning more about the ATs from the students who they were supposed to assist. The staff was in this case not able to organize for formal training of the students to enable them use the available AT. More
so it would be inferred that the staff was not able to accordingly advise the universities they serve on the most appropriate technology required.

5.2.5 Utilization of ATs for the blind to ensure quality instruction in KU

This study established that the Blind and VI students in KU used the AT for the blind to perform various tasks including writing notes using braille machines and braille papers, using computers to type their work and communicate through emails and even browsing using screen readers for academic materials. It was however noted that due to lack of training on how to use the modern devices and software the students either struggled very much to perform a task or were totally unable to use the AT for the tasks they were designed to perform. It was also found that their lecturers did not have knowledge on how to use the technologies in conducting their instruction. This situation left them only one option to use in the instruction and that was to lecture to the students and dictate notes to them.

5.2.6 Utilization of ATs for the blind to ensure quality instruction in SU

This study discovered that the Blind and the VI students in SU were able to perform various tasks in both the basic curricula and the core or extended curricular using the ATs for the blind. The study revealed that due to the longtime of interaction with the ATs in the developed country, the students were able to perform more tasks using the same devices and software compared to what the students in KU would do. The students were even able
to enlarge writing fonts using their computers and even some were able to convert the PDF documents into the JAWS friendly format.

On the other hand the staff, though not trained, was able to support the students in converting PDFs to word format which was accessible by all the screen readers and also to convert the printed texts into digital form that could be read using the various screen readers that were available in the university. The professors/lecturers, though also not trained in the field of the ATs for the Blind, managed to use the technology available to enable the students to access their content presentations in class. They for example enlarged writing by projecting the notes on the wall screen and also synchronizing the visuals with the audio. This gave the Blind and the VI students more options to choose from during the instruction.

5.2.7 Legal requirements predetermined to guarantee quality instruction for the Blind and VI students

This study noted that the Government of Kenya and that of the USA have laws governing the education of the Blind and the VI students in the universities. For Kenya, the PDA of 2003 was designed to ensure that the students with disability in the universities were not discriminated. Likewise the Americans laws ADA of 1992 and Section 504 of the Rehabilitation Act of 1973 forbids any type of discrimination of the students with disabilities in the universities. The study noted that both the law of Kenya and those from USA were not clear and that they were difficult to follow. The laws generalized the needs of
the students with disabilities without specifically considering the type of disabilities and the environment required for the provision of services for each disability. The Laws also took a charity approach by not clearly making it mandatory for the university to provide the ATs to the students with specific disabilities. The study also discovered that neither of the universities under study had its own institutional policy to guarantee access to quality instruction for the Blind and VI students.

5.2.8 Designing and Conducting Instruction for Best Learning by the blind and VI Students

According to this objective, the study found out that from KU the lecturers were only able to use oral presentation when teaching the Blind and the VI students. This was so due to the following: Lack of ATs in the university, lack of skills by the lectures on how to teach the Blind and the VI students and the presence of very large classes that were deterrent to easy interactions with the students.

In SU the study found out that designing design and conducting of instruction was more advanced. There was some engagement of the students during the lectures and especially when the lecturer/professors made sure that the students had interacted with the reading materials before the classes. The students were able to contribute in the mixed ability group discussions and the in problem solving tasks. In the course outline, the students were well directed on the class activities, reading materials, directions on where to get specialized
services (Office of Disability Studies) and the expected discipline in the class. However, due to the lack of teaching skills for the blind and VI students, the instructions did not much benefit the students. The students even complained of being frustrated and intimidated.

5.3 Conclusion

According to the findings of this study, there are numerous problems affecting the utilization and accessibility of quality of instruction for the blind in universities both in developing and in the developed countries. The problems range from the scarcity of essential AT for the blind in the universities to the lack of knowledge and the skills by both the students and the Lecturers/professors to use the available ATs for the instructions. To this extent, it can be inferred that the Blind and the VI students do not get access to quality education in the universities in both the developing countries and in the developed countries. In essence this could be seen as a global problem.

This study further concludes that due to the high costs of the technology for the blind, there has been a serious scarcity of these essential technologies in the universities. The desire of Blind and VI students to access quality instruction and the desire of the lecturers/professors to offer quality instruction to the students had created intense pressure to the universities to procure the AT and train on how to use it. Due to this pressure, some individuals who have authority in the universities have come up with some negative mechanism to suppress the pressure. The mechanism is that exerting their
authority and power over those students and staff who support the students to
in the demand for the services they so deserve. This has led to the
stigmatization, of intimidation and neglecting of Blind and the VI students to
the extent that they express their fear, frustration, stress and feeling of
unwanted. This situation further creates a great barrier to the access of quality
education for education to the students.

This study also concludes that there are so far no specific laws and
institutional policies predetermined to guarantee access to quality instructions
for the Blind and the VI students in the universities both in developed and in
the developing countries. The laws that are available are too general to ensure
provision of ATs and the appropriate services that go with it to the Blind and
VI students. Instead the law generalizes the needs all the students with
disabilities without considering their unique needs. The laws also are not clear
on the qualification of those who offer services to the students and even those
who offer instructions to these students. There should be specific laws
demanding that those who offer the educational services to the specific types
of disability be trained in the field. Also the law should be clear that all the
lecturers should be sensitized on the needs of the students they teach and be
trained to solve simple problems these students might be facing in their
classes.

Another conclusion of this study is that the education of the Blind and VI
students in the universities tends to depend too much on the extremely
expensive modern AT. the findings of this study shows that both the student and the staff that serves them only mention high technologies like advanced CCTVs, BrailleNotes, Book since and so on. The less expensive technology for example adaptable tables, reading lamps, abacus, chalks of different colors, felt pens and makers and so on were rarely mentioned. Some of the technologies could also be improvised to enable access of instructions by the Blind students. The tendency to rely too much on the modern technology might block the creativity that is required in the conduction of instructions in the university.

This study also infer that the best practices in teaching which is well described in the universal design and particularly in the universal design for learning have not being well practiced in the universities in both the developing and in the developed countries. Although UDL is in some extent dependent on the modern technology, it is also true that its guidelines are also applicable in the situations where the high technology is scarce.

### 5.4 Recommendations

In brief, the findings of this study vividly showed that there is generally scarcity of high tech and modern AT for the blind in both the developing and the developed countries. The findings also showed that the AT for the Blind is vital for the access of quality education by these students. Additionally the findings have shown that there is apparent lack of knowledge and skills in the utilization of the available AT by both the students and the staff in the higher
institution of learning. Moreover the study has established that there is generally lack of legal and institutional policies to guarantee the access of quality instructions for the Blind and the VI students. The findings also precisely showed that the lecturer/professors whose duty is to conduct instructions for these students have unfortunately little knowledge about the needs of these students and that majority generally lack skills to instruct the students. Finally, this study has inferred that the Blind and VI students do not have access to quality instruction in the universities both in the developing and in the developed countries. This study therefore recommends the following.

5.4.1 Establishment of specific legal and Institutional Policies

Due to the uniqueness in different types of disabilities and due to their specific needs in their educations emanating from these unique differences, it is not enough to have a general law governing all types of disabilities in all the institutions. It is therefore imperative that the government laws be clear on what kind of services the particular type of disability should be given in all the institutions of higher learning. This study would further recommend that each institution of higher learning and especially universities establish their specific legal and practical policies to guarantee provision of AT and other relevant resources, facilities and services and access to quality in instructions by the students. In the case of this study, the specific legal and institutional policies should guarantee quality instructions for the blind and VI students in the universities.
5.4.2 Government Support in Provision of AT in Universities

This study has established that there are many laws in the world including the law by the United Nations which prohibits discrimination of students with disabilities in learning institutions. In order not to discriminate these students, the institutions should be able to provide the necessary AT and other specialized services to the students with disabilities. This study has found out that the AT for the blind is very expensive and that the universities are not able to purchase enough to meet the demands of their students. It is therefore recommended that the same governments that make the laws should be able to support the universities in the provision of the AT and the specialized services for the Blind and VI students.

5.4.3 Training in the Use of AT in the Universities

This study discovered that the Blind and the VI students in the Universities mostly struggle to train themselves how to use the available ATs. By doing so, these students are not able to benefit fully from the devices and software which are otherwise designed to enable them access quality education. The study therefore recommends that the universities come up with mechanism to train its staff who are employed to provide the AT services and in Also organize formal training on the use of the AT to all the Blind and VI students who enroll in the universities.
5.4.4 In-service of Faculties/Lecturers in Conducting Instructions for SWD in an inclusive set up

This study established that the lecturers/professors in the university often get frustrated when instructing the Bling and VI students. It was found out that the major reason for this was lack of knowledge about the needs of these students and the skills to meet these needs in during the instructions. This situation is even worse when there are very few students with disabilities among a large class of students like it was the case in the developing countries. In this sense, this study recommends that the universities organize for the in-service of the lecturers following the UDL principles of best practice in teaching.

5.4.5 Embracement of Universal design in Designing learning Resources

This study discovered that most Blind and VI students especially in the universities developing countries do not access books and other learning resources due to the fact that the resources are not adapted for their use. This study would in this case recommend that all the books and other learning resources be designed following Universal Design. The principle of universal design is that all the resources and facilities onset is designed to cater for a variety of users and to enable performance of a variety of tasks by the users in various kinds of environments.
5.5 Suggestions for Further Research

This was a case study that adopted explorative descriptive method. As results, the study shall only be generalised through replications. With this limitation therefore, other studies with even the same topic can be replicated in other universities and institutions of higher learning in other countries. The study to this extent suggests the following for further studies.

i) A study of this nature be conducted to establish measures put in place to ensure access to quality education for students with other forms of disability in other higher institutions of learning.

ii) A research of this kind is urgently needed to improve on AT devices, notably devices that make VI learners more independent in accessing the ever growing knowledge base on the internet.

iii) Research should be conducted to establish other factors other than AT and instructional approaches and methods that affect access to quality education for the blind and those with other forms of disabilities.

iv) Research should be conducted to establish ways of adapting the universal design for learning in the developing countries where the Assistive Technology is scarce.
REFERENCES


http://www.rwgrayprojects.com/synergetics/synergetics.html


Voices Based on “the Voice Principle” (published PhD dissertation), Mauritius: University of Mauritius.


APPENDIX A: Complementary questionnaire for students

The purpose of this questionnaire is to gather some information about you as a person with visual impairment. The information you give will be used only for the purpose of this research and will be treated confidentially. Please give your answers with confidence.

A: Demographic details

1. Please indicate your age

2. State your gender
   a) Male (   )   b) Female (   )

3. Indicate the category of disability
   a) Blind (   )   b) Partially sighted (   )

4. Name of your university
   a) KU   b) SU

5. Indicate your level of study
   a) 1st year (   )   b) 2nd year (   )   c) 3rd year (   )   d) 4th year, (   )
   e) Master   f) PhD (   )

6. If you have any other type of disability apart from visual disability please indicates and briefly describe

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
APPENDIX B: Interview Protocol for Blind and VI Students

The purpose of this interview is to seek information that will be used to provide a general description of the ability of the students who are visually impaired to access quality instruction through the use of assistive technology.

Introduction of the interview

Hello my name is _________________ and I would request to interview you.

During the interview I would like to discuss the following topics: availability of AT for your use in the university, services you receive in the utilization of these ATs, and your accommodations during instructions in the university.

Provision and utilization of ATs for access of quality instruction

<table>
<thead>
<tr>
<th>Main question</th>
<th>Addition questions</th>
<th>Clarifying question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you tell me about the provision of ATs in the universities</td>
<td>• Which ATs are available for your use in the university?</td>
<td>Can you tell me more about how you are facilitated or trained to use the available ATs?</td>
</tr>
<tr>
<td></td>
<td>• Which other ATs are you aware of that could assist you though are not in the university?</td>
<td></td>
</tr>
<tr>
<td>Please tell me about the services or support you receive for your</td>
<td>• Which challenges do you face in the use of these ATs?</td>
<td></td>
</tr>
<tr>
<td>utilization of the ATs in the university.</td>
<td>• What would you propose to be done to improve the services?</td>
<td></td>
</tr>
<tr>
<td>Please tell about the support you are given during instruction?</td>
<td></td>
<td>Can you tell me more about the challenges you face in doing homework?</td>
</tr>
<tr>
<td></td>
<td>• Which are some of the most beneficial things your lecturer (professor) do to help you fully benefit from the instruction?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Which problems do you face during the class time?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• What are most worrisome</td>
<td></td>
</tr>
<tr>
<td>Challenges you face in carrying out tasks given by your professors?</td>
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<tr>
<td>In your opinion do you feel that you gain as much as the sighted students during the instructions?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| • Why?  
• What do you think should be done for you to fully benefit from the instructions? |

**Conclusion of the Interview**

<table>
<thead>
<tr>
<th>Are there other academic problems we have not discussed and you find worrisome? Or Do you want to add anything else in our discussion about the academic challenges you face in the university</th>
</tr>
</thead>
</table>
APPENDIX C: Interview guide for Staff (ODS and AT) who provide AT Services

The interview will seek deep information about the provision of AT services to both University students and faculty members including lecturers/professors.

Introduction of the interview

Hello my name is _________________ and I would request to interview you.

During the interview I would like to discuss the following topics: availability of AT for the blind in the university, services you provide for the utilization of these ATs, and the practical policies (government and institutional) governing the provision of services for the blind and VI the students in the university.

Services for the students and the lecturers (professors).

<table>
<thead>
<tr>
<th>Main questions</th>
<th>Additional questions</th>
<th>Clarifying questions</th>
</tr>
</thead>
</table>
| Can you tell me about the services you give to the blind and VI students in the university? | • In which way did you learn to offer these services?  
• Which challenges do you face in giving these services?  
• How do you organize the training of the students in using the ATs available?  
• What would you suggest to be done to improve the services? | Could you please tell me more about your training? |
| Can you tell me about the available ATs for the blind and VI students?       | • Are all the ATs available in functioning condition?  
• Which conditions or restrictions do you have in giving these ATs to the students?  
• Which other ATs for the blind are you aware of that are not available in the university that could improve the education of | Can you tell me more about how you became aware about those other ATs which are not available in the university? |
<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Question</th>
</tr>
</thead>
</table>
| Can you tell me about the policies that put in place guarantee quality provision of the services you give to the blind and VI students | **1.** Which polices come from the government?  
**2.** Which policies has the university designed to ensure quality of the services? | Can you tell me your opinion about these policies |
| Can you tell me about the support services you give to the lecturers (professors) | **1.** What kind of support do you give particularly for the blind students during instructions?  
**2.** Which advice do the lecturers (professors) mostly seek from you to support the instruction for the blind students?  
**3.** What future plans are there to improve the provision of AT and services for the blind in the university?  
**4.** What are your suggestions to better the instructions of the blind and VI students to the university? | |

**Conclusion of the interview**

- Are other services issues that we have not discussed and you find important?  
- Or  
- Is there anything else you would like to add to our discussion?
APPENDIX D: Documentary Analysis

The researcher obtained the following documents for analysis.

i) Inventory and resources of each university to analyze the availability and accessibility of the AT for the blind.

ii) University policy document detailing how AT based resources (hardware and software) should be utilized and the AT services that need to be provided.

iii) Course (unit) Syllabus

iv) Documents detailing UDL practices
APPENDIX E: Class Observation Schedule

The class observation is guided by the Universal design (UD) principles in the following learning components: Representation, Expression, and Engagement. The key thing is how the lecturers accommodate the blind and VI students in the teaching and learning process.

<table>
<thead>
<tr>
<th>Students</th>
<th>Lecturer (professor)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
<td><strong>Content Knowledge</strong></td>
</tr>
<tr>
<td>What is the core objective of the lesson?</td>
<td>What is the core idea of the topic lesson/Lecture?</td>
</tr>
<tr>
<td>How is the blind or VI student experiencing the content?</td>
<td>How has the lecturer constructed the lesson to address the idea?</td>
</tr>
<tr>
<td>What kind of thinking are students involved in (procedural, conceptual, problem solving, justification)?</td>
<td>What experience/medium are being used to teach the idea?</td>
</tr>
<tr>
<td>How has the lecturer constructed the lesson to address the idea?</td>
<td>How does the Lecturer assess student understanding?</td>
</tr>
<tr>
<td>What experience/medium are being used to teach the idea?</td>
<td>How is the content extended or adjusted for student own learning demands?</td>
</tr>
<tr>
<td>How does the Lecturer assess student understanding?</td>
<td>How does the lecturer develop the student’s idea about the content?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning</th>
<th>Pedagogy/andragogy</th>
</tr>
</thead>
<tbody>
<tr>
<td>How are the students using the discipline (subject/course) reasoning?</td>
<td>How does the lecturer use the reasoning of the students?</td>
</tr>
<tr>
<td>What connection are students making?</td>
<td>How does the lecturer facilitate/encourage students’ connections?</td>
</tr>
<tr>
<td>What understanding are they demonstrating?</td>
<td>How is the lecturer assessing student understanding?</td>
</tr>
<tr>
<td>What misconception are they holding?</td>
<td>How is higher level reasoning supported in class?</td>
</tr>
<tr>
<td>What are the results of this misunderstanding?</td>
<td>How is the proof and justification supported in class?</td>
</tr>
<tr>
<td>What conjectures have students made?</td>
<td></td>
</tr>
<tr>
<td>What justifications are they making?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Environment</th>
<th>Creation of Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well do students talk with each other and with their sighted peers?</td>
<td>What does the lecturer do to support the student centered thinking?</td>
</tr>
<tr>
<td>How well do students listen to each other?</td>
<td>In which ways does the lecturer support respect for the student’s ideas?</td>
</tr>
<tr>
<td>How do students support each other in the classroom?</td>
<td>Does the lecturer encourage the</td>
</tr>
<tr>
<td>How do the students access tools material and equipment?</td>
<td>students to use others as resources?</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>How are ideas respected/dismissed in the class?</td>
<td>How does the lecturer support various learning styles and needs?</td>
</tr>
<tr>
<td>Are students willing to take tasks?</td>
<td>How does the lecturer manage materials, supplies and equipment?</td>
</tr>
<tr>
<td>Are students engaged in the teaching/learning process?</td>
<td>How does the lecturer facilitate ideas as the currency of learning?</td>
</tr>
<tr>
<td></td>
<td>What interventions are sued in to maintain engagement and success?</td>
</tr>
</tbody>
</table>

**General comment on the overall access of instruction by the blind and the VI students**

**Source:** Adopted from Noyse Foundation 2007
**APPENDIX F: An Observation Checklist on Availability and Quantity of Instructional Resource**

Some of the AT resources expected to be found in the universities are listed on this table and more would be added in case those that are available in the universities goes beyond the list.

<table>
<thead>
<tr>
<th>Learning Resource</th>
<th>Available</th>
<th>Functioning condition</th>
<th>Not Available</th>
<th>Enough</th>
<th>Not Enough</th>
</tr>
</thead>
<tbody>
<tr>
<td>ipads, iPhones, ipods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note takers: Book sense, Braille sense, Voice sense, BrailleNote</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binoculars, monocular, Telescope</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice output machines: AbleNet bookworm, Alanddin Ambassador, Cicero Text reader etc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCTVs: Portable CCTV systems, Hand held magnifying cameras, Telesensory, VTI, Guerilla Technologies etc</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braille writers (machine), Braille papers, Braille slates, Templates, writing and signature guides</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice recorders: Tape recorder, Smart pen</td>
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<tr>
<td>Desktop and laptop computers, Microcomputers with speech synthesis, screen readers and Braille input and output software</td>
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<tr>
<td>Tactual maps, Tactual diagrams and globs, Braille books, Talking books Braille games, Braille labels Large print books</td>
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<td>Calculators: Law vision, Scientific, Talking: Talking watch, clocks</td>
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<tr>
<td>Measuring tools: Braille ruler, compass, protractor and tapes, thermometers</td>
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<tr>
<td>Measuring tools:</td>
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<td>Canes &amp; Mobility: NFB canes, WCIB canes, Ambutech canes, etc</td>
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<td>Tactile graphic kit: Braille readiness materials, Large print resources</td>
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<td>Markers and reading “windows”, Felt pens, Tactual symbols and signs</td>
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<tr>
<td>Opticon (optical-tactual-converter), Book readers, Viewscan, view sense, Speech compressor, Neospeech voice text</td>
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<td>Embossers, Scanners, Large print, photocopier</td>
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<td>Book stands, Adjustable tables, Adapted chairs</td>
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<td>Mp3 players</td>
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<td>Braille transcription software: Duxbury braille converter, SiloamBraille professional</td>
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<tr>
<td>Screen readers, JAWS, Dolphins pen, NVDA, Kurzweil, 1000, Kurzweil 3000</td>
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</tr>
</tbody>
</table>
APPENDIX G: Data Analysis Spiral

Figure 2: Data Analysis Spiral
APPENDIX H: Some Academic Technologies for Students with Visual Impairments

<table>
<thead>
<tr>
<th>Type of AT</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptive Video Services (DVS)</strong></td>
<td>The technology insets narrative verbal description of visual elements such as costumes, characters’ physical descriptions and facial expressions.</td>
</tr>
<tr>
<td><strong>Screen Readers e.g. Jaws etc.</strong></td>
<td>The software represents what is known as a text-to-speech application, which analyzes letters, words, and sentences and converts them into synthetic or digital speech.</td>
</tr>
<tr>
<td><strong>Closed-Circuit Television Magnification (CCTV)</strong></td>
<td>Device that enables the VIs to enlarge any type of text or graphic material. It uses a small vertically mounted video camera with a zoom lens directly connected to a monitor for displaying the image. The user is able to adjust the magnification, contrast, brightness, and focus, and to change the background display to either black or white, or in some cases, color.</td>
</tr>
<tr>
<td><strong>Optical Character Recognition (OCR)</strong></td>
<td>The technology enables blind students to place books or other print materials on a scanner and have the text interpreted and read using synthetic or digital speech.</td>
</tr>
<tr>
<td><strong>Braille Notetakers e.g. Braille sense</strong></td>
<td>Device that enables the blind students to enter and store Braille characters in the form of words and sentences.</td>
</tr>
<tr>
<td><strong>Magic Dictate e.g. Dragon Naturally Speaking</strong></td>
<td>Speech-to-text dictation program which allows the user to dictate to the computer and have their dictation typed out.</td>
</tr>
<tr>
<td><strong>Accessible Graphing Calculator</strong></td>
<td>Talking scientific graphing calculator which has audio output for the graphing function, and the graphs can also be brailled.</td>
</tr>
<tr>
<td><strong>Duxbury Braille Translator</strong></td>
<td>The software enables the conversion of print texts and graphics into braille and tactile graphics.</td>
</tr>
<tr>
<td><strong>Pulse Smart Pen</strong></td>
<td>This is a special pen with a camera embedded in the tip. The pen, along with its special paper, can record audio along with the associated written notes and then play back the notes by touching the pen to any point in the notes. Can also be played back on the computer as a flash movie. With additional software one can be able to transfer written notes into typed text if desired.</td>
</tr>
<tr>
<td><strong>Perkins Braille Writer</strong></td>
<td>This is the standard manual Braille typewriter with six keys and a space bar, plus backspace key and line space key. It has a rugged durable metal case and is designed for use over a long period of time. It takes up 15 inches of space, this writer helps the blind students to type their work.</td>
</tr>
</tbody>
</table>

APPENDIX I: Letter of Consent

DEPARTMENT OF EDUCATIONAL, COMMUNICATION AND TECHNOLOGY
Po Box 43844-00100
NAIROBI

Dear Student,

My name is Bernard C. Mugo and I am a graduate student pursuing Ph.D. in education. I am also a Tutorial Fellow at Kenyatta University, Kenya. I am currently on University exchange program and pursuing Certificate of Advanced Studies (CAS) Degree in curriculum and teaching here at Syracuse University, and collecting data for my dissertation entitled “Assistive Technology and Access to Quality Instruction for Visually Impaired Students: A Comparative Case Study of Kenyatta University, Kenya and Syracuse University, USA.” I am inviting you to participate in my research study. Involvement in the study is voluntary, so you may choose to participate or not. This letter will explain the study to you but please feel free to ask questions about the research if you have any. I will be happy to explain anything in detail if you wish.

I am interested in learning more about the Assistive Technology and access to quality instruction for the blind and the visually impaired students at Syracuse University. Your participation in this research project will take approximately one hour of your time. I would like to interview you as a part of my data collection effort. With your permission, the interview will be audio recorded. The purpose of audio recording will only be to facilitate data analysis for this study. Also With your consent, I will observe in the classes which you attend and take notes during my observation. Only the researcher will have access to the recorded information. All information I collect will be kept confidential. Furthermore, in my written reports of this research or any presentations that I make, I will use a pseudonym and change details about your institution and its location so that you will not be identified in any way. All data will be kept safely in locked files cabinet to ensure confidentiality. The recordings will be destroyed when the study is complete.

The benefit of this research is that you will be helping us to understand how provision and utilization of assistive technology would guarantee access to quality instruction for the blind and visually impaired students in universities. This information should help us to come up with strategies that will ensure the blind and visually impaired students benefit fully from university instructions.
The risks to you of participating in this study are minimal and may include being interviewed and further being inconvenienced by having to devote time to be interviewed. You may also feel uncomfortable being audiotaped. These risks will be minimized by scheduling the interview at time that is most convenient to you and by using observer field notes instead of electronic devices if you so desire. If you do not want to take part, you have the right to refuse to take part, without penalty. If you decide to take part and later no longer wish to continue, you have the right to withdraw from the study at any time, without penalty.

You may print this copy for your record. Also please contact me in case you require a Braille format of this letter. I will collect your signature personally before I interview you.

All of my questions have been answered, I am 18 years of age or older, and I wish to participate in this research study.

___ I agree to be audio recorded
___ I do not agree to be audio recorded

____________________________________    ___________ ______________
Signature of participant                                                                          Date

_______________________________________
Printed name of participant

_____________________________________
Signature of researcher                                                                   Date

Bernard Mugo

You may direct any specific questions or concerns about this research to:

Bernard C Mugo
Department of Educational, Communication & Technology,
Email mugobc@gmail.com/mugotech@yahoo.com

Please contact the Chair person Department of Educational, Communication and Technology, if you have questions regarding your rights as a participant, or if you have questions, concerns or complaints you wish to address to someone other than the investigator, or if you cannot reach the investigator.

You may also contact the Deputy Vice Chancellor academic office if you have any concerns about this research.
Kenyatta University,
Office of DVC Academics,
P.o Box 43844-00100
Nairobi
Dear Student,

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_______________________________________
Printed name of participant

____________________________________    ___________ ______________
Signature of researcher                                                                   Date

Bernard Mugo

You may direct any specific questions or concerns about this research to:

Bernard C Mugo
Department of Curriculum and Teaching
Phone (315)708 2564
Email bcmugo@syr.edu

Please contact the IRB, (315) 443.3013, if you have questions regarding your rights as a participant, or if you have questions, concerns or complaints you wish to address to someone other than the investigator, or if you cannot reach the investigator

You may also contact the Syracuse University IRB/Human Subject Board if you have any concerns about this research.

Syracuse University,
Office of Research Integrity and Protections,
121Bowne Hall/Syracuse, NY, 13244-1200,
Phone (315)4433013,
Orip@syr.edu
Dear Staff,

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