

**UNIVERSITY OF EDUCATION, WINNEBA**

**ACCESS TO ASSISTIVE TECHNOLOGY FOR STUDENTS WITH VISUAL  
IMPAIRMENT IN ADIDOME SENIOR HIGH SCHOOL**



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IMPAIRMENT IN ADIDOME SENIOR HIGH SCHOOL**



**A thesis in the Department of Special Education,  
Faculty of Educational Studies, submitted to the School of  
Graduate Studies in partial fulfilment  
of the requirements for the award of the degree of  
Master of Philosophy  
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in the University of Education, Winneba**

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## DECLARATION

### Student's Declaration

I, Agorsh Mawuli Anyigbanu, declare that this thesis, with the exception of quotations and references contained in published works which have all been dully identified and acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

**Signature**.....

**Date**.....



### Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

**Supervisor's Name:** DR. ADAM AWINI

**Signature**.....

**Date**.....

## **DEDICATION**

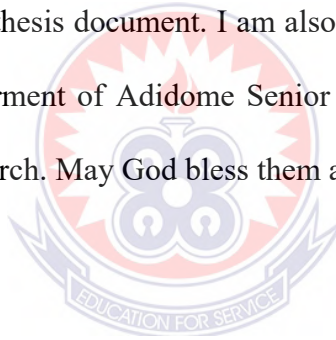
This work is dedicated to my mother Norwiegbor Adzinu, and in memory of my father,  
SGT. S.B.K Anyigbanu.



## ACKNOWLEDGEMENTS

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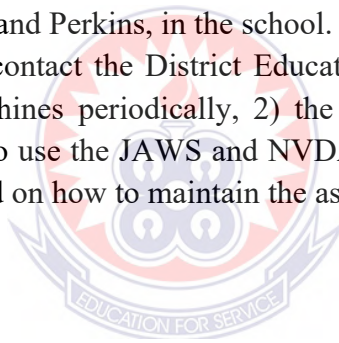
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## ABSTRACT

The purpose of this study was to examine how students with visual impairment access assistive technology in Adidome Senior High School and to make recommendations for effective use of such technologies. The case study design was adopted to guide the study. The sample size was 30 respondents. The sampling technique adopted was purposive sampling. Interview and observation were used to gather data from the respondents. Data collected were transcribed and analysed thematically. Findings of the study revealed that both high-tech and low-tech assistive technology devices such as desktop computers, an embosser, Perkins, slates, and stylus were available in the school. However, they were not enough to meet the learning needs of the students with visual impairment. In addition, the majority of the Perkins machines in the school were broken down. Findings of the study revealed that students with visual impairment did not frequently access JAWS because they did not have the requisite skills. Furthermore, the findings revealed that resource teachers were not trained on how to maintain assistive technology devices. On the positive side, the students with visual impairment had mobility and keyboarding skills. It was recommended that the headmaster could collaborate with benevolent organizations to provide more assistive technology devices such as desktop computers and Perkins, in the school. The researcher recommended that 1) the headmaster should contact the District Education to hire a technician to repair broken down Perkins machines periodically, 2) the students with visual impairment should be trained on how to use the JAWS and NVDA, and 3) the resource teachers in the school should be trained on how to maintain the assistive technology devices.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the Study

Assistive technology has become an important component in educating students with visual impairment because it helps them to overcome many barriers. Access to information for learning by using assistive technology can help students with visual impairment to maximize their potential and ability for achieving individualized objectives. In educational settings, assistive technologies help students with visual impairment to access and share information, complete schoolwork independently, provide an environment for socializing, and enable access to information and activities in the same way as regular students (Alves, Monteiro, Rabello, Gasparetto, & Carlvarho, 2009). Similarly, Kelly and Smith (2011) stated that assistive technology can enable students who are visually impaired to achieve educational success and gain competitive employment by providing tools for increased independent access to information and for effective communication.

Access to assistive technology enables students who are visually impaired to access information and to complete tasks efficiently, thereby enabling them to achieve the highest level of independence possible. Emerging research suggests that technology promotes acquisition of literacy, provides more equal access to information required for employment, and for access to information, in general, and facilitates social and community networks (Kelly & Smith, 2011).

Adidome Senior High School situated in the North Tongu district in the Volta region, is one of the few senior high schools that practices inclusive education in Ghana. It was the first regular senior high school to practice inclusive education in the

Volta Region in 2008. The school introduced inclusive education to enable it to educate all students with visual impairment, so that they would be equipped with the ability and capacity to live as "normal" as possible. Ocloo (2011) stated that the school thrives to inculcate in students with visual impairment both cognitive and vocational skills which they could use for their independent livelihood and sustenance.

In Adidome Senior High School, students with visual impairment are educated together with their sighted peers therefore they need additional support to learn. Support services provided to students with visual impairment in Adidome Senior High School include orientation and mobility which aims to ensure independent movement inside and outside the school, giving them the opportunity for freedom and independence. Again, students with visual impairment are given guidance and counselling services to encourage them to accept their conditions as well as focus on vocational and employment opportunities and skills for meaningful leisure. In addition, students with visual impairment are allowed extra time to complete tasks and tests to ensure that such students can meet learning outcomes. Despite the supports that are provided for students with visual impairment at Adidome Senior High School, no research has been conducted in the school on accessibility of assistive technology for students with visual impairment. Therefore, such students rely on their sighted peers to type assignments for them, as well as help them to retrieve information that is stored on their laptops.

In this study, access to assistive technology for students with visual impairment was focused on types of assistive technology, how students with visual impairment access assistive technology, factors affecting access to assistive

technology and students with visual impairments' knowledge and skills in the use of assistive technology. Wong and Cohen (2011) did general classification of assistive technology devices as a spectrum of equipment, from high to low tech that which can be applied in writing, reading, having access to computers, communication, mobility, and leisure. According to Georgia's Assistive Technology (2011), low-tech devices do not require intensive training and are inexpensive. Low-tech devices include devices such as hand-held magnifiers, large print texts, reading stand and mobility canes. High-tech devices are more sophisticated tools requiring special training to use the devices effectively. The devices are more expensive, such as voice recognition, digital hearing aids, electronic organizers, and communication devices with voices. There is, however, no research conducted in Adidome Senior High School to determine the types of assistive technology devices that are available, and this necessitated the researcher to conduct this study to find out whether such types of assistive technology devices are used in the school or not.

Mugo (2013) published a study on how students with visual impairment in Kenyatta University and Syracuse University access assistive technology. Mugo observed that students with visual impairment struggled with Braille machines in studying as major tools of writing. They did not willingly interact with computers due to little or no exposure, and also, they need sighted guides to orient them before opening up.

Research indicates that there have been numerous problems in access and the use of assistive technology for students with blindness in learning institutions (D'Andrea, 2010). There has been lack of piloting in schools for the blind before implementation of assistive technology. D'Andrea affirmed that, despite the federal

regulation that assistive technology services should be provided in learning institutions in the United States, half of high school students with visual impairment were not provided assistive technology services. One of the problems emanated from lack of technical skills to use some of the assistive technology devices and software. Teachers reported common problems in the areas of student technology assessments, training in the use of assistive technology and available personnel to repair and maintain the technologies. In a Brazilian study, the top reason teachers of students with visual impairment gave for not using assistive technology was the lack of training (Alves et al., 2009). There is, however, no research conducted on factors that affect access to assistive technology in Adidome Senior High School, and this informed the researcher to conduct this study in the school.

Cummings (2011) conducted a Delphi study to identify which assistive technology competencies and knowledge were important for teachers of students with visual impairment. Smith identified 111 competencies required for teachers of students with visual impairment the visually impaired. The areas of competencies included foundations of assistive technology, disability-related assistive technology, use of assistive technology, assistive technology instructional strategies, learning environments, access to information, instructional planning, assessment, professional development, and collaboration. There appears to be many areas of overlap between the competencies that were developed by the researcher. The various literatures reviewed about knowledge and skills of assistive technology among students with visual impairment were about students with visual impairment in Europe and East African countries. This was another reason that prompted the researcher to conduct this study in the school to examine how much knowledge and skills in assistive technologies the students with visual impairment enrolled in the school had.



Students with visual impairment in Adidome Senior High School have unique educational needs which are most effectively met using a team approach involving professionals, parents, and students themselves. Shapiro and Baker (2011) state that to meet the unique needs, students with visual impairment must have specialized services, books, and materials in appropriate media (including braille), as well as specialized equipment and technology to assure equal access to the core and specialized curriculum, to enable them to compete with their peers most effectively in school and, ultimately, in society. According to McNaughton and Light (2013), to meet regular curriculum learning outcomes, students with visual impairment need to be taught skills covered in the expanded core curriculum, such as accessing assistive technology, social skills instruction orientation and mobility. Assistive technology, both low technology and high technology, helps to improve the basic skills of students with visual impairment, giving them the ability to access literature, attain information and complete assignments and tests (Bausch & Ault, 2012). The authors concluded that technology allows these students to achieve learning outcomes in a variety of ways. Non-electronic equipment can be very helpful with completing course work (Petty, 2012). For example, students with vision impairments, who can write, can use dark-lined paper to lessen any eye strain associated with written work (Bausch & Ault, 2012).

Reading stands allow students to have their books as close to themselves as needed, without dealing with muscle fatigue. Aids for accomplishing mathematics tasks, such as braille rulers, abacus, and braille protractors, help students to meet prescribed mathematics learning goals (Petty, 2012). Slate and stylus enable students with visual impairment to produce work in braille, allowing them to take notes in class (Petty, 2012). Electronic technological devices are excellent tools students can

use to gain access to the core curriculum. Using other assistive technology, such as speech synthesis and braille translation software, give students with visual impairment a myriad of opportunities, such as using a word processor and accessing the internet, to access prescribed learning outcomes (Wormsley & Baker, 1994). Assistive technology, in all its forms, allows students with visual impairment to achieve the same learning outcomes expected of their sighted peers (Glodowski, 2006).

## **1.2 Statement of the Problem**

Assistive technology devices are designed to enhance academic independence of all manner of persons including students with visual impairment, there is inadequate use of such devices in Adidome Senior High School. Published study in Kentucky states that assistive technology helps students with visual impairment to cope with academic work. However, the types of assistive technology devices used by students with visual impairment do not match the current trends of technology, and example of which is the use of 2009 version of Job Access with Speech (JAWS) in 2021. Research by Presley and D'Andrea (2009) state that access to assistive technology for students with visual impairment facilitate their participation in the curriculum with a high-level independence. However, there is no clear-cut way regarding how students with visual impairment access assistive technology. There is low awareness among the students with visual impairment on the significance of the assistive technology in the school.

Ayiah (2017) states that access to timely and relevant information has become a prerequisite for survival as information has become a resource for nations, organizations and the individual. On the contrary, there are a number of factors affecting access to assistive technology in Adidome Senior High School that have not

been researched into. In addition, research by Smith and Kelly (2011) state that technology helps individuals have access to information thereby interacting with the outside world. Indications in the school suggest that teachers do not possess enough knowledge and skills in helping students with visual impairment in the use of assistive technology in Adidome Senior High School.

### **1.3 Purpose of the Study**

The purpose of the study was to examine how students with visual impairment access assistive technology in Adidome Senior High School, and to make recommendations for effective use of such technologies.

### **1.4 Objectives of the Study**

The following objectives were raised to guide the study:

1. To find out the types of assistive technology devices available for students with visual impairment at the Senior High School level.
2. To examine how students with visual impairment access assistive technology at the Senior High School level.
3. To determine the factors affecting access to assistive technology by students with visual impairment at the Senior High School level.
4. To find out what knowledge and skills students with visual impairment possess in the use of assistive technology.

### **1.5 Research Questions**

The following questions guided the research:

1. What types of assistive technology devices are available for students with visual impairment in Adidome Senior High School?

2. How do Senior High students with visual impairment access assistive technology in the school?
3. What are the factors affecting access to assistive technology for students with visual impairment at the Senior High School level?
4. What knowledge and skills do Senior High School students with visual impairment possess regarding assistive technology use?

### **1.6 Significance of the Study**

The findings from the study will provide information on the types of assistive technology devices in the Adidome Senior High School. Findings from the study will also reveal how students with visual impairment access assistive technology. Moreover, the results of this study will reveal factors affecting access to, and use of assistive technology by students with visual impairment. This will enable school authorities to take appropriate measures to address the challenges. Finally, the results of this study will reveal knowledge and skills possessed by students with visual impairment in the application of assistive technology thereby encouraging school authorities to keep providing the necessary support to equip the students with the appropriate assistive technology to enhance their learning.

### **1.6 Delimitation of the Study**

Although there are a number of Senior High School students in Adidome Senior High School, this research was only focused on the students with visual impairment. This is because it is the students with visual impairment who often use assistive technology individually. The researcher only focused on access to assistive technology for students with visual impairment, because though assistive technologies

may be available in the school, accessibility to the technologies could often pose some challenges to the students.

### **1.7 Limitation of the study**

The study was conducted in one school, and as such the findings may not be sufficient for generalization.

### **1.8 Operational definition of terms**

**Access:** Access in this study means use of assistive devices available in Adidome Senior High.

**Assistive devices:** Assistive device is any device that helps someone to do something well. For this work, assistive devices mean electronic and non-electronic devices that help students with visual impairment to overcome their handicapping condition to function effectively.

**Assistive technology:** Assistive technology in this study means any tool or product system, modified to increase, maintain, or improve the functional capabilities of students with special needs.

**High-tech assistive technology:** Electronic assistive technology devices that use an integrated circuit or “chip”. Examples include electronic magnifier, talking calculator or adapted computer. High-tech technology devices require electricity or power to function.

**Low-tech assistive technology:** Non-electronic assistive technology device, such as an optical magnifier, bold marker, or mechanical braillewriter. Low-tech assistive technology devices do not require electricity to work.

**Visual impairment:** In this study, visual impairment referred to both students with low vision and students with blindness in Adidome Senior High School.

### **1.9 Organisation of the Study**

The study was organized into five chapters. Chapter one introduces the study with background to the study, statement of the problem, the purpose of the study, objectives, and research questions. Again, the significance of the study was stated in this chapter as well as delimitation, the limitations, the operational definition of terms and organisation of the study. Chapter two deals with the review of related literature. It presents an overview of the theoretical framework and conceptual framework of the study. Chapter three covers the general methodology for the study. It describes the research approach, the research design, the population, sample size, sampling technique, data gathering instruments and access. Procedure for data collection as well as trustworthiness, credibility, dependability, confirmability, transferability, ethical considerations, and data analysis are included in this chapter. In Chapter four, data presentation, analysis and discussion of findings have been provided. Finally, in Chapter five, the major findings have been summarized, conclusion and recommendations have been made.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.0 Introduction**

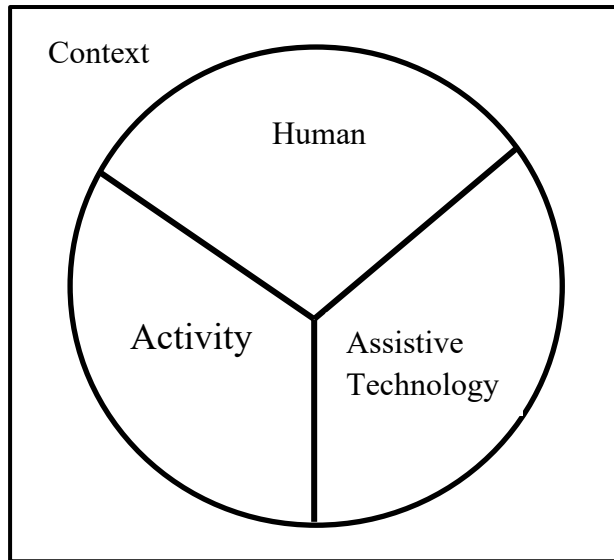
This chapter presents the theoretical framework, conceptual framework, and literature review. The review first covered the theoretical framework followed by the conceptual framework and review on the various sub-headings derived from the variables raised as the main themes in the research questions which are:

- Theoretical framework
- Conceptual framework
- Types of assistive technology devices available for students with visual impairment
- Students with visual impairment access to assistive technology
- Factors affecting access to assistive technology by students with visual impairment
- Knowledge and skills needed by students with visual impairment to access assistive technology
- Summary of literature review

#### **2.1 Theoretical Framework**

The theoretical framework that guided this study was Human Activity Assistive Technologies (HAAT) model propounded by Cook and Hussey (1995). Cook and Hussey posited that, assistive technologies must centre on individuals with visual impairments with the primary consideration of making individuals with visual impairment benefit significantly from the use of assistive technologies leading to

improvement in performance. The Human Activity Assistive Technologies model is presented on a diagram below.



**Fig 1.1 Human Activity Assistive Technologies (HAAT) model**

Source: Cook and Hussey, 1995

In the above diagram, Cook and Hussey identified four (4) core components in the model namely: Human, Activity, Assistive technology and context.

The human component contains cognitive, physical, and emotional elements. Cognitive abilities include problem solving, attention, alertness, and concentration, and they have effect on emotional abilities. Physical abilities include balance, range of motion, strength, and coordination. It is very important to know these abilities about human because they probably affect the use of assistive technology. Therefore, for the effective use of assistive technology, a match between human abilities and the requirements of assistive technology is needed. Also, assistive technology may provide assistance in the area, which the person has problems such as visual. For example, in students with visual problems assistive technology can provide a device for mobility and provide the person to maintain this ability again.



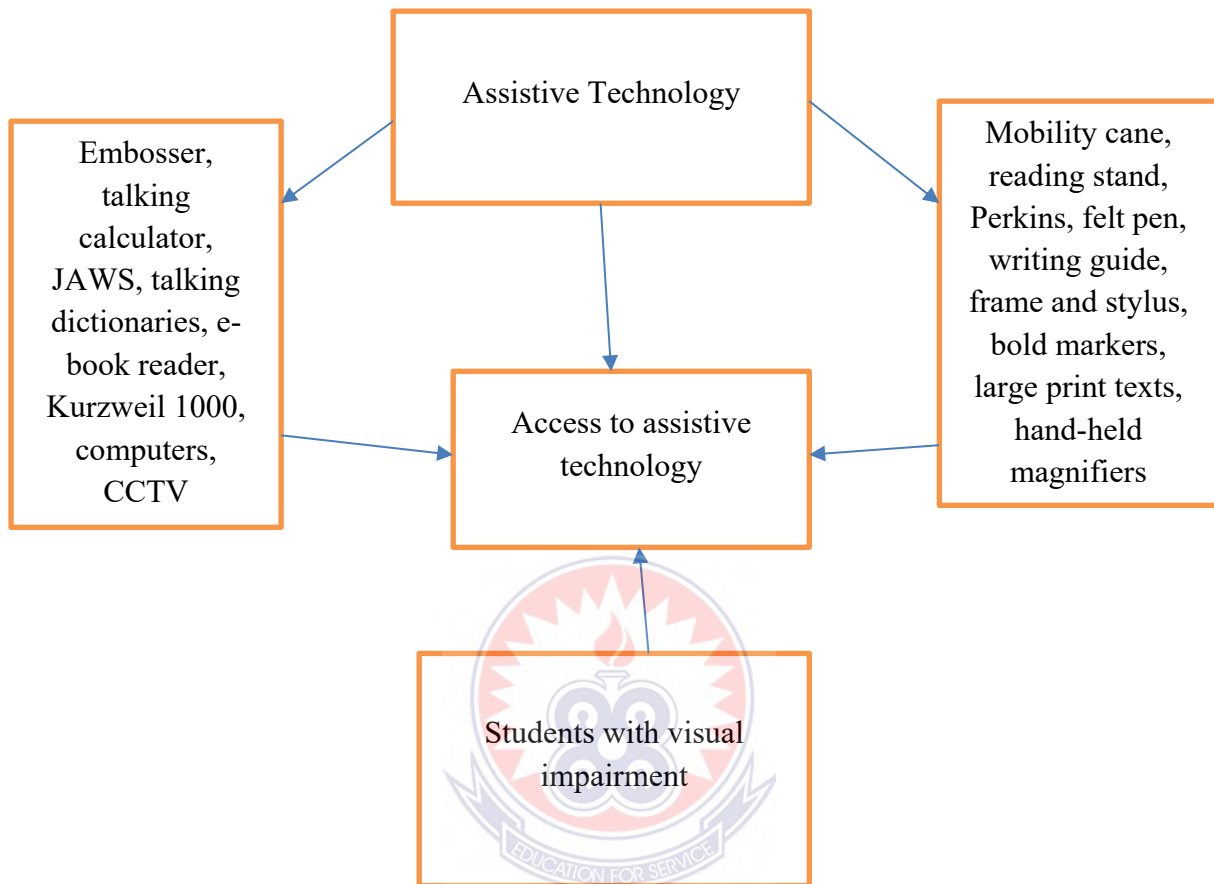
The activity component contains self-care, productivity, and leisure activities. Self-care activities include dressing, eating, hygiene, mobility, and communication. Productive activities are educational and vocational activities and home management. Leisure activities include relaxation or enjoyment such as watching television, resting, reading books, or dancing. These activities may require many abilities such as cognitive and physical. If the person has no capacity to do an activity, with the use of an assistive technology system, the person may gain his/her performance on this activity again.

The context contains cultural (pattern of behaviours, values, attitudes) physical (natural and built surroundings such as home, school, workplace, or parks), institutional (religious, educational institutions), and social (family, friends, strangers). Facilitators and barriers in the environment are very important for the selection, evaluation, and use of the assistive technology system.

The assistive technology is described as extrinsic enablers because they provide the performance, which is blocked by disability (Cook & Hussey, 1995). Choosing or designing an assistive technology system should be done through considering needs, skills, and goals of the person. Therefore, a detailed assessment about functions, activities, and environment is needed before determining the assistive technology system for the person (Cook & Hussey, 1995).

## 2.2 Conceptual Framework

Fig. 2 shows a diagrammatic representation of the conceptual framework



**Fig. 2.1: Diagrammatic representation of the conceptual framework**

Source: Researcher, 2020

Access to assistive technology by students with visual impairment plays very significant role in their education. Students with visual impairments access assistive technology devices such as mobility cane, reading stand, Perkins, felt pen, writing guide, frame and stylus, large print texts, hand-held magnifiers, bold marker, talking dictionaries, e-book reader, Kurzweil 1000, and talking calculators to enhance their learning.

## **2.3 Types of Assistive Technologies Available for Students with Visual Impairment**

Smith (2010) stated assistive technology can be low-tech (something very simple and low-cost, like a pencil grip), or high-tech (something sophisticated, like a computer). Wong and Cohen (2011) did general classification of assistive technology devices as a spectrum of equipment, from high to low tech that can be applied in writing, reading, having access to computers, communication, mobility, and leisure. Georgia's Assistive Technology (2011), the low-tech devices do not require intensive training and are inexpensive. Low-tech devices include: hand-held magnifiers, large print texts, reading stand, felt pen, writing guides and mobility canes. High tech devices are more sophisticated tools requiring special training to use effectively. The devices are more expensive. Examples of high-tech assistive devices include computer, talking calculator, touch tablet, embosser, scanner, electric wheelchair and smart board (Smith, 2010).

Students with visual impairment have difficulty accessing visual material in printed form or on the computer screen, where standard keyboards can aid in accessing Braille input devices, with Braille key labels assisting with the keyboard use (Smith, 2010). Petty (2012) stated Optical Braille Recognition (OBR) software can enable users having visual impairment to read Braille documents on a standard A4 scanner, scan the Braille document, analyse the dot pattern, translate the text, and present it on the computer screen. Refreshable Braille displays allow line-by-line translation of screen text into Braille, which can help in detailed editing (Smith, 2010). The Braille printers provide the 'hard copy' output for the visually impaired users. Scanners with optical character recognition can read printed material, which can then be stored electronically on computers, and be read using speech synthesis, or

printed using Braille translation software and Braille printers. Such systems provide independent access to journals, syllabi, and homework assignments for the visually impaired students (Petty, 2012).

Speech output systems can be used to read screen text, while the screen readers or the text-to-speech software like JAWS (Job Access with Speech) can help the user in adjusting the volume, pitch, and speed of reading, and in choosing or adjusting to a male or female voice according to their preference (Petty, 2012). Screen readers including navigation tools allow users to skip from headline to headline, or category to category while reading. Using the synthetic speech, the computer can read text passages, analyse the phonetic structure of words and attempt re-constructing words by putting together a string of synthetic phonemes, ensuring easy understandability of the message by the student. The use of earphones for individuals using speech output systems can reduce and limit the distractions for other individuals present. Audio materials like talking books and audio cassettes of recorded lessons can be used by students with visual impairment. The use of sophisticated audio devices, CD players, cassette players, and recording machines can be used to record lectures, books and other study materials and help students in submitting their assignments in audio formats. The descriptive video service with a narrative verbal description of the visual elements displayed on the screen enables the students to automatically hear the descriptions of all the visual elements, providing the students with visual impairment an opportunity for better socialization and knowledge building (Petty, 2012).

Burgstahler (2012) stated the use of large print key labels, special equipment for the modification of display or printer output, computer-generated symbols, both text and graphics enlarged on the monitor or printer, can prove useful to students with low

vision, especially in using standard word processing, electronic mail, spreadsheet, and other software applications. Adjusting the colour of the monitor or changing the foreground and background colours, through special software like reversing the screen from black on white to white on black for individuals who are light sensitive, can help improve access and readability (Burgstahler, 2012). Anti-glare screens can make screens easier to read, while voice output systems can also be used by people with low vision. The printed material can be read by scanners with optical character recognition and stored electronically on computers, where it can be read using speech synthesis or printed in large print. Assistive devices that are suitable for students with low vision may be used to aid in efficient learning like close circuit television, magnifying glasses and hand magnifiers, Braille language, talking calculators and tape recordings (Burgstahler, 2012).

The American Foundation for the Blind classifies the types of assistive technology for students who are blind or low vision into four main categories, as shown in Table 1 (Presley & D'Andrea, 2008, p. 43).

**Table 1: Types of Assistive Technology for Students with Visual Impairment**

<b>Types of Assistive Technology</b>	<b>Device</b>
Technology for accessing print material	Large print, reading stand, acetate overlays, lighting, handheld and stand magnifiers, telescopes, video magnification systems, scanning and optical character recognition (OCR) systems, electronic whiteboards, Braille reading, tactile graphics, digital talking books, e-book readers, talking calculators, talking dictionaries.
Technology for accessing electronic information	Large monitor, adjustable monitor arms, cursor enlarging software, screen magnification software, accessible Personal Digital Assistant (PDA), large print, online dictionaries, refreshable Braille displays, touch tablet, text reader, self-voicing applications, e-book reader, digital voice recorder.
Technology for producing written communications	Felt-tip pen and bold marker, dedicated word processor, imaging software, drawing software, math software and spreadsheets, slate and stylus Braillewriter, electronic Braillewriter, Braille translation software, Braille embosser, accessible PDA
Technology for producing materials in alternate formats	Scanning and optical character recognition (OCR) system, laser print, Braille translation software, Braille embosser, graphics software, fusers and capsule paper, digital and analogue audio recording device.

(Presley & D'Andrea, 2008, p. 43).

Smith (2010), assistive technologies are classified as simple low-tech adaptation, electronic magnification, computer magnification, electronic telescopes and auditory-based technologies

#### **2.4 Simple Low-Tech Adaptations**

Students with mild visual impairments may function adequately with enlarged reading materials that have been either created on a photocopier or published with large print (Smith, 2010). Smith (2010) opines that enlarging materials not only makes it easier to read the print but to scan and find details on a page. Directed lighting on reading materials, set-up to avoid glare and use of prescribed glasses, contact lenses or a magnifier may also enhance abilities to use large print materials.

Smith (2010) opines that the use of bold lined paper, writing guides and low vision pens often makes it easier to perform writing tasks and this is another simple form of low-tech assistive technology adaptation for students who are visually impaired.

#### **2.4.1 Electronic magnification**

Smith (2010), closed circuit televisions (CCTVs) enable users to view a screen with colour contrast and print size options. Reading materials are placed under the screen on a sliding surface that glides as the student reads. The colour contrast options can be very helpful since many students find that white letters on a black background are easier to read than the traditional colours. The students with visual impairments can therefore choose other colour combination options such as yellow and blue. The sliding board can also be locked into place before the student performs writing tasks that are viewed on the screen. A CCTV may be a desktop model such as the Merlin family, Acrobat family or Amigo models (Smith, 2010). A portable handheld electronic magnifier such as the “Pebble” provides greater flexibility to read at any time since it is small enough to store in a backpack. A handheld scanner can also be used in conjunction with a large video screen at the desk. In addition, teachers can set up a camera aimed at the blackboard to enable students to view contents on their desk top screens (Smith, 2010).

#### **2.4.2 Computer magnification**

Petty (2012) highlighted computer magnification assistive technology to include computer screens magnified by simply enlarging the font size or using magnification software programs such as “Zoom Text”. According to Smith (2010), the “Web Eyes” software enlarges web pages on Internet Explorer up to 144-point

font and even forms and boxes are increased in sizes. Screen magnifiers are available that can be attached to computer desktop monitors, laptops, or televisions.

### **2.4.3 Electronic telescopes**

Students also need to be able to view distant images - for instance, during field trips such as a visit to an art museum. The hand-held VisAble video Telescope looks like a small camcorder that is held in the palm and allows the user to view enlarged images. The “Jordy” consists of a head-mounted display with a video camera that is pointed by head movement (Smith, 2010).

### **2.4.4 Auditory-based technologies**

Ocloo (2011) opines auditory-based assistive technology for students with visual impairment include tape recorder, talking calculator and software programs such as “JAWS” that convert text to voice. Also, auditory- based technology include Braille and voice recognition computer systems such as the Kurzweil 1000 that converts text on the computer or from scanned pages to speech (Ocloo, 2011). As the reading demands increase for older students, the use of recorded books and speech recognition systems may take on greater importance to save time and energy (Smith, 2010).

## **2.5 Students with Visual Impairment Access to Assistive Technology**

Mugo (2013) conducted a study on how students with visual impairment in Kenyatta University and Syracuse University access assistive technology. Mugo observed that students with visual impairment struggle with Braille machines in studying as major tools of writing. They do not willingly interact with computers due to little or no exposure. They need sighted guide to orient them before opening up. The general view is that students and teachers fear technology due to lack of exposure



and skill, but with interaction and gaining of skill, assistive technology becomes a necessity of accessing knowledge and information conveniently. Access to assistive technology must be driven by individual needs, not by logistical constraints such as availability of equipment, location or model of service delivery, or funding restraints. Currently, some students with visual impairment have access to a wide range of blindness and low vision specific assistive technology devices, while others have none (Kelly, 2008). Also, some students with visual impairment have access to teachers who are well-prepared to deliver special instruction in blindness and low vision specific assistive technology, while others do not (Smith, Kelley, Maushak, Griffin-Shirley, & Lan, 2009).

Professional support is also a factor related to ongoing use of technology in the diffusion of innovations theory (Ahmad, 2014). Ahmad indicated that professional support is one of the variables most highly related to continued use of technology. Additionally, research on assistive technology contends that individuals with disabilities without support are typically less successful than those who have it. For instance, individuals without social support often discontinue technology with a loss of functioning, learning capacity, employment, and quality of life (Gersten & Edyburn, 2007). Support services in the form of device training and device maintenance were also documented as essential to continued use of assistive technology (Giusti, Giusti, Zancanaro, Gal, & Weiss, 2011).

A review of the literature indicates that there is consensus that consumer involvement in the selection, acquisition, use and maintenance of assistive technology devices is important. Other research results demonstrated that devices are discontinued less frequently when users believe their opinions are taken into

consideration in the selection process (Griths & Price, 2011). A change in consumers' needs has also been cited as a significant cause of discontinuance of assistive technology devices. Researchers indicated that changes in individuals with disabilities' priorities and needs rather than problems with assistive technology devices, often results in device discontinuance. Overall, some technological discontinuance is to be expected as individuals with disabilities experience changes in their lives (Mundy, Kupczynski, & Kee, 2012). A study by Ayiah (2017) on availability and usage of assistive technology devices such computers or laptops, large-screen monitors, scanners, Perkins machines, LCD projector, Job Access with Speech (JAWS) software, dictation software, Interactive whiteboard in academic library for students with visual impairment at University of Education, Winneba revealed that such assistive technologies were available but not enough and this makes it difficult for students to access and use them. She further inquired from students how they were able to cope with their academic work without the use of assistive technologies. Interesting responses were adduced as respondents cite friends and voluntary service by concern students. Access to information for classwork, project or research work was mainly done through personal friends.

Smith, Kelly, and Kapperman (2011) stated that with access to technology, appropriate instruction, and provision of specialized skills based upon diagnostic evaluation, students will develop ability to navigate computer using word processing software or any other possible applied software programme. These skills will enable students with visual impairment to effectively use the internet to search for specific information, send mails, and participate in online learning. Smith, Kelly, and Kapperman (2011) added to attain such high-level operation, students with visual impairment require systematic and consistent instruction from teachers accompanied

with patience and practice. Practical skills bring about mastery of keyboarding skills, use of word processing programme to proofread, check spelling, compose, and revise documents. The appropriate use of assistive technology translates to academic autonomy leading to educational attainment.

## **2.6 Factors Affecting Use of Assistive Technology by students with visual impairment**

### **2.6.1 Lack of teacher training**

Research suggests there may be factors that affect the use of assistive technology use by students with visual impairment (Smith, 2010). These factors include teacher training, teacher years of experience, student's primary learning media, student's educational placement and technology funding (Smith, 2010). Research indicates that there have been numerous problems in the use of assistive technology for students with visual impairment in learning institutions (D'Andrea, 2010). There has been lack of piloting in schools for students with visual impairment before implementation of assistive technology. D'Andrea affirms that despite the federal regulation that assistive technology services should be provided in learning institutions, half of high school students with visual impairment were not provided assistive technology services. One of the problems emanates from lack of technical skills to use some of the assistive technology devices and software. Teachers reported common problems in the areas of student technology assessments, training in the use of assistive technology and available personnel to repair and maintain the technologies. In a Brazilian study, the top reason for not using assistive technology given by teachers of the students with visual impairment was not sufficiently familiar with assistive technology, lack of training and how to use it effectively (Alves et al., 2009).

Research published in Kenya on challenges faced by teachers and students with visual impairment using modern assistive technology by Mugo (2013), states that without appropriate skills modern assistive technology cannot realize its full potential of improving the educational achievement of students with disability. The challenge can only be averted by providing technical skill in addition to Braille, orientation and mobility, guidance, and counselling for better curriculum delivery.

### **2.6.2 Simple or complex nature of assistive technology**

Sachdeva (2012) conducted research on assistive technology for students with visual impairment – barriers to access, adoption, and use. The extract below was what one student said:

“Lack of consistency in technology causes me numerous problems. Something as simple as chip and pin machines that accept debit cards should be standardized. I have to learn different layouts of same technology. I am frustrated by the fact that I don’t have people around me, which would help me in doing things that are outside my (and technology) control. For example, I recently lost my debit card, and now I have a new one. They have sent my pin number through, and of course, I cannot see it. And because of the way the number is printed, I cannot use a scanner to read it either. It is impossible...I have been incredibly frustrated most of the time with technology. Recently, JAWS kept hanging, and my new laptop is slow as well. What I do online is very complicated...and to use assistive technologies for that is even more complicated. Technology has a constant learning curve...and price for all this is frustration and stress” (page 11).

The above statement by the student indicates that frustration because of assistive technology’s lack of consistency affects access to assistive technology for students with visual impairment.

### **2.6.3 Socio-psychological barriers**

Sachdeva (2012), the model for socio-psychological barriers affect access and use of assistive technology. He states that children with visual impairments face social embarrassment, frustration, anxiousness, and they do not have the control over their

surroundings. The socio-psychological barriers seem to suggest that when people feel socially embarrassed, they are more likely to resist or reject technology usage. There is a lack of trust over the technology and high expectation leads to failure for the adoption of the modern technology. These socio-psychological attributes create negative effect on the use of the technology as due to sympathetic attitude shown by the society, reduces the use of modern assistive technologies. The children with visual impairments face frustration, social embarrassment, and anxiousness because of the sympathetic attitude of society towards them and sometimes it may hurt their ego and self-respect leading to lack of their control over their surroundings.

#### **2.6.4 High cost of high-tech assistive technologies**

Calder (2010), a barrier generally faced by students with visual impairment is that everyone cannot afford the high cost of high-tech assistive technologies. The screen reading software's which they use are very costly and thus they are not affordable. Tablet flax players used by the students with visual impairment have a very high price which a student with visual impairment with low economic status cannot purchase. Alsalem (2010), states that having access to assistive technology mostly the learning Access suite in South Africa through micro link have seen classroom benefit, an added dimension of learning and development support especially with severe cases of students with visual impairment. The learning Access suite creates a more inclusive engagement for learners and provides educators/teachers with the means to support their students more effectively, enhancing teaching and learning of students with visual impairment. However, a very high price makes it difficult for the most schools in south Africa to buy the learning Access suite. Zapf, Scherer, Baxter and Rintala (2016) discussed factors that affect assistive technology use by students with disabilities in elementary and secondary

education. Some of the barriers cited include insufficient funding or an inadequate understanding of where funding can be found and school districts' demand that the assistive technology stays in the classroom.

#### **2.6.5 Lack of technology awareness, integration, and education of professionals of assistive technology in school settings**

Mugo (2013), in a comprehensive review of the literature on assistive technology for students with visual impairment concluded that students with visual impairment are not fully benefiting from the use of assistive technology in home, school and community settings. He identified key shortcomings in the awareness, integration, and education of professionals on assistive technology in school settings. In a nutshell, lack of teacher training, simple or complex nature of assistive technology, high cost of high-tech assistive technology, socio-psychological barrier and lack of technology awareness affect students with visual impairment access to assistive technology.

#### **2.7 Knowledge and Skills Needed by Students with Visual Impairment to Access Assistive Technology**

In a research by Alberto and Troutman (2012), they stated to encourage students' access to and use of assistive technology, professionals, parents, and other caregivers should (a) use evidence-based methods to teach and support skills for assistive technology use, (b) include goals and objectives for assistive technology use in the students' individualized educational plans, (c) integrate intervention into students' preferred functional activities, and (d) provide complimentary services that support the students' assistive technology use. Many forms of assistive technology for students with visual impairment and blindness require specific skills for successful use. On-going use of evidence-based methods for teaching and behaviour support,

such as direct instruction, practice with feedback, shaping, and reinforcement of success, provides the greatest likelihood students will acquire the requisite skills and maintain the related behaviours.

In a study conducted by Eligi (2017) in Tanzania to assess the accessibility and usability of Information and Communication Technology (ICT) facilities to facilitate learning among students with visual impairment at the University of Dar es Salaam (UDSM), findings revealed that 55.5% of the respondents agreed that training was not effectively offered by the Special Education Unit. In other words, ineffective ICT training for the students with visual impairment constitute a challenge to enjoying learning as much as the sighted students do. In particular, ICT facilities can be effective in enhancing learning opportunities for students with visual impairment if they possess adequate and appropriate skills and knowledge to operate them. These findings also imply that training for some of the ICT facilities was not productive in the sense that the demand for ICTs was higher than the actual supply. As a result, training in these facilitative ICTs might not necessarily translate into actual usage in the face of scarcity of ICT facilities. During an interview, one of the students with visual impairment contended:

I do not have enough skills and knowledge on ICTs. Without having the JAWs programme, it is difficult to access these facilities. I do not see what appears on a screen, I only depend on being told what is visible by my fellow. (98).

One of the transcribers reinforced this view by indicating, “Most of the students with visual impairment have no technical knowhow for some of ICT’s facilities and the majority cannot operate computers effectively” (98).

Kavagi (2010), found that training on special ICTs skills constitute an important component of university education for students who are visually impaired.

Indeed, properly co-ordinated training in ICT skills development in university programmes helps the students with visual impairment to gain positive experience, develop good career development paths and attain independent learning. Thus, the accessibility of ICT and training to the use of the accessible ICTs should aligned parallel.

Jidamva (2012), in his study on assistive technology applications for students with visual impairment, titled “Special education teachers’ experiences and perceptions” which appeared in *Disability and Rehabilitation*, emphasized that when students move into secondary education, assistive technology can serve as a mean of allowing students with visual impairment have access to literacy in independent ways. In addition, Jidamva (2012) stressed the importance of students with visual impairment having enough skill of using assistive technology in learning situations in order to accomplish their potentials. In Jidamva’s study, findings showed that when the students with visual impairment were provided with practice and opportunities, many were perceived to be able to be independent (or well on their way) in text-based learning, as well as being perceived to be motivated for assimilating and communicating text, in line with previous research. This was also supported by that approximately 70% of all students with visual impairment continued to use the technology after the intervention, and indication of the perceived clinical significance of the intervention for most of the students. In some cases, this meant that the students substantially increased the number of books and texts assimilated, that they could use the same books as their peers, that they more easily could follow the general classroom teaching and that they could use apps for improving study skills. Kamei-Hannan, Howe, Herrera, and Erin (2012) found that, approximately 80% of respondents found assistive technology training helpful and were better equipped to



handle their unique technologies to access and support their own learning, building their feelings of self-esteem, worth and sense of belonging to their classes.

Hopkins (2016) in her school library accessibility, the role of assistive technology states that a student who has mastered basic skills in assistive technology use can proceed to more complex levels of skills acquisition and efficiency, anyone who has attempted to manoeuvre a wheelchair first time will quickly appreciate the skills and performance competency of wheelchair athletes who participate in basketball, volleyball and other athletic events. In addition, she states that assistive technology skills development can provide challenge and motivation for people for greater independence and enhanced performance.

Brokop and McIntosh (2009), published a study on context situated assistive technology training and its impact on engagement, learning outcomes and assistive technology adoption for students with visual impairment. They said that presence or lack of environmental supports including training, also influenced an individual's access and choice to use technology. In their study, students with visual impairment were matched one on one with able partners who provided hands-on application of technological skills. Course content encouraged individuals to use their technology, and the recommendations of specific equipment that targeted their personal needs resulted in a positive experience with assistive technology. Training is seen not as a single event, but rather as an ongoing and collaborative process.

Day and Edwards (2016) in their assistive technology for post-secondary students with visual impairment, offer the following strategies for effectively training students with visual impairment to use technology.

1. Using a multi-sensory approach to training, in which students are provided with visual instruction (including videotapes and diagrams), oral instruction, and written instruction. Related to this strategy is the notion of using technology to teach technology. Having student watch videotapes demonstrating how a device is used can be an effective training strategy that simultaneously reaches the use of other types of technology. Trainers should be cautioned, however, not to overload students with too much technology at one time.
2. Providing repetition by giving students numerous opportunities to practice what they have learned.
3. Modelling, whereby student watches others using the device and they attempt to do the same.
4. Having frequent concept review, that is, competency check conducted frequently during each training session, in which students demonstrate what they know. Also, each training session should begin with a review of the previous day's session. This allows the trainer to assess whether the student retained previous information and is ready for additional information; if not, previously presented information must be taught.
5. Providing meaningful instruction. Allow students to generate their own words for technical terms, based on what is meaningful to them. Assist students in developing mnemonics to foster information retention. This strategy includes the use of acronyms, visualization, and rhyme to help student remember functions or steps in operating a device.
6. Instill motivation. To be motivated to learn to use technology the student must accept their disability exists and have an immediate need that can be met by

the technology. The instruction should be meaningful. Develop the concept for need and the value incorporating student experience in their suggestions.

## **2.8 Summary of Literature review**

The literature review points out that assistive technology was classified into two groups namely low-tech and high-tech. The low-tech assistive technology devices do not require electricity to work and they are very cheap to acquire. On the other hand, the high-tech assistive technology devices require electricity to work and they are expensive to acquire. Low-tech and High-tech devices enable students with visual impairment to move, read, access academic information, and do assignment independently. Also, literature reviews that, students with visual impairment struggle to use brail machine in writing. In addition, students with visual impairment do not interact with computers on their own unless sighted peers guide them before opening the computers. This is due to lack of exposure and skills. Access to assistive technology must be driven by individual needs.

The literature also reveals that, there are factors that affect the use of assistive technology for students with visual impairment. One major problem literature reported was lack of technical skills to use some of the assistive technology devices and software. Also, high cost of buying high tech devices affect students with visual impairment access to assistive devices. In addition, lack of personnel to repair and maintain the technologies was a factor that affect the use of assistive technology. Finally, literature reviews that teachers acquire assistive technology as part of their college training in other to student with visual impairment skills to use assistive technology. Again, a study from Delphi showed that teachers of students who are visually impaired acquired competencies in foundations of assistive technology,

instructional strategies, disability related assistive technology and use of assistive technology. Most of the study reviewed was conducted in developed countries therefore, other factors such as environment and socio-economic factors can make the findings of such studies not applicable to developing countries, hence a need to conduct on access to assistive technology and its effects in educational achievement of persons with disability in a developing country such as Ghana.



## CHAPTER THREE

### METHODOLOGY

#### 3.0 Introduction

In the methodology the following areas would be covered: Research approach, research design, population, sample size, sampling technique, instrumentation, procedure of data collection, access, trustworthiness, ethical considerations, and data analysis.

#### 3.1 Research Approach

The research approach that was adopted for this study was qualitative approach. Hennick, Hutter and Bailey (2011) stated that qualitative research is used to provide in-depth understanding of research issues that embrace the perspectives of the study population and the context in which they live and to explore new topics or understanding complex issues, explaining people's beliefs and behaviour. Qualitative research takes into consideration the holistic description of whatever is been observed, rather than comparing the effects of a particular treatment as quantitative research does. Qualitative research also seeks insight into issues rather than statistical analysis. Qualitative approach studies phenomena in its natural settings. The researcher deemed qualitative method useful in that it helped to conduct an in-depth exploration of the issue being investigated. Qualitative approach allowed the researcher to get into respondents' personal world and gain deeper and clear understanding of their experiences and feelings. The nature of the study and the kind of data obtained demanded this approach; for example, personal interview and observation.

### **3.2 Research Design**

The research design adopted for the study was case study. Case study design was employed in order to intensively explore on what was going on in Adidome Senior High School on students with visual impairment access to assistive technology in the real-life events and their relationships. Choosing case study as the research design offered me the opportunity to examine in-depth types of assistive technology devices available, factors affecting access to assistive technology, how students with visual impairment access assistive technology and students with visual impairments' knowledge and skills in assistive technology use at Adidome Senior High School.

### **3.3 Population**

Thirty-seven (37) individuals formed the population for the study. This consisted of thirty-five (35) students with visual impairment and two (2) resource teachers. Creswell (2012) defines population as a group of individuals with some common defining characteristics that a researcher can identify and study. Population refers to the complete set of individuals, subjects or events having common observable characteristics in which the research is interested (Braun & Clarke, 2013).

### **3.4 Sample Size**

The sample size that was involved in this study was 30 participants. This consisted of 28 students with visual impairment and 2 resource teachers. A sample is a small portion of a target population. Mugenda and Mugenda (2012) state that sample size comprises units, subjects, objects, or items in the sample. The 28 students with visual impairment were selected because they had been in the school for over 2 years. Again, the 28 respondents with visual impairment could give a vivid representation of access and uses of assistive technology in the school because they

use them. The 2 resource teachers were chosen as informants because of their day-to-day interactions with students with visual impairment in the resource room giving them an opportunity to observe how students with visual impairment access assistive technology. Also, the 2 resource teachers had been in the school for over 7 years.

### **3.5 Sampling Technique**

Purposive sampling technique was adopted in selecting students with visual impairment from second year to third year offering different programmes. Hayford (2013) states that in purposive sampling (sometimes referred to as purposeful judgment or judgmental sampling) the researcher selects elements from the population that will be representative or informative about the topic. Based on the researcher's knowledge of the population, a judgment was made about which cases should be selected to provide the best information to address the purpose of the research. Purposive sampling was employed to select the 28 students with visual impairment who were in second and third years. The first years were left out because they were new and had not done much orientation and academic work had not begun with them as at the time, I went to the school, so they did not have in-depth information about the school and the assistive technology devices. Again, this method of purposive sampling was ideal for this study because the students with visual impairment are the direct beneficiaries of assistive technologies, so I needed to know how they had access to assistive technologies and factors that affected access to those assistive technologies.

### **3.6 Instrumentation**

Silverman (2010) opined that instrument are a range of data collection techniques which can yield data that can be validated. The instruments that were used

to collect data for this study were interview and observation. The use of these instruments was to gather enough information for the study. The interview guide consisted of semi-structured questions that the researcher asked the respondents to get information about access to assistive technology.

### **3.6.1 Interview schedule**

Mugenda and Mugenda (2012) affirm that an interview schedule as a research tool is used by the researcher to guide an open-ended interview. In order to gain detailed information about access to assistive technology for students with visual impairment in Adidome Senior High School, I used semi structured interview. The semi structured interview contained questions with prompts to elicit responses from the respondents.

Kusi (2012) argued that semi-structured interviews are neither fully fixed nor fully free and are perhaps best seen as flexible. Interviews generally start with some defined questioning plan but pursue a more conversational style of interview that may see questions answered in an order natural to the flow of the conversation. Semi-structured interviews may also start with a few defined questions but be ready to peruse any interesting tangents that may develop. I opted for this instrument because of its consistency in data collection. The interview schedules were designed for the students with visual impairment and the resource teachers who work in the resource room in the school. They were designed to gather information on access to assistive technology for students with visual impairment

The interview guide for students with visual impairment had sections A and B. Section A contained questions that sought information on respondents' background. Section B dealt with the major aspects of the study; namely, a) the types of assistive



technology, b) how students with visual impairment access assistive technology, c) factors affecting access to assistive technology and d) skills students with visual impairment possess in the use of assistive technology. The interview guide for the resource room teachers was also structured in two parts; the first section dealt with the background information of the teachers, the second elicit how students with visual impairment access assistive technology in Adidome Senior High School.

### **3.6.2 Observation**

To see the reality of how students with visual impairment access assistive technology in Adidome Senior High School, observation was employed. Observation was selected as the second method because the researcher aimed at establishing the types of assistive technology devices available in the school. The observation schedule contained the following options: Availability of a list of various types of technology devices, Yes, No, Adequacy (enough or not enough) and Condition (working or not working). Observation is suitable in a qualitative study because it takes place in the arena where the study phenomenon takes place. Observation can provide more detailed and new information in addition to the interview about the students with visual impairment' access to assistive technology. In this study, I employed non-participant observation. A non-participant observer is the one observing the situation without active participation in what is taking place in the research field. This type of observation does not require prolonged time for an observer to engage in a social setting where the phenomenon is being studied (Bryman, 2012). Observation schedule was used to guide and maintain the focus of the observed behaviour. The behaviours observed from teachers and students with visual impairment were recorded through writing notes immediately as the behaviour was occurring.

### **3.6.3 Access**

According to Avoke (2005), access is seeking permission before accessing the schools or site for interviewing or embarking on observation. This is always referred to as negotiating with the gate-keeper. A gate-keeper according to Creswell (2005) is an individual who has an official or unofficial role at site and provides entrance to a site and helps the researchers locate people as well as assist with the identification of places to study. I sought permission to do the research in Adidome Senior High School from the headmaster. An introductory letter from University of Education Winneba, Department of Special Education, was given to the Headmaster of Adidome Senior High School to seek for authorization to undertake the research study in the school.

### **3.7 Procedure for Data Collection**

The researcher booked appointments with the resource teachers through telephone call. During the pre-visit, I took a letter to the school detailing the purpose of the study, and the interview guide to the resource teachers. The in-depth interview guide was developed with thematic aspects upon which participants were interviewed. On the appointed day for interviews, I used in-depth interviews and I collected data by recording and writing respondents' answers. I informed the resource teachers that their participation was voluntary, and they were free to withdraw from the study if they felt not participating, though they expressed their willingness to participate and added that they can learn something as they participate.

The interview with each resource teacher was done in the resource room for the students with visual impairment and was audio recorded using tape-recorder. This was a good place to minimize the noise and distracting conditions that would have

disrupted the interview. The interviews were done in English which is the official language used in the school. Teachers were able to give their opinions on access to assistive technology by students with visual impairment in the school. The two resource teachers all were interviewed as it had been earlier planned. Before each interview, the interviewees were briefed about the purpose and the amount of time scheduled for the interview. In each interview 30 minutes was used; I used one hour for the two resource teachers. The order in which the open-ended questions were presented, and the wording depended on the responses from the respondents. The in-depth interviews were recorded by using tape-recorder. I set the tape-recorder before the interview and immediately and after informing the informants that I was going to record them, I started recording immediately when the respondent started answering all the questions on the interview guide.

In addition, I used a logbook to write notes about each question made to cater for reflective information during the interview sessions. After the interviews, I transcribed them. The transcribed data were read back to the respondents. After completion of data collection, I extended appreciation to the resource teachers to thank them for taking part and giving the relevant information.

On the aspect of the observation, I had observation schedule form which contained a list of assistive technology devices which students with visual impairment used to effectively participate in teaching and learning process. Therefore, in the resource room, I had the observation schedule form and ticked appropriately assistive technology devices that were available in the school. Also, the assistive technology devices that were available whether, enough or not enough, as well as those in good working condition and not in good working condition, were ticked, accordingly.

### **3.8 Trustworthiness of the Instrument**

Trustworthiness criteria is often used to establish the quality of qualitative studies. Johnson and Christensen (2012) suggested four constructs which can act as guides in aiding the determination of trustworthiness in research undertaken as: a) credibility b) dependability c) confirmability d) transferability

### **3.9 Credibility**

Credibility was ensured in this study through participant triangulation. This strategy enabled the researcher to gather data from the interviewees for comparison before conclusions were drawn. In addition, the data transcribed from the interview were read to respondents for them to confirm or refute their responses.

### **3.10 Dependability**

Dependability is the consistency of research findings (Erlandson, Harris, Skipper, & Allen, 2005). Dependability was ensured in the study by audio-taping conversations with the participants to have a verbatim account of the interviews. This helped the researcher to listen attentively to each of the interviewees and capture the interviewee's words accurately (Bryman, 2008). In order to ensure an inquiry audit of this study, the interview schedule was shown to the supervisor for rectifications before it was administered.

### **3.9 Confirmability**

Confirmability refers to the accuracy of the data and the reflexivity of the researcher (Johnson & Christensen, 2012). To ensure the confirmability of this study, an audit trail, detailing the process of my data collection, data analysis and interpretation of the data was carried out by coming up with themes and sub-themes. Also, the researcher ensured that the findings of the study were guaranteed to be

grounded on the raw data gathered from the field and devoid of the researcher's preconceived notions and ideas.

### **3.10 Transferability**

To transfer interview data accurately the researcher had a notebook in which he recorded responses of the respondents. This made it possible to transfer data accurately. Again, to transfer the interview data, I recorded the respondent's responses. The recording helped me to get accurate responses that reflected what the respondents meant. Furthermore, to ensure transferability in this study, the researcher provided a description of findings to show how students with visual impairment accessed assistive technology.

### **3.11 Ethical Consideration**

Ethics in educational research are those issues that are related to how educational researchers conduct themselves or their practices and the consequences of these on the people who participate in their research (Kusi, 2012). The research conducted considered a number of ethical issues. First, participation in the research was voluntary and confidentiality was guaranteed. Thus, to uphold to confidentiality and anonymity, information disclosed by participants was not made known to others. For example, the known personal or demographic data were left out in the report as well as in the attachment of the entire work. That is, all names of the respondents were made anonymous to prevent identification of respondents. Secondly, teachers' and students' consent were sought before undertaking the interviews. In other words, all participants were informed of the objectives of the research and the implications to be part of the study. In addition, the right to respond to a question willingly was also explained to them. Thirdly, due consideration was given to the students with visual

impairment to avoid embarrassing them during the interview session and not to force them to disclose information they are uncomfortable sharing.

### **3.12 Data Analysis**

Data collected from the interviews were transcribed verbatim by two different persons, separately and independently of one another. The transcription was done by playing back the recorded version of the responses with references from the jotted points. The different transcriptions were compared to come out with more accurate response that reflected the respondent's views. The transcribed responses were submitted to the respondents to read through and make further corrections, if any. Data were categorized in relation to the research questions raised and analysed descriptively using the thematic content analysis approach. Inferences from literature and other relevant studies was drawn to support the findings. The verbatim expressions of some respondents were indicated at some instances. As the study is about students with visual impairment' access to assistive technology in Adidome Senior High School, the researcher summarized and described data from the respondents and came out with a conclusion and some recommendations.

## CHAPTER FOUR

### ANALYSIS OF FINDINGS

#### 4.0 Introduction

This chapter presents the results and discussion of the findings from the study. The demographic information of the respondents was presented first. The demographic information presented includes age and gender of the respondents. The study examined how students with visual impairment accessed assistive technology in Adidome Senior High School. This research was guided by four research objectives:

1. The first objective was to find out what types of assistive technology available in Adidome Senior High School.
2. The second objective was to examine how students with visual impairment access assistive technology in the school.
3. The third objective was to determine factors affecting access to assistive technology in the school.
4. The fourth objective was to find out students with visual impairment
5. knowledge and skills in assistive technology use.

Findings were collected by using two research instruments, which were observation and interview.

Observation method was used to collect data for questions which were covered by the first and second objectives. It was important to use observation method for these questions in order to have plenty of information on the types of assistive technology available and on access to assistive technology by students with visual impairment at Adidome Senior High School. Data collected from interview and observation were analysed to reflect themes that emerged from the data.

#### 4.1 Background of Students

Table 2 shows the age and gender distribution of the students with visual impairment who participated in the study.

**Table 2: Age and gender distribution of respondents with visual impairments**

Demographic variables	Frequency f=28	Percentage (%)
<b>Gender</b>		
<b>Male</b>	20	71
<b>Female</b>	8	29
<b>Age</b>		
<b>14-16 years</b>	10	36
<b>17-19 years</b>	11	39
<b>20 years and above</b>	7	25

Source: Field data, 2020

Table 2 indicates age and gender distribution of the respondents with visual impairments in Adidome Senior High School. Ten (10) respondents, representing 36%, were aged 14-16 years old, 11 respondents, representing 39% were aged 17-19 years old and 7 respondents representing 25% were 20 years old and above.

#### 4.2 Background of teachers

Table 3 shows the age and gender distribution of the resource teachers who participated in the study.

**Table 3: Age and gender distributions of the resource teachers**

Demographic variables	Frequency f=2
<b>Gender</b>	
<b>Male</b>	1
<b>Female</b>	1
<b>Age</b>	
<b>35-40 years</b>	0
<b>41-46 years</b>	1
<b>47-52years</b>	1

Source: Field data, 2020



Table 3 shows age and gender distribution of resource teachers in the school who participated in the study. No teacher in the resource room was within the ages of 35-40 years old. One male resource teacher was aged 41-46 years old. Also, one female resource teacher was aged 47-52 years old.

#### **4.3 Types of Assistive Technology Devices available for Students with Visual Impairment in Adidome Senior High School**

This was one of the specific objectives of this study. In eliciting response from the respondents on the types of assistive technology devices available in Adidome Senior High School, the question I asked was what types of assistive technology devices are available in the school?

One student said:

*There are devices which do not use light and others that I need to be connected to electricity available. The one which don't need to use light is Perkins machine and hand frame and stylus. The other devices that needed to be connected to light are desktop computer, Close Circuit Television (CCTV) and laptop.*

Another student noted:

*Frame and stylus, Perkins, CCTV and desktop computer are available in the school. In addition, embosser is available which our resource teachers use to print for us as well as scanner which is also used by the resource teachers to scan books for me when I want the book in a soft copy form.*

One student also said:

*In Adisec, we have desktop computers, braille machine which is Perkins and Close Circuit Television (CCTV).*

Another student stated:

*In the school, we have Perkins machine, desktop computer, embosser which the resource teachers use to emboss for us, Slate and stylus, and CCTV.*

Teacher A said:

*We have desktop computers, embosser, scanner, slate and stylus, printed brailled books, CCTV and Perkins machines in the school.....however, the desktop computers and the Perkin machines are not enough therefore we group students with VIs in order to access the few ones available.*

Resource teacher B stated:

*In the resource room, we have a scanner, embosser, CCTV, stylus and slate, desktop computers, Perkins .....but the Perkins and the desktop computers are not enough to meet the demand of the students with visual impairment.*

In order to know the condition of Perkins machines in the school, I asked the resource teachers how many Perkins machines are in good working condition?

Resource teacher A remarked:

*Majority of the Perkins machines are not working.....they are spoilt but they can be repaired.*

Resource teacher B stated:

*The majority of the Perkins machines are broken down.....they are broken down for some time now.*

It was evident from the transcripts of students with visual impairment and resource teachers that assistive technology devices such as scanner, Perkins, CCTV, desktop computers, frame and stylus and embosser were available in the school. The assistive technologies mentioned by the interviewees could be put into two major categories namely high-tech and low-tech. In addition, the two resource teachers added that the devices mentioned especially the CCTV, Perkins and desktop computers were not adequate in the school. Also, majority of Perkins machines available in the school were broken down.

## **Discussions**

From the analysis, data from the interview revealed that high-tech assistive technology devices were available in the school. Examples of high-tech devices mentioned by the respondents were desktop computers, scanner, embosser, and CCTV. Consistent with Petty (2012), high-tech assistive technology devices include voice recognition, digital hearing aids, desktop computers with specialized software for helping persons with visual impairments to read, Close Circuit Television, electronic organizers, and communication devices with voices.

In addition, the interview with the respondents revealed that low-tech assistive technology devices were available in the school. Low-tech devices mentioned by the respondents consist of frame and stylus, Perkins machine, mobility cane and brailled books. This finding is consistent with Georgia's Assistive Technology (2011), who states that low-tech assistive technology devices include devices such as Perkins machine, slate and stylus, hand-held magnifiers, large print texts, reading stand, felt pen, bold marker, and mobility canes. Mugo (2013) remarked that low-tech assistive technology devices such as Perkins machine is considered effective because it has provided individuals with visual impairments with access to information faster than the slate and stylus. All students with visual impairment are entitled to the independence and efficiency afforded by technology, including assistive technology. Appropriate assistive technology enables students who are visually impaired to access information and to complete tasks efficiently, thereby enabling them to achieve the highest level of independence possible (Kleiman, 2010). Again, Kelly and Smith (2011) stated that assistive technology can enable students with visual impairment to achieve educational success and gain competitive employment by providing tools for increased independent access to information and for effective communication.

Additionally, analysis of data from the interview with students with visual impairment and resource teachers in Adidome Senior High School revealed that the Perkins machines available in the school were not enough hence inadequate to meet the demand of students with visual impairment. Similarly, the desktop computers available in the resource room were not enough. This was affirmed by resource teacher A and B and one student respectively “the Perkins machines and desktop computers are not enough therefore students with visual impairment have to take turns to access them” “we pair at times at the resource room whenever we have computer classes”. The findings that were revealed through my interview is consistent with Flanagan, Bouck and Richardson (2013), who conducted a study on availability of assistive technology in some selected schools in Kenya, stated that assistive technologies such as talk book, Perkins machines, slate and stylus and desktop computers were available but inadequate in public primary teachers’ college in Kenya. In view of this, students with visual impairment did not have the desire to visit the resource room meant for them to access the desktop computers.

More so, the interview with the resource teachers revealed that most Perkins machines available in the school were broken down. There were twelve (12) Perkins machines available in the school and out of that only four (4) of the Perkins machines were working. The Perkins machines are the tools students with visual impairment use to communicate, therefore, with most of the Perkins machines broken down, this adversely affected how students with visual impairment accessed to them.

On the aspect of observations, it was revealed that high-tech devices such as embosser, scanner, desktop computers and Close Circuit Television (CCTV) were available in Adidome Senior High School. Furthermore, the observation revealed that

low-tech assistive devices such as frame and stylus and Perkins were available in the school. Examples of low-tech devices available were Perkins machines, frame and stylus, printed braille books and mobility cane. In addition, the observation revealed that only four out of the 12 Perkins machines available in the school were in good working condition. Also, the observation revealed that reading stand, magnifiers and talking calculators were not available in the school.

#### **4.4 Students with Visual Impairments' Access to Assistive Technology**

One student stated:

*I go to the resource room borrow Perkins machine, the slate and the stylus. When it comes to accessing the desktop computer, I find it difficult to operate because I don't have requisite skills about the JAWS.*

A student noted:

*The is Non-Visual Desktop Access (NVDA) on the laptop which reads to me so I don't have problem with the keyboard. I have my own laptop therefore I don't frequently access the desk top computers in the resource room. In some instances, I do request support to access some of the assistive devices.*

Another student said:

*I'm not familiar with the JAWS installed on the desktop computers so I find it difficult to operate the desktop computer... I don't frequently access it.*

Also, another student stated:

*There are software programs like JAWS and NVDA on the desktop computers which help me to listen to whatever information I want. I don't frequently access the desktop computers because the few that are available are connected to the embosser for printing.*

One student stated:

*NVDA and JAWS are installed on the desktop that reads for me. I don't frequently access assistive technology devices especially the desktop computer because I don't have the requisite skills.*

It was evident from the respondents of the students with visual impairment responses that JAWS and NVDA were installed on the desktop computers, which enabled them to access the desktop computers. However, the students with visual impairment indicated that they did not frequently access the desktop computers because they did not have the requisite skills to manipulate the desktop computers. Also, the respondents reported that they did not received the support to access the desktop computer. A respondent had his own personal computer with JAWS installed on it, so he frequently accesses the computer. Another respondent accessed frame and stylus by borrowing from the resource centre.

### **Discussions**

The findings from the study revealed that students with visual impairment in the school had access to frame and stylus and Perkins machine. The Perkins machine and frame and stylus are tools used by people with visual impairment for writing braille. These tools are relevant for students with visual impairment because they are means through which students with visual impairment express themselves when given classwork and assignments.

In addition, the study revealed that students with visual impairment accessed NVDA and JAWS in the school. The JAWS and NVDA are talking software packages that read scanned books which are converted into word format. These software packages are important and useful for students with visual impairment because they enable students with VIs listen to text at their own pace in order to comprehend the text well. When the JAWS and NVDA read for students with visual impairment, they enable students with VIs cover a lot within a short period of time. However, the study revealed that some students with visual impairment had not

access the JAWS and the NVDA because they did not have the requisite skills to operate them.

Furthermore, the findings from the study revealed that students with visual impairment in the school did not frequently access the desktop computers because they did not have the requisite skills and did not receive support. The desktop computer is relevant for students with visual impairment to access because when students' textbooks are scanned, they are converted into word format. After that, students with visual impairment command talking software JAWS installed on the desktop computer to read for them. Again, the desktop computer helps students with visual impairment to type classwork and assignments very fast instead of using analogue means such as the use of frame and stylus to write. This result is consistent with Mugo (2013) who conducted a study on how students with visual impairment in Kenyatta University and Syracuse University access assistive technology. Mugo observed that students with visual impairment do not willingly interact with computers due to little or no exposure. They need sighted guide to orient them before opening. The general view is that students and teachers fear technology due to lack of exposure and skill, but with interaction and gaining of skill, assistive technology becomes a necessity of accessing knowledge and information conveniently. Access to assistive technology must be driven by individual needs, not by logistical constraints such as availability of equipment, location or model of service delivery, or funding restraints.

A positional paper by Smith et al. (2011) state that with access to technology, appropriate instruction, and provision of specialized skills based upon diagnostic evaluation, students will develop ability to navigate computer using word processing

software or any other possible applied software programme. These skills will enable students with visual impairment to effectively use the internet to search for specific information, send mails, and participate in online learning. To attain such high-level operation, they require systematic and consistent instruction from teachers accompanied with patience and practice. Practical skills bring about mastery of keyboarding skills, use of word processing programme to proofread, check spelling, compose and revise documents. The appropriate use of assistive technology translates to academic autonomy leading to educational attainment. Flanagan et al (2013) found that training on special ICTs skills constitute an important component of university education for the students who are visually impaired. Indeed, properly co-ordinated training in ICT skills development in university programmes helps the students with visual impairment to gain positive experience, develop good career development paths and attain independent learning. Thus, the accessibility of ICT and training to the use of the accessible ICTs should be aligned parallel.

#### **4.5 Factors Affecting use of Assistive Technology by students with Visual**

##### **Impairment**

Factors affecting use of assistive technology by students with visual impairment have been put into five (5) themes namely, lack of teacher training, simple or complex nature of assistive technology, socio-psychological barriers, high cost of assistive technologies and lack of awareness, integration and education of professionals of assistive technologies in school settings.



#### 4.5.1 Lack of teacher training

Resource teacher A stated:

*I have not been to trained on how to maintain assistive technology devices for students with visual impairment not even when I was in the university.*

Resource teacher B said:

*I have never been trained or prepared on maintaining assistive technology devices for students with visual impairment.*

Transcript of the resource teachers' responses indicated that they were not properly trained on how to maintain assistive technology devices for students with visual impairment in the school.

#### 4.5.2 Simple or complex nature of assistive technology

A student opined:

*Some devices are complex and not easy to manipulate especially the desktop computer where I'm not familiar with the JAWS.*

One student remarked:

*Some of the devices are complex, especially the new type of recorder. It has many functions.*

Another student stated:

*The JAWS installed on the desktop computer makes accessing the desktop very complex.*

A student said:

*The manipulation of the CCTV is a complex one, so I find it difficult to use it if nobody is present to help me.*

It was evident that students with visual impairment admitted assistive technology devices such desktop computers, CCTV and recorder were complex. The complex nature of such devices made it difficult for the

students with visual impairment to access them because they were unfamiliar with the devices mentioned.

#### 4.5.3 Socio-psychological barriers

One student stated:

*Sighted students tease us and this makes me lose my confidence.....it makes some of my colleagues not to use the mobility cane hence makes some of them fall in uncovered gutters sometimes.*

Another student remarked:

*On the aspect of socio-psychological, I don't feel happy when sighted colleagues refer to me as VI because I use mobility cane.....I feel depressed. They address me as if VI is my surname.*

One student opined:

*Sighted students make statements like don't use that cane (mobility cane) to beat me.....I don't want to be blind like you. Sometimes they disgrace me in such a way that I cry.... I lose confidence and I even blame God why am I created in this way.*

A student noted:

*Colleagues that is the sighted ones sometimes make unpleasant comments that make some of my VI friends not use the mobility cane but for me, I can't refuse to use my cane where I will go and fall in a gutter somewhere. Some comments from the sighted students sometimes make me not to concentrate on my studies.*

It was evident from the transcript of students with visual impairments' response on socio-psychological barriers that they faced unfriendly comments from sighted friends in the school. The unfriendly remarks from the sighted students made the students with visual impairment to lose self-confidence hence not willing to use assistive technology like mobility cane which would have made their movements easy.

#### 4.5.4 High cost of assistive technologies

A student mentioned:

*Sometimes the Perkin machine locks when writing and this is because the machines are very old.... this frustrates me. I wish I have my own Perkins but my parents do not have the money to buy for me.....it's very expensive.*

One student remarked:

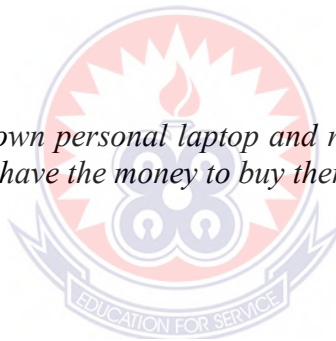
*The JAWS is slow in responding and does not describe things, such as diagrams and pictures.....this is because I don't have money to buy the licensed one so I use the trial or 'cracked' version.*

One student stated:

*The JAWS I have on my laptop normally fails me when I needed it most .....and I can associate it to lack of money. Having the licensed JAWS would have been far better but it's very expensive and I don't have money to buy it.*

A student noted:

*I wish I have my own personal laptop and recorder. but they are very expensive. I don't have the money to buy them.*



A student added:

*Slate and stylus and recorder are the basic assistive devices I should have had but because they are expensive, I don't have any of them. The few Perkins machines in the school are even too old so they easily breakdown when using them.....but because they are very expensive, they cannot replace them.*

Transcript of students with visual impairment showed that the assistive technology devices needed to effectively function were very expensive. The expensive nature of the assistive technology devices made the students with visual impairment resort to the use of old devices and 'cracked' versions of software that easily failed the students with visual impairment.

#### 4.5.5 Lack of awareness, integration and education of professionals of assistive technology

A student remarked:

*I don't have much awareness on assistive technology devices because I was enrolled in regular school.*

Again, another student stated:

*I don't have any awareness about assistive technology devices, so I was surprised when slate and stylus and computer with JAWS were introduced to me in the school for the first time.....I don't have any idea at all. I didn't attend any special school.*

A student said:

*I don't really have awareness about assistive technology devices.*

Also, another student remarked:

*I have some information and knowledge about desktop computer but desktop with the jaws I find it difficult to operate.*

A student opined:

*I have awareness about mobility cane, slate and stylus because I use them but when it comes to advance devices like CCTV, desktop computer with JAWS and other ones I do not have any information or knowledge about them.*

It was evident from the transcript of students with visual impairment that majority were not given awareness about assistive technology devices in order to choose devices that could meet their needs. However, two students with visual impairment admitted that they were given awareness or information about basic devices like CCTV, desktop computer with JAWS and mobility cane therefore they could effectively use them.

#### Discussions

The results of the finding revealed that the resource teachers in Adidome Senior High did not receive or were not trained on how to maintain assistive

technology devices. This finding was consistent with the findings of Alkahtani's (2013) study on teacher preparation on assistive technology device maintenance in United States of America, in which he reported that 93% of the respondents were poorly prepared to provide assistive technology maintenance for students with disabilities in their schools. Regarding teachers' level of knowledge, most of the respondents reported that they have little knowledge or no knowledge about assistive technology. Most of the participants 98.4% reported that they never take a college or graduate level course about assistive technology. Only 1.6% of the participants took one or two college or graduate level courses about assistive technology. Nearly ninety-three percent (92.9%) of the respondents reported that they never attend workshops or in-services training pertaining specifically to assistive technology. Only 5.5% of the respondents attend one or two workshops or in-services training pertaining specifically to assistive technology (Alkahtani, 2013). Similarly, Bryant and Bryant (2011) have repeatedly highlighted the importance of special education teachers and assistive technology specialists to be equipped with up-to-date knowledge and skills when choosing and using assistive technology products. Edyburn (2013) stated that for special education teachers to be fully competent, they need to move beyond awareness levels of knowledge towards "working knowledge." He listed several expectations associated with this "working knowledge." Some of these expectations are commitment to learning about assistive technology, instructional applications of assistive technology, decision-making, and advocacy for accessibility.

D'Andrea (2010) affirms that despite the federal regulation that assistive technology services should be provided in learning institutions, half of high school students with visual impairment were not provided assistive technology services. One

of the problems emanates from lack of technical skills to use some of the assistive technology devices and software. Teachers reported common problems in the areas of student technology assessments, training in the use of assistive technology and available personnel to repair and maintain the technologies. In a Brazilian study, the top reason for not using assistive technology given by teachers of the students with visual impairment was not sufficiently familiar with assistive technology, lack of training and how to use it effectively (Alves et al., 2009).

Again, it was revealed from the interviews with students with visual impairment that some devices such as the desktop computers were complex due to the JAWS installed on them. This was because the students with visual impairment were not familiar with the JAWS. This finding is consistent with a study by Hussin (2013) in Malaysia where he reported that, some students with VIs described experiencing technical difficulties when accessing Digital Talking Textbooks (DTTs). These difficulties discouraged access of DTTs. If hardware and software are user-friendly, then they might be adopted quickly for the delivery of course materials (Hersh, 2012). When AT appears complex to access this would be expected to reduce its accessibility by the learners. According to Smith (2010), many types of simple and highly complex assistive technology for students with visual impairment are available to help them access printed materials and perform writing tasks. Assistive technology can be as simple as enlarging work sheet on a photocopier or as complex as using computers with voice recognition that can print materials in Braille.

Results of the finding revealed that students with visual impairment faced social and psychological challenges such as stigmatization and unfriendly remarks from sighted students with regards to access to assistive technology in the school.

This finding validates the model for socio-psychological barriers by Sachdeva (2012), which the children with visual impairments face social embarrassment, frustration, anxiousness and they do not have the control over their surroundings. When people feel socially embarrassed, they are more likely to resist or reject technology usage (Shapiro & Baker, 2011). There is a lack of trust over the technology and high expectation leads to failure for the adoption of the modern technology. These socio-psychological attributes create negative effect on the use of the technology due to sympathetic attitude shown by the society, reduces the use of modern assistive technologies. The visually impaired children face frustration, social embarrassment, and anxiousness because of the sympathetic attitude of society towards them, and sometimes, it may hurt their ego and self-respect leading to lack of their control over their surroundings. In addition, students with special needs seem to experience negative emotions when accessing assistive technology, which can be attributed to the lack of awareness and the stigma associated with disability. This research finding conforms to findings from McNaughton and Light (2013) and Bausch and Ault (2012) whereby stigma associated with disabilities can have an adverse effect on the social well-being of the person with disability. Similarly, as highlighted in the study conducted by Kurt and Muhammed (2012), people who are blind prefer to be aware of their surroundings in the way of knowing the time, location, and other useful information. However, curiosity and unwanted attention from others, as well as lack of empathy, can lead to heightened self-attention thus hindering assistive technology usage. Social embarrassment is also a major deterrent to assistive technology adoption for people who are totally blind.

Furthermore, the results of the finding revealed that students with visual impairment in Adidome Senior High School had difficulty in accessing the assistive

technology devices in the school. This is because the devices there were too old hence reduce efficiency when using it and perceived by the students to encounter many problems when using it speech was too fast and the pronunciation of certain terms and words was perceived by the students to be different from their conventional understanding and this posits a challenge. It was as well noted that, there was always malfunctioning and sometimes sudden failure of the use of Perkins and JAWS application as were being used and the students believed it retarded progress in their studies. In expressing this frustration, one of the students indicated, “At times, the JAWS could stop working while being used and misplacement of keys in the use of Perkins hence reducing efficiency”. Upon further interaction, the students with VIs explained that the type of the Perkins used in the school is old and easily breakdown without anybody repairing them. In addition, there is a malfunction of the JAWS that is being used in the school. This is because it is unlicensed and limit in some of its applications or functions. The students are therefore limited to access other uses of JAWS because they use the “cracked version” or trial version coupled with its inefficient functioning.

The results of the finding showed that students with visual impairment did not have appropriate information and education on assistive technology devices. This was evident in literature review as Michaels, Prezant, Morabito and Jackson (2012), the researchers underscored the need for students with special needs to be fully knowledgeable about assistive technology devices and their usage if they want to become lifelong learners who can use and manipulate information now and in the future. Providing access to assistive technology alone is not the resolution. Expertise in assistive technology usage must be aligned closely with its importance. This may be of a more pressing issue considering the rapid continuous changes taking place in



the field of assistive technology. In addition, Mugo (2013), in a comprehensive review of the literature on assistive technology for people with disabilities, concluded that individuals with disabilities are not fully benefiting from the use of assistive technology in home, school and community settings. He identified key shortcomings in the awareness, integration, and education of professionals of assistive technology in school settings.

#### **4.6 Knowledge and skills needed by Students with Visual Impairment to access**

##### **Assistive Technology**

One Student stated:

*I have keyboarding skill because I know the position of the letters on the computer keyboard, smartphone and Perkins. This skill helps me to type and braille without any difficulty.*

Another student reported:

*I have file navigation skill.....I use short cut to navigate files on my laptop. The use of the short cut to navigate files helps me to retrieve class works and assignments saved on the laptop hence not relying on anyone for help.*

Also, a student said:

*I have mobility skill.....this is because I can independently walk to classroom, dormitory, resource room and dining hall without any hindrance.*

In addition, another student mentioned:

*I can move around the school compound with ease through the help of my mobility cane without depending on sighted friends.*

A student noted:

*I have good listening skill that enables me to listen when the JAWS is reading for me. This listening skill puts me in a good position to understand what the JAWS reads to me.*

Again, a student said:

*I have video conferencing skills.....this skill enables me call friends in other schools via skype or WhatsApp to discuss things they are learning in their school to compare notes.*

It was evident from the transcript of students with visual impairment responses that they had keyboarding skills, file navigation skills, mobility skills, listening skills and video conferencing skills.

## **Discussions**

During my interview in the school, it was evident that students with visual impairment had keyboarding skill. Knowing the position of letters on the computer keyboard and the Perkins machine enabled the students with visual impairment to type and braille their class works and assignments on their own hence raising the confidence of the students. This finding is consistent with Kavagi (2010), who stated that a child with visual impairment who learns to touch type will have the confidence and assertiveness to use technology to their advantage, whether that is for typing an essay, researching a topic or collaborating with students in their class in a virtual collaboration network. Kavagi added that when students with visual impairment are not intimidated by technology, they are also more receptive to learning more advanced skills like coding and web design. Again, the findings revealed that students with visual impairment in the school had file navigation skills. The students with visual impairment used combination of keys to navigate files saved on the computer. This file navigation skill helped the students with VIs to easily retrieve their classwork and assignments saved on the computer.

Furthermore, through my interview, it was revealed that students with visual impairment had mobility skills. Mobility means skills which are achieved by persons

with visual impairments, which can enable the person to perform daily routine activities or more about independently and competently in familiar and unfamiliar environment. The person is therefore only mobile if the individual can gather and use sufficient information in the environment in order to avoid hazards and reach a desire destination (Kurt & Muhammed, 2012). Mobility therefore describes all situations ranging from moving around within a single room in a house to travelling from one town to another or even between countries. Mobility is the action of travelling, of going from one place to another. To be mobile, a person should be able to gather and use sufficient information from the environment to avoid hazards and to reach his destination safely. The mobility skills students with visual impairment had enabled them to use their mobility canes to move around the school compound, dining hall, classroom, and town. This agrees with Carolina (2013), who noted that mobility enables individuals with visual impairments to perform daily activities like going to a grocery shop, temple, common place, venues of social activities, houses of relatives, neighbours and friends. Through such movement, individual can interact with others and to develop inter-personal relations. It would enhance the quality and quantity of social contacts and integration in community. The extent of social interaction would be enhanced further if the individual is able to use the public transport and go far off places and other towns.

In addition, the findings again showed that students with visual impairment in the school had good listening skills. In the view of Richard and Shmidt (2010), listening is an active process in which listeners select and interpret information that comes from auditory and visual clues in order to define what is going on and what speakers are trying to express. Listening can also be referred to as a child's ability to attend to and distinguish both environmental and speech sounds from one another.

The listening skills students with visual impairment acquired helped them to listen attentively, discriminate sounds as well as appreciate whatever the JAWS reads to them. Consistent with Bisi (2013), he stated that it is crucial for a child especially a child with blindness, to develop good listening skills in order to cope with the academic demands of school and to learn adequate literacy skills. He added that listening skills play an important role in the continued development of language and communication skills, concept development literacy skills, skills for independent travel, appropriate social interaction skills and the use of technology.

Finally, the findings revealed that students with visual impairment had video conferencing skills. The video conferencing skills of students with visual impairment in the school made them to communicate with other colleagues in different school efficiently. Consistent with Maccormac (2019), video conferencing applications facilitate interaction by bringing people together. Video conferencing can connect participants from all over the world making it possible to engage local students as well as international students. In addition, video conferencing in education encourages interaction and collaboration between students and teachers and this make students more motivated and engage in their learning experience.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

#### 5.0 Introduction

The purpose of the study was to examine how students with visual impairment accessed assistive technology in Adidome Senior High School and to make recommendations for effective use of such technologies.

The study specifically sought to:

1. Find out the types of assistive technology devices available for students with visual impairment in Adidome Senior High School.
2. Examine how students with visual impairment access assistive technology in the school.
3. Determine the factors affecting access to assistive technology by students with visual impairment in the school.
4. Find out what knowledge and skills do students with visual impairment possess in assistive technology use.

#### 5.1 Summary of Major Findings

The major findings are summarized here as follows:

##### 5.1.1 Types of assistive technology devices available for students with visual impairment in Adidome Senior High School

The study revealed that, both high-tech and low-tech assistive technology devices were available in Adidome Senior High Schools. The high-tech assistive technology devices in the school included a scanner, an embosser, CCTV and a desktop computer. In addition, the low-tech assistive technology devices that were

available in the school were mobility canes, recorder, frames and styluses, printed brailled books and Perkins. However, the desktop computers, Perkins, and CCTV in the school were not sufficient to meet the demands and needs of students with visual impairment. Also, the few Perkins available in the school were all not in good condition.

### **5.1.2 Students with visual impairment access assistive technology in the school**

In terms of students with visual impairment access to assistive technology in the school, the findings showed that, some students with visual impairment accessed assistive technologies by borrowing devices such as slate and stylus from the resource centre and return them after use. Again, the study revealed that, though JAWS and NVDA were installed on the few desktop computers, majority of the students with visual impairment did not frequently access the desktop computers simply because they did not have the requisite skills to operate the computers, and they did not receive the necessary support to enable them access the desktop computer.

### **5.1.3 Factors affecting access to assistive technology by students with visual impairment in the school**

With respect to factors affecting use of assistive technology by students with visual impairment in the school, the study revealed that the resource teachers were not trained to provide assistive technology services for the students with visual impairment. Again, the findings showed that the complex nature of assistive technology devices made it difficult for the students with visual impairment to manipulate on their own. The findings again showed that socio-psychological factors affected students with visual impairment use of assistive technology. For example, unpleasant comments from sighted students made students with visual impairment

lose confidence, thereby making it difficult for them to use their mobility canes. In addition, high cost of assistive technology devices made it difficult for students with visual impairment to buy their own devices such as laptop and Perkins. The high cost of purchasing assistive technology devices made some of the students with visual impairment to result to the use of obsolete software, such as the JAWS, which more often than not, did not function well. Again, the findings revealed that students with visual impairment did not have knowledge and awareness about advanced assistive technologies such as desktop computers with installed JAWS and CCTV. On the contrary, two respondents admitted that they had knowledge and awareness about some devices like slate and stylus, and mobility cane.

#### **5.1.4 Knowledge and skills needed by students with visual impairment to access assistive technology**

With regards to knowledge and skills needed by students with visual impairment to access assistive technology, the study found that students with visual impairment had keyboarding skills, file navigation skills, mobility skills, good listening skills and video conferencing skills. These skills enabled the student to access some assistive technology devices on their own effectively, and as a result, they were not dependent on others.

## **5.2 Conclusions**

From the study, I found that in Adidome Senior High School, low-tech and high-tech assistive technology devices that were available, did not meet the demands of most of the students with visual impairment. Secondly, I found that students with visual impairment take turns to access desktop computers as well as borrowing devices such as slate and frame and Perkins machine from the resource room. Again, I

found out that lack of teacher preparation, high cost of assistive technology devices, socio-psychological issues, the complex nature of assistive technology devices, and lack of awareness, integration and education of professionals of assistive technologies in school settings, affected how students with visual impairment were able to access assistive technology at Adidome Senior High School. Finally, from the findings, I could conclude that students with visual impairment had keyboarding skills, mobility skills, file navigation skills, video conferencing skills and good listening skills.

### **5.3 Recommendations**

Based on the findings, the following recommendations were made:

1. The headmaster should collaborate with other stakeholders and benevolent organisations to provide enough desktop computers and Perkins machines in the school.
2. The headmaster should contact the District Education office to hire a technician to repair broken-down Perkins machines periodically.
3. The students with visual impairment could be trained on how to use JAWS and NVDA.
4. The resource teachers should educate students with visual impairment about the use of the assistive devices.
5. The headmaster and other benevolent organisations should provide licenced JAWS for the students with visual impairment.
6. The headmaster should bring assistive technology experts to train the resource teachers how to maintain assistive technology devices.
7. The headmaster and other organisation should create awareness about assistive technology devices for students with visual impairment.



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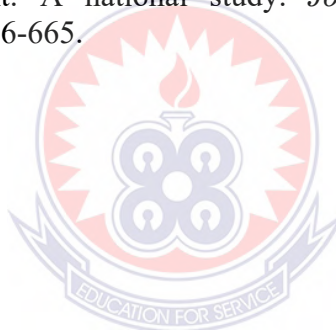
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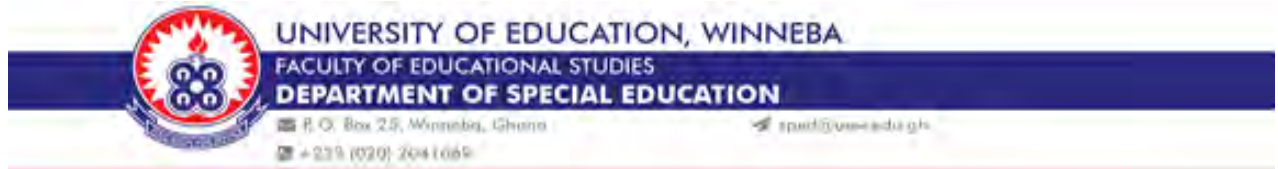
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## APPENDICES

### APPENDIX A

#### Letter of Introduction



6<sup>th</sup> July, 2020

#### TO WHOM IT MAY CONCERN

Dear Sir/Madam,

#### ***LETTER OF INTRODUCTION: MR. AGORSH MAWULI ANYIGBANU***

I write to introduce to you, *Mr. Agorsh Mawuli Anyigbanu* an M. Phil student of the Department of Special Education with index number 8180150011.

He is currently working on his dissertation on the topic: "*Access to Assistive Technology for Students with Visual Impairments in Adidome Senior High School.*" He needs to conduct an interview and do observations from your school.

I would be grateful if you could give him the needed assistance to enable him to collect the data.

Thank you for your consideration and assistance.

Yours faithfully,

DEPARTMENT OF SPECIAL EDUCATION  
UNIVERSITY OF EDUCATION  
WINNEBA  
25

**DR. DANIEL S.Q. DOGBE**  
*Ag. Head of Department*

## **APPENDIX B**

### **Interview Guide Teachers**

**UNIVERSITY OF EDUCATION, WINNEBA**

**DEPARTMENT OF SPECIAL EDUCATION**

### **Interview Guide for Resource Teachers in Adidome Senior High School**

#### **Types of Assistive Technologies Available for VIs**

1. What types of AT devices are available in the school?

#### **Prompts:**

- a. Describe them.
- b. Mention some of the AT devices.

#### **Students with visual impairments Access to Assistive Technology**

2. How do VIs get access to AT?

#### **Prompts:**

- a. Describe it.
- b. How often do VIs access computer?
- c. What service do you offer to VIs in the use of AT?

#### **Factors affecting access to assistive technology by VIs**

3. What are some of the problems VIs face in accessing AT?

#### **Prompts:**

- a. Have VIs been trained to access AT?
- b. How dependable are the AT devices?
- c. How simple or complex is AT devices to access?
- d. Are the AT devices bought by the school?

#### **Knowledge and skills needed by students with visual impairment to access assistive technology**

4. What knowledge and skills do VIs have in the use of AT?

#### **Prompts:**

- a. Are VIs trained to access AT?
- b. Has the school organised in-service training for VIs on AT devices usage?
- c. Are VIs confident with their AT abilities?



## **APPENDIX C**

### **Interview Guide for students UNIVERSITY OF EDUCATION, WINNEBA DEPARTMENT OF SPECIAL EDUCATION**

#### **INTERVIEW GUIDE FOR STUDENTS WITH VISUAL IMPAIRMENT.**

##### **Types of assistive technology Available for VIs**

1. What kinds of AT devices are available for you to access?

**Prompts:**

- a. Describe them.
- b. How do they work?
- c. Mention some of them.

##### **Students with Visual Impairments Access to Assistive Technology**

2. How do you access AT?

**Prompts:**

- a. Describe it.
- b. Does someone support you before you access AT devices?
- c. Do you frequently access AT?
- d. Do you effectively use the keyboard when using the computer?

##### **Factors affecting access to assistive technology by VIs**

3. What challenges do you face when accessing AT devices?

**Prompts:**

- a. Explain them.
- b. Do you face socio-psychological problem in accessing AT?
- c. Are AT devices simple or complex to access?
- d. Do you have awareness about AT?

##### **Knowledge and skills needed by students with visual impairment to access assistive technology**

4. What knowledge and skills do you have in accessing AT?

**Prompts**

- a. Are you trained to access AT?
- b. Has the school organised training for you on AT usage?
- c. Are you confident with your AT abilities?

**APPENDIX D****Observation Checklist**

Availability of-	Yes	No	Adequacy of AT		Condition	
			Enough enough	Not	Working working	Not
Frame and stylus						
Magnifiers						
Large print books/ materials						
Close Circuit Television						
Reading stand						
Computers						
JAWS for windows						
Embosser						
Scanner						
Perkins braille						
Dolphin pen						
Touch tablets						
Cramnier abacus						
Tactual maps and globes						
Talking calculators						
Writing guides						