Availability and use of adaptive technology devices for Visually Impaired student teachers in Primary Teacher Training Colleges in Kenya

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Abstract

Adaptive technology devices improve the quality of education and remove learning barriers for the Visually Impaired learners. This paper is a report of a study that assessed the availability and use of adaptive technology devices for Visually Impaired (VI) student teachers in the instructional process in primary Teacher Training Colleges (TTCs) in Kenya. The research question that guided this study was: What types of adaptive technology devices for Visually Impaired student teachers are available and used in the instructional process in the primary TTCs? The study was based on the diffusion of innovation theory by Rogers which gives a basis for adoption of innovations in institutions and other settings. The study adopted a Mixed Methods research approach and a descriptive survey research design. The study population included administrators, tutors and Visually Impaired student teachers in three primary TTCs that admit student teachers with visual impairments in Kenya. Purposive sampling technique was used to select 3 deans of curriculum while simple random sampling was used to select 9 heads of departments and 93 tutors. Census sampling method was used to select 41 VI student teachers (blind and low vision) making a sample size of 146 respondents. The instruments used for data collection were questionnaires, interview schedule, and observation checklist. Descriptive statistics such as frequencies and percentages were used to analyse the quantitative data. Qualitative data was analysed through a discussion of emerging themes. The findings of this study revealed that, adaptive technology devices for VI student teachers were insufficient. The VI student teachers' attested that adaptive technology devices were inadequate and hardly used by tutors. The paper recommended for provision of adequate adaptive technology devices for VI student teachers by the government, parents, communities and donors. Another recommendation was that the tutors should be sensitized and trained on the use of adaptive technology devices. The study sheds light on the challenges influencing the integration of adaptive technology in instruction for VI students. The study is of significance in programme development and implementation for VI students in Kenya and elsewhere.

Key Words: Adaptive technology devices, Visually Impaired students, technology integration, resource use, resource availability

1.1 Introduction

The goal of education is to provide equal opportunities for all persons including those with special needs. Kenya is one of the 92 nations of the world who originally signed the Salamanca statement and framework for action on special needs education (1994) where it was agreed that regular schools should admit all persons irrespective of their physical, social and mental conditions. This was in a bid to ensure that quality education was accessed by all. This is also echoed in the world declaration on Education For All (EFA) [1990], the UN standard rules on the equalization for persons with disabilities (1993) and the Dakar framework for action (2002). Millennium Development Goals endorsed at the UN millennium Development Summit (2002) targeted the eradication of extreme poverty and hunger and the achievement of Universal Primary Education (UPE) as its first two goals. The education goals of the vision 2030 also consider this by providing globally competitive quality education, and among other things integrate special needs education into learning and training institutions. Inclusive education is about both getting children into and through school by developing schools that are responsive to the actual, diverse needs of children and communities.

According to the 2005 Sessional Paper No.1, the government of Kenya would integrate special education programmes in all learning and training institutions and ensure that the institutions are responsive to the education of learners with special needs. Special education programmes are designed to meet the unique needs of children with special education needs which includes classroom instruction (Republic of Kenya, 1999).

Learners receiving special education have educational handicaps such as physical, hearing, visual, mental, emotional, language, and multiple handicaps. These handicaps interfere with regular learning unless modifications and related services, equipment and specially trained teachers are provided (Republic of Kenya, 1999).

This situation can be addressed through the use of adaptive technology. Adaptive technology refers to any product, device, and equipment whether acquired commercially, modified or customized that is used to maintain, increase or improve the functional capabilities of individuals with disabilities (Bitter & Legacy, 2009). Some of the adaptive technology devices include; tactile maps and diagrams, Braille embossers, screen readers, and dolphin pens among others.

Adaptive technology devices improve access to quality education, enable the learner to address individual and collective temporary social problems and be able to reach responsible judgment in seeking solutions to these problems. They enhance the performance of a target skill, including cognitive processes, learning, communication, and physical abilities. Adaptive technology therefore improves the functionability of learners (Republic of Kenya, 2005). They improve the quality of education and remove barriers to learning. Teachers should modify and adjust materials of learning so that the VI learners can access the curriculum content adequately. This can be done by using them in their original form e.g. braille clocks and watches, materials manufactured specifically for VI students. Real objects can also be modified by preparing models and tactile diagrams. It is against this background that this study sought to investigate the availability and use of adaptive technology devices for Visually Impaired (VI) student teachers in the instructional process in primary TTCs in Kenya.

1.2 Statement of the Problem

A dominant problem for the Visually Impaired (VI) is lack of access to education. This is due to inadequate capacity among many teachers to handle students with special needs, lack of

coordinators among service providers, inadequate and expensive teaching/ learning materials among others (MOEST, 2005). In order to increase access in the provision of education for the VI students, the Kenya government has implemented integrated special education programmes in pre-service teacher education in three primary teachers' training colleges in Kenya. In these programmes, VI student teachers are admitted and taught in the same classes with the sighted student teachers. With regard to the significance on the use of adaptive technology devices in the improvement of quality education for the VI students, the focus of this study was on the availability and use of adaptive technology for VI student teachers in instruction in the primary TTCs where the VI student teachers receive their training.

A VI student teacher 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 and therefore need adaptive technology. The student teacher may also be unable through physical disability, to focus or move his/her eyes to the extent that would normally be acceptable for visual reading. This situation can be addressed through the use of adaptive technology which improves the function ability of VI student teachers. Some of the adaptive technology devices used by low vision VI student teachers include; highlighters which make the print more visible, stand alone and hand held magnifiers and reading stands. They also require spectacles mounted on magnifiers, telescopes and screen readers. Exercise books should be boldly ruled and textbooks should have large prints. The totally blind student teachers obtain information through tactile and auditory media. They require braille machines or slate and stylus which are used when the braille machine is not available, brailed textbooks, tactile maps and diagrams are also used. For the VI student teachers to graduate as skilled, confident and competent primary school teachers, tutors should modify and adjust materials of learning so that they can access the curriculum content adequately. The VI student teachers have been admitted in selected primary TTCs in Kenya and have been placed in the same classes with the sighted student teachers. They are taught by the same tutors at the same time in the same class yet they use different learning materials. The syllabus stresses that the teaching of student teachers who are visually impaired demands that tutors use appropriate resources (KIE, 2005).

Inclusive education has been introduced in primary TTCs in Kenya and thus there is need for research in the area to ascertain the state of affairs. Evidence is necessary because without use of adaptive technology, VI student teachers will not be adequately prepared as primary school teachers. The VI student teachers in the primary TTCs in question are under an inclusive setting. This prompted the researcher to find out the state in the provision of the required materials because as noted by Wambugu (2017), inclusive education in Kenya has been challenged by lack of specialized facilities and equipment. Therefore, it is against this backdrop that the study was carried out on availability and use of adaptive technology for VI student teachers in the instructional process primary TTCs in Kenya.

1.3 Research Question

The objective of this study was: What types of adaptive technology devices for Visually Impaired (VI) student teachers are available and used in the instructional process in the primary TTCs?

1.4 Justification of the study

Adaptive technology devices can make a measurable difference in VI student teachers' achievement, attitudes and interaction with tutors and other student teachers. A VI student teacher's motivation can be fully realized and positively challenged through the use of adaptive technology devices. Purcell & Grant (2002) opine that adaptive technology gives students with special needs

access to the curriculum. As a result of this, a VI student teacher is able to acquire the necessary skills, confidence and competence to teach in primary schools upon completion of the Primary Teacher Education course.

When technology integration is fully adopted, the visually impaired learners would be accepted more in the society and attain the desired professional skills such as teaching. With full integration of adaptive technology for visually impaired student teachers the teachers will be better trained since they will access the curriculum and understand it at a deeper level.

According to the Kenya Education Sector Support Programme (2005-2010), as a result of the recent changes in education, the curriculum delivery requires continuous monitoring to ensure that it is effectively implemented (MOEST, 2005). A major constituent in curriculum monitoring lies on the provision and use of the required resources. In this case, the focus of this study was on adaptive technology devices in the instructional process for the VI student teachers. Therefore, through this study, the availability and use of adaptive technology in the instructional process of the VI was established. The Primary TTCs used in this study usually admit VI student teachers to study with sighted student teachers in the same classrooms. There was need to ascertain the integration of adaptive technology which would ensure that VI student teachers are adequately prepared as primary school teachers.

1.5 Significance of the study

The study was of significance in several ways. The study examined the available adaptive technology devices for VI student teachers used at the primary TTCs. The shortcomings on the availability and use of the adaptive technology devices were identified and recommendations made. The findings of this study are useful to teachers, educational administrators, the government, policy makers as well as the curriculum development centres in Kenya and other parts of the world. The study provided information on adaptive technology devices for VI student teachers to Kenya Institute of Special Education (KISE) whose function is to design, produce and maintain educational resources and adaptive devices for persons with special needs and disabilities. Other educational stakeholders will find the findings and recommendations of this study useful as it sheds light on challenges affecting inclusive programs in educational institutions.

1.6 Theoretical Framework

First, this study was informed by Gerlach and Elly's theory of systems approach to teaching and learning (1980) as cited in Mwaka, Nabwire and Musamas (2014). A system is a group or collection of interacting and related units, element or entities that have central interest and work towards the achievement of a common goal or purpose (Mwaka etal, 2014). In this study, the instructional process in the TTCs was taken to be a system comprising of the interactions by various persons and conditions. The persons included the tutors and the VI student teachers while the conditions were the available resources or materials to be used in the implementation process. Gerlach and Elly (1980) outline various elements of a teaching and learning system thus: specification of objectives, selection of content, assessment of learners' entry behaviour, selection of teaching strategies and methods, selection of resources, allocation of time, organization of the learning environment, evaluation of learners and analysis of feedback. The systems theory was used to investigate the availability and use of adaptive technology devices for VI student teachers in the instructional process in primary TTCs in Kenya. Resources form a basic element in teaching and learning as per the systems theory.

Second, the study was based on the diffusion of innovation theory by Rogers (2003). This theory gives a basis for adoption of innovations in institutions and other settings. Adoption is the process through which an organization decides to acquire systems or technology devices in this case while diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003). With regard to the nature of a social system, Rogers (2003) explains that a social system is a set of interrelated units engaged in joint problem solving to accomplish a common goal. The social and communication structure of a system can facilitate or impede the diffusion of innovations in the system, for example, provision of adaptive technology devices for visually impaired student teachers can enable integration of adaptive technology in the instructional process.

2.1 Literature Review

Nabwire and Musamas (2017:177) define teacher education as the policies and procedures adapted in equipping prospective teachers with professional skills, knowledge, attitudes, values, and experiences in readiness to practice as well as the procedures that enhance lifelong education and training of practising teachers. Teacher education is of two types: Pre-service and in-service programmes (Farrant, 2009; Nafukho, 2002; Nabwire & Musamas, 2017). Pre-service teacher education takes place before the student teachers begin to practice as trained teachers while in-service teacher education takes place during the professional lives of the teachers. Teacher education is offered for various levels of education such as early childhood education, primary school education and secondary school education. This study was centred on pre-service primary teacher education for VI student teachers. Specifically, the study focused on the availability and use of adaptive technology devices in the instructional process for VI student teachers. This section reviews some literature on this research topic.

2.2 The use of materials and resources in the instructional process

Curriculum implementation effort cannot succeed without sufficient resources or materials (Carl, 2012; Syomwene, 2017). Teaching and learning materials are objects intended to be used during the processes of teaching and learning; when studying specific topics and achieving specific educational goals defined in syllabuses. They are used to simplify the content being taught (Mwaka et al, 2014). According to Agumba et al (2009:246), teaching/learning materials can be categorized into:

a) Display boards e.g. chalkboard, flannel board and bulletin board.
b) Three dimensional materials like objects, models, specimen, mobile sculpture, diorama, sand table, salt maps and globes.
c) Graphic materials like charts, graphs, maps, posters, college, diagrams, pictures, and illustrations.
d) Electronic resources like radio, television, tape recorder, record player, opaque projector, overhead projector, slide projector, film strips, computers etc.
e) Printed materials like books, workbooks and programmed instructional materials.
f) Community resources e.g. people, realia, local environment.

This study investigated the availability and use of adaptive technology devices in primary pre-service teacher education programme. Adaptive technology devices are kinds of electronic devices that are pertinent in integration of technology in the instructional process.

According to Mazgon and Stefanc (2012) educational materials are among the key components of educational technology. This is because teaching materials are used by the teacher during the

teaching process as students use learning materials to acquire or revise their knowledge. Educational materials should help the teacher in carrying out the teaching process and students with their independent learning. Effective materials are those that will enable learners achieve cognitive, affective and psychomotor objectives (Mwaka et al, 2014). Teaching and learning resources are incorporated into the lesson to enhance learner achievement in the instructional process. According to Tuimur (2011) the teacher has to select the instructional procedures and materials that would enable the leaner to internalize, retain, and apply what has been learnt. They occupy an integral place in the instructional process and should thus be selected, prepared and used carefully in order to give the leaners maximum benefit. Teaching learning materials are used to improve the quality of instruction. Each resource has its own strengths and weaknesses, and therefore resources are chosen to match specific learning problems and blended so that weaknesses in one are overcome by strengths of another (Koech, 2011). Kilel (2012) asserts that teaching resources are a key component towards realization of quality teacher training.

2.3 Adaptive Technology Devices for Visually Impaired Student Teachers

The potential that technology has for improving special education services and quality of life of exceptional people has yet to be fully realized (Berdine & Blackhurst, 1985). Visually Impaired learners are generally affected in the optimal visual performance in learning. This necessitates educational adaptations to ensure that the student and in this case the VI student teacher benefits in the learning process. According to Rukwaro and Kimani (2007), the general objectives of education of students with visual impairment dictate that the student should learn as much as possible the same content as any other student.

Both total blindness and low vision may have implications that limit learning. It is important that adaptations are made with regard to teaching and learning materials. Some of the adaptive technology devices used by low vision VI student teachers include highlighters which make the print more visible, stand alone and hand held magnifiers and reading stands. They also require spectacles mounted on magnifiers, telescopes and screen readers. Exercise books should be boldly ruled and textbooks should have large prints. Berdine and Blackhurst, (1985) assert that conditions such as proper lighting, reduction of glare, print size, spacing and the use of low vision aids must be considered to ensure that the learner is reading as effectively as possible. The most effective print size will vary with learners. VI student teachers who have low vision rely on large print materials, specialized magnification lenses, or electronic enlargement for the assistance they need. Some of the computer applications that would be useful to low vision students include Closed-Circuit Television Magnification (CCTV) and Computer Screen Magnification. These applications enlarge materials to enable students read them. Closed-Circuit Television Magnification (CCTV) enlarges any type of text or graphic material by using a small vertically mounted video camera with a zoom lens directly connected to a monitor for displaying the image. The text or graphic material is placed under the camera lens on a sliding reading stand and the image is projected on the attached video monitor. The amount of magnification is controlled depending on the needs of the user, contrast and brightness of the image is also controllable.

CCTV can offer student teachers access to photographs, maps and colour coded charts. Computer Screen Magnification allow for the magnification of the screen through the use of special software. The user can select and enlarge a portion up to 16 times the original size. This technology makes it possible for student teachers with visual impairments to use computers in accessing required information on maps and diagrams.

The totally blind student teachers obtain information through tactile and auditory media. They require braille machines, slate and stylus which are used when the braille machine is not available, brailed textbooks, tactile maps and diagrams. The primary tactile medium used by the visually impaired is the braille code developed by Louis Braille in 1829, (Berdine and Blackhurst, 1985). In 1951 the Perkins Braille was invented which was the first fast method for writing braille. In Braille code many words are represented by abbreviations, shortened forms of words and non-alphabetic symbols. Berdine and Blackhurst, (1985) point out that the changes in the braille code designed to same space have created problems in sequencing of words. With the slate and stylus, they consist of a metal or plastic frame which is sometimes mounted on a board. A pointed steel stylus is used hard punch Braille dots. Each slate has two parts connected by a hinge on the left side. The bottom side has several rows of Braille cells indented on its top. The top part has holes that correspond to the indentations. The paper is placed between the top part and the stylus is used to punch in the dots from the top. This may be tiring for the visually impaired student teachers.

The thermoforming machine acts as a photocopier for brailed work and tactile diagrams and maps. Tape recorded text, talking tablets models, and real objects are also used (Rukwaro and Kimani, (2007). Optical character recognition systems scan printed material and "speak" the text while braille embossers create hard-copy braille from text files. By the 1970s, adaptive technology for teaching the visually impaired had become more available. For example, the Kurzweil Reading Machine, a text-to-speech optical scanning machine, it converted printed words into synthetic speech. This provided access to print material which was initially unavailable for the visually impaired (Berdine & Blackhurst, 1985). It was the forerunner for the current portable devices, including lightweight and portable scanners.

Computers are important resources for all kinds of students. A computer's role in instructional process cannot be undermined since learners are actively involved in benefiting from the information in superhighway. This could be in words, games, graphics, numbers, ideas, records or messages. As a resource, a computer can store, retrieve, manipulate, transmit, and receive information electronically in a digital form. Blind student teachers can access computer devices that can help them become independent learners. They include; Descriptive Video Services (DVS), Optical Character Recognition (OCR), Braille Note takers and Screen Readers.

According to Hasselbring and Glazer (2000), Descriptive Video Services (DVS) technology inserts a narrative verbal description of visual elements such as sets and costumes, characters' physical descriptions, and facial expressions into pauses in a program's dialogue. Some television sets and VCRs have been designed with a "second audio program" (or SAP) switch that can be turned on so that the user can automatically hear descriptive video. DVS is available for both standard VHS and DVS formatted videotapes. DVS technologies help visually impaired student teachers by providing them with access to information, and opportunities for increased socialization and knowledge building. For instance when learning about the role play method of teaching the sighted students can watch a recorded video lesson while the visually impaired student teachers listen to the verbal description. This may also be used during micro teaching in giving feedback to the visually impaired student teachers on their performance.

Optical Character Recognition (OCR) technology enables blind student teachers to place books or other print materials on a scanner and have the text interpreted and read using synthetic or digital speech. It provides access to printed matter. The first OCR system for individuals with visual

impairments was introduced in 1976, when Ray Kurzweil invented the Kurzweil Reader. There are portable stand-alone OCR devices and devices that can attach to other computers and scanners. OCR devices can enable the visually impaired student teachers listen to literature set books. Braille note takers are small, portable devices that enable students to enter and store braille characters in the form of words and sentences. The note takers use the same six keys found on a traditional braille writer used for making a paper copy of braille. They allow users to review what they have written by listening to the text-to speech function of the device. Software translators allow the braille to be converted into text. The stored files can then be used with a standard word processor or a screen reader. The user can connect the note taker directly to a standard printer for text output or a braille printer for braille output to get a hard copy of the information.

Similarly, a paperless Braille display can be attached to a computer or a personal note taker that can display up to 80 characters simultaneously. Devices such as the Braille note taker that combines Braille with computer technology have made Braille much more useful than it was in the past, Hasselbring and Glazer (2000). This computer technology enables the tutor to mark the visually impaired student teacher's assignments without knowledge on Braille. This is because the technology can convert Braille to text. The student can also listen to what he/she has written which makes learning interesting.

Screen reader 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. Today, text-to-speech software is common in many software packages, including many word processing and educational software programs in math, reading, and spelling. With synthetic speech, the computer reads text passages, analyzes the phonetic structure of words, and attempts to reconstruct the words by putting together a string of synthetic phonemes that are then "spoken" by the computer. Digital speech is composed of actual recordings of human speech. The adaptive technology devices should be easily accessible to both students and tutors. Since the need for school resources is of paramount importance in modern day's educational systems as stated by Chumo (2009), adaptive technology devices should be available and in use for integration in instruction in primary TTC thus justifying the need for this study.

3.1 Research design and methodology

This study used mixed methods approach which borrows from qualitative and quantitative approaches to guide the collection of data. The close-ended questions in the tools of research formed content of quantification and open-ended questions which mainly sought for opinions on issues of use of adaptive technology devices for VI student teachers were explained qualitatively. The integration of the mixed methods within the same study was done to complement each other (Caracelli & Greene, 1997).

This study used quantitative approach in order to inform on the sample size of the respondents, quantify categorization of respondents and present the frequencies and percentages in order to understand the differences which may emanate in the descriptive statistics on aspects of availability and use of adaptive technology for VI student teachers in instruction in primary teachers training colleges in Kenya.

The study was based on the constructivist approach where learners construct their own understanding and knowledge of the world through experiencing things and reflecting on those

experiences (Piaget, 1985). Thus, it was based on the premise that (cognition) learning is the result of mental construction. Knowledge is not received from outside but by reflecting on own experiences, fitting new information with what one already knows and constructing knowledge. People learn best when they actively construct their own understanding.

In applying constructivism to the study, the adaptive technology devices were seen as cognitive tools. They enhanced the acquisition of the overall picture by the VI student teachers as well as their experiences. Using Braille books, VI student teachers were able to identify and retrieve information while tactile diagrams enabled information to be presented in a meaningful and appropriate way. Tactile maps allowed VI students teachers to establish relationships and appropriate representation while models converted new information to prior knowledge.

The research design was descriptive survey. The purpose of descriptive survey research is to provide a picture of a condition or phenomenon (Boudah, 2011). The phenomenon in this case was the availability and use of adaptive technology devices for VI student teachers in the instructional process in primary TTCs in Kenya.

The sample used in this study was drawn from a population size of 261 informants comprising of deans of curriculum, heads of department, tutors and VI student teachers in three primary TTCs in Kenya. The Three primary TTCs were selected purposively as they are the only ones permitted by the Ministry of Education (MOE) in Kenya to offer inclusive pre-service primary teacher education by integrating VI student teachers with the sighted ones in the instructional process. Purposive sampling technique was used to select three (3) Deans of Curriculum while simple random sampling was used to select nine (9) heads of departments (three from each college) and 93 tutors from the three primary TTCs used in the study. On the other hand, census sampling method was used to select all the forty one (41) VI student teachers from the three primary TTCs. The VI student teachers consisted of 28 totally blind students and 13 low vision students. This gave a sample size of 146 respondents which was over fifty percent of the targeted population.

The instruments used for data collection were questionnaire for tutors, interview schedule for Deans of Curriculum and Heads of Departments, focus group discussions for VI student teachers and observation checklists.

4.1 Results

The study sought to find out the availability and use of adaptive technology devices for VI student teachers in the instructional process in the primary TTCs in Kenya. Table 1 summarizes the data obtained from the tutors' questionnaires.

Table 1: Tutors' responses on availability and use of Adaptive Technology devices for VI student teachers in the instructional process

Adaptive Technology Device	Available and in use		Not available		Available and not in use		Total	
	F	%	F	%	F	%	F	%
Tactile diagrams	47	50.5	45	48.4	1	1.1	93	100
Tactile maps	40	43.0	49	52.7	4	4.3	93	100
Tactile globe	14	15.1	78	83.9	1	1.1	93	100
Braille machines	84	90.3	7	7.5	2	2.2	93	100
Braille clock	9	9.7	83	89.2	1	1.1	93	100
Large print texts	70	75.3	21	22.6	2	2.2	93	100
Brailed textbooks	53	57.0	37	39.8	3	3.2	93	100
Screen readers	25	26.9	64	68.8	4	4.3	93	100
Tape recorded texts	41	44.1	51	54.8	1	1.1	93	100
Real objects	52	55.9	41	44.1	0	0.0	93	100
Talking tablets	13	14.0	80	86.0	0	0.0	93	100
Highlighters	15	16.1	74	79.6	3	3.2	93	100
Magnifiers	37	39.8	52	55.9	4	4.3	93	100
Telescopes	9	9.7	82	88.2	2	2.2	93	100
Slate and stylus	35	37.6	56	60.2	1	1.1	93	100
Closed circular television	0	0.0	0	0.0	93	100	93	100
Braille note takers	0	0.0	93	100	0	0.0	93	100
Computer screen magnifiers	0	0.0	93	100	0	0.0	93	100
Descriptive video services	0	0.0	93	100	0	0.0	93	100
Optical character recognition	0	0.0	93	100	0	0.0	93	100

It can be observed from the Table 1 that 50.5 % (47), 48.4 % (45) and 1.1 % (1) of the respondents stated that the tactile diagrams were available and in use, not available and available and not in use respectively. It is also evident that on the tactile maps 52.7% (49) indicated that they were not available while 43.0% (40) and 4.3% (4) asserted that they were available and in use and available and not in use respectively.

Further majority 89.3% (78) stated that the tactile globe was not available while only 1.1% (1) said that they were available and not in use. Table 1 further reveals that 90.3% (84) had observed that Braille machines were available in use, 89.2% (83) indicated the non-availability of braille clock while 75.3% (70) asserted that large print texts were available and in use. When asked whether brailed textbooks were available 57.0% (53) observed that they were available and in use, 68.8% (64) stated that screen readers were not available while on the case of tape recorded texts, 54.8% (51) had observed that they were not available while 44.1% (41) stated that they were available and in use. It is also evident that 55.8 % (52) and 42.1% (41) of the respondents asserted that real objects were available and in use and not available respectively while majority 86.0% (80) stated that talking tablets were not available consequently it was revealed that 79.6% (74) of the responses showed that highlighters were not available and another 55.9% (52) observed that magnifiers were not available similarly, 88.2%(82) and 60.2%(56) of the responses showed that telescopes and slates and stylus were not available in their colleges while all 100% (93) indicated that closed circular television was available and not in use.

Further all 100% (93) of the respondents asserted that braille notes takers, computer screen magnification, description video services and optical character recognition were not available. This was in line with findings from interviews with the heads of departments and Deans of Curriculum who observed that adaptive technology devices for VI student teachers for integration in primary TTC were inadequate. The few that were available were not sufficiently utilized. Tactile diagrams, maps, and braille machines were available and in use. Braille machines were used by the VI student teachers when writing notes in class while tactile diagrams and maps were used by some tutors during instruction. They further confirmed that large print texts, brailed textbooks and magnifiers, were available but inadequate.

In addition, the primary teacher education revision books had not been transcribed into braille. This, they said, made the VI students request the sighted students to read the textbooks loudly for them to hear which was not convenient. With regard to the tactile globes, braille clock, tape recorded texts, talking tablets, highlighters telescopes, slate and stylus, braille note takers, closed circular television, computer screen magnification, description video services and optical character recognition, the heads of departments and Deans of Curriculum said that they were not available and therefore not in use. Computers are of great significance in the teaching and learning of VI student teachers. They can be used to store, retrieve, manipulate, transmit and receive information electronically in digital form (Agumba et al, 2009). Visually impaired student teachers may have missed out on these since computer applications were not available in the primary TTCs studied.

This was similar to what Kiaritha (2011) found in her study of implementation of Persons with Disabilities Act (2003) in public universities in Kenya which found that a major challenge was lack of assistive devices for students with disabilities. There was poor provision of special facilities and services. According to the Kenya Constitution, any person with disability is entitled to access materials and devices to overcome constraints arising from the person's disability (RoK, 2010).

The data from the questionnaires and interviews was further confirmed through an observation check list on the adaptive technology devices available in the institutions studied. The findings are indicated in Table 2.

Table 2: Availability of Adaptive Technology for VI Student Teachers in the Primary TTCs

Adaptive Technology Device	**Available**		**Not Available**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**
Tactile diagrams	2	66.7	1	33.3	3	100
Tactile maps	2	66.7	1	33.3	3	100
Tactile globe	0	0.0	3	100	3	100
Braille machines	3	100	0	0.0	3	100
Braille clock	0	0.0	3	100	3	100
Large print texts	0	0.0	3	100	3	100
Brailed text books	3	100	0	0.0	3	100
Screen readers	2	66.7	1	33.3	3	100
Tape recorded texts	0	0.0	3	100	3	100

Real objects	1	33.3	2	66.7	3	100
Talking tablets	0	0.0	3	100	3	100
Highlighters	0	0.0	3	100	3	100
Magnifiers	2	66.7	1	33.3	3	100
Telescopes	0	0.0	3	100	3	100
Slate and stylus	3	100	0	0.0	3	100
Closed circular television	3	100	0	0.0	3	100
Braille note takers	0	0.0	3	100	3	100
Computer screen magnification	0	0.0	3	100	3	100
Descriptive video services	0	0.0	3	100	3	100
Optical character recognition	0	0.0	3	100	3	100

Table 2 presents an analysis of availability of Adaptive Technology for VI Student Teachers in the Primary TTC's as per the observation schedule. With regard to tactile diagrams and maps, they were available in 66.7 % (2) institutions and not available in 33.3 % (1) institution. Braille machines and brailled textbooks were present in all the institutions studied, 100% (3).Tactile globe, braille clock, large print texts, talking tablets and highlighters were not available in all the three institutions. Screen readers and magnifiers were available in 66.7% (2) institutions and not in 33.3 %(1) institution. Real objects were found in 33.3 % (1) institution and not present in 66.7% (2) institutions. Closed circular television was available in all 100 % (3) institutions. On the contrary, tape recorded texts, telescopes, slate and stylus, braille note takers, computer screen magnification, description video services and optical character recognition were not available in all 100% (3) institutions. These findings show that the available adaptive technology devices are inadequate. This is similar to what Kilel (2012) in his study on factors influencing quality training in public primary teachers training colleges found out. The teaching and learning materials were inadequate and obsolete. Various practical skills needed to be reinforced using the teaching and learning aids which would in turn be applicable during teaching practice and professional actualization. He also noted that the few available up-to-date learning resources were inaccessible.

The visually impaired student teachers were engaged in focus groups discussions on availability and use of adaptive technology devices in their primary TTCs and they gave the following information. Majority of the visually impaired student teachers said that tactile diagrams and maps, slate and stylus were available and in use. Commenting on Braille machines, all of them agreed that they were available and in use. On the other hand the braille clock, talking tablets, highlighters and telescopes were not available and therefore not in use in their primary TTCs. Large print texts, Braille textbooks, screen readers, recorded texts and magnifiers were available but not adequate. They further explained that large prints were only seen during the exams when the low vision student teachers were given exams. Available brailled textbooks, they said, were mainly bibles and a few novels. Braille note takers, computer screen magnification, description video services and optical character recognition were not available and therefore not in use by all the visually impaired student teachers in the selected primary TTCs. These findings implied that the visually impaired student teachers were not adequately catered for in terms of adaptive technology devices.

5.1 Conclusions

Based on the findings of this study, the following conclusions were made:

i) The adaptive technology devices for VI student teachers were inadequate in the TTCs where this study was conducted. Braille machines and large print texts, were available and adequate. Tactile

diagrams, tactile maps, brailled textbooks, screen readers, tape recorded texts, real objects and magnifiers were available but inadequate. While those that were not available were CCTVs.

ii) The few adaptive technology devices that were available were also not adequately utilized. Tutors experienced challenges in using tactile diagrams, tactile maps, tactile globes and screen readers, Tape recorded texts, brailled text books, talking tablets and real objects.

6.1 Recommendations

The following recommendations were made for this study

1. The government, ministries, parents, communities, donors and other stakeholders should avail sufficient adaptive technology devices for VI student teachers for integration in the instructional process.
2. Tutors should be sensitized and trained in the use of Adaptive Technology devices. The Ministry of Education should develop in-service courses to train the tutors on the use of Adaptive Technology devices such as brailles and preparation of tactile diagrams so as to effectively teach VI student teachers in primary TTCs.

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