# UNIVERSITY OF EDUCATION, WINNEBA

# EXPERIENCES OF STUDENTS WITH VISUAL IMPAIRMENT IN STUDYING INFORMATION, COMMUNICATION AND TECHNOLOGY AT THE UNIVERSITY OF EDUCATION, WINNEBA

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**of the requirements for the award of the degree of**
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**AUGUST, 2023**

# DECLARATION

**Student's Declaration**

I, Alberta Korankyewaa Kyei, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly 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 work was supervised in accordance with the guideline for supervision of thesis as laid down by the University of Education, Winneba.

**Name of Supervisor**: DR. AWINI ADAM

**Signature**……..…

**Date**……..……

# DEDICATION

I dedicate this work to my parents, Daniel Kyei and Grace Arthur, whose encouragement has brought me this far.

# ACKNOWLEDGEMENTS

My heartfelt gratitude goes to my supervisor, Dr. Adam Awini for his encouragement, guidance and support throughout the entire period of my research work. Every encounter with him enhanced my understanding of the concept of the research, and I am grateful for that.

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# ABSTRACT

This study explored the experiences of students with visual impairment in studying Information and Communication Technology (ICT) at the University of Education, Winneba (UEW). Employing a qualitative phenomenological approach, the researcher utilized semi-structured interviews and observations for data collection. The sample included 36 students organized into seven focus groups, as well as two ICT instructors who were purposefully sampled. The findings unveiled several noteworthy outcomes. Firstly, students with visual impairment relied on voice applications like JAWS and NVDA to navigate computers and mobile phones. However, a lack of basic computer skills such as typing, creating and saving files or documents were prevalent and were attributed to limited participation during practical ICT sessions. Additionally, while a few students independently utilized technology for information access, many depended on sighted peers for support. Meanwhile, students demonstrated their capability to locate, retrieve, and analyze digital information using references of course manuals, notes, and prior knowledge. The study highlighted various impediments that hindered students from integrating ICT into their academic pursuits fully. These included limited access to technology devices, financial constraints, and inadequate ICT skills. Consequently, the students often preferred traditional braille-based methods of reading and writing. Recommendations emerged from the findings, focusing on enhancing ICT education for students with visual impairment at UEW. Proposed strategies encompassed the adaptation of course content for teaching and online platforms to meet specific needs of the students, the provision of robust assistive devices in ICT labs and libraries, and specialized training for instructors in utilizing technology for individuals with visual impairment.

# CHAPTER ONE

# INTRODUCTION

## 1.0 Background to the Study

Exploring the experiences of students with visual impairment in studying Information Communication and Technology (ICT) cannot be underscored when looking at ICT education in Ghana. Experiences in this study refer to the personal encounters, interactions, events, and activities that individuals go through in their lives. Looking into the experiences of students with visual impairment in studying ICT at the University of Education, Winneba (UEW) sought to delve into the students' encounter with the course with regards to computer literacy skills, information literacy skills and integrating technology into their learning process as well as the skills and the impact of the course into their academic lives.

Over the years, as technology is advancing, it has become necessary for each individual willing to upgrade themselves to be abreast with modern technology as ICT has become more popular and essential in our everyday life. Due to this, Ghana has incorporated ICT into its educational systems from the basic level to the tertiary level. ICT is now a necessary tool in the educational process of learning the new methods of contemporary educational systems, as it is believed that technology is the guarantee for the active participation of the student in the learning process by turning them from passive receivers to active participants, making them more independent, autonomous, and allowing them to approach learning in accordance with their own abilities and expectations.

The University of Education, Winneba (UEW), is the public university with the largest number of students with visual impairment (Kwafoa & Imoro, 2020) and persons with disabilities (PWDs) in general practicing inclusive education. The University has made ICT a compulsory general course for all students pursuing a degree in any programme as a basic skill essential for every student including students with visual impairment. Their key concern is how teachers can effectively use ICT to accomplish instructional, learning, and institutional goals, prepare teachers who are competent, knowledgeable, and skilled in the use of relevant ICT technologies as well as ethical and skilled in both technical and interpersonal communication. The course puts emphasis on pedagogical integration of ICT tools in line with student-led instructional methodologies. The availability of ICT gives the students with visual impairment "hope" (Hollier, 2007:10) because it makes instructional materials accessible.

Students with visual impairment may have varying experiences in the study of computer literacy, information literacy and further integrating technology into their academic work. In terms of availability, accessibility and usability of ICT tools and teaching resources to enhance understanding of practical concepts, attitudes of lecturers towards students with visual impairment in the ICT lab during practical sessions. Grobler (2014) noted that, most effective ways to investigate possible advancement strategies for ICT inclusion and equal access would be to explore the experiences of the community in need (students with visual impairment), and paying special attention to their opinions regarding future solutions could also encourage them to take ownership of their situations and possibly foster new insights in technological issues.

One area of ICT education is literacy in computing. Computer literacy is therefore having a general knowledge about a computer, its components (hardware and software),

the various parts, peripherals and understand each of their uses and use them accordingly (Lau, n.d.). For students with visual impairment to continue living successful and fulfilling lives, it is crucial that they receive computer literacy training (Bayir et al., 2010). A study by Wyclife and Nyambura (2018) revealed some limitations students with visual impairment encounter in computer literacy skills training such as lack of specialised disabled friendly teacher training, limited flexibility in methodology options for students with disabilities, limited availability of specialised disabled-friendly hardware and software resources due to financial business, lack of formal involvement of governmental organisations and ICT support structure for the disabled.

Schiff (2009) revealed that, after a few exercises in a study she conducted, she was able to determine that some students with visual impairment were engaged and participating effortlessly in computer literacy class experience while other students had a difficulties with it. They needed the help of the tutor because they had either forgotten a particular keyboard command or were tactilely missing the keys they needed to press in order to activate the necessary computer function. Even the more fluent students needed extra time for certain exercises. Also, students were not able to locate something as basic as the search button because of the design complexity of the screen.

Unfortunately, some screens that go out of their way to be friendly to sighted users can overstep the bounds of what can be “read” by assistive technology users. Schiff’s study conducted in New York where ICT education and attention for individuals with visual impairment are very critical made such revelations which will help to improve upon some teaching strategies and resources as far as computer literacy skill is concerned. In UEW, the ICT unit at the Resource Centre for Students with Special Needs makes an

effort to take students with visual impairment through remedial teaching of some basic computer literacy skills however, per observations, the unit lacks resources such as computers and other assistive devices to enhance effective remedial teaching.

Therefore, it is necessary to explore issues concerning ICT and computer literacy in connection with persons with visual impairment at UEW and how they cope in such situations. This is to improve on issues which call for concern in terms of students' experiences in accessibility and usability of resources in class, strategies or methods lecturers use when it comes to students with visual impairment for better ICT education. Kinash, Crichton and Kim-Rupmow (2004) also reported that persons with disabilities are among the least considered in the educational context of literacy in computing. These findings highlight the limitations students with visual impairment encounter. However, there may be some achievements that will be important to bring to light which will inform and encourage stakeholders to improve on those positive practices.

Information literacy is another skill expedient in ICT education. Information is unquestionably the foundation of education and has grown to be a crucial source for global economies. Lau (n.d.) revealed that, information is a crucial component of scientific and technological advancement. Byerly and Brodie (1999) defines information literacy as the ability to find and use information. He explains that learners "should have both information-gathering strategies and the critical thinking skills to select, discard, synthesize, and present information in new ways to solve real-life problems". Owusu-Ansah (2003) also asserted that, information literacy extends beyond library skills and beyond the use of discrete skills and strategies to the ability to use complex information from a variety of sources to develop meaning and solve problems. A study by Ahmed et. al (2009) found out that, even with fairly recent

versions of JAWS (Job Access With Speech), students tend to find it difficult to browse through large documents such as e-books, and they express difficulty in effectively organizing these documents or sections for future use. Students with visual impairment also experience greater difficulty when requested to complete online tests, quizzes and CD-ROM tutorials (Fichten, et. al., 2009).

However, studies by Alqurashi and Alghamdi (2019), Haneefa and Syamili (2014) have shown that digital resources that could enhance effective information literacy skill acquisition may be hypothetically accessible, yet navigational difficulties may persist for users who are blind and visual impaired. At the University of Education, Winneba a braille library purposely set up for students with visual impairment where the students can get access to information through braille, computer and the internet is however located at the topmost floor of their building. In view of this, emphasis should be made on their experiences concerning accessibility and usability issues when it comes to their information literacy skills.

Integrating technology into the everyday lives of students with visual impairment is important as it brings some level of independency and also enables the student to be abreast with modern world, knowing how to gather information in their society as well as in their education. In doing so, they may encounter various interesting experiences. Grobler (2014) revealed that, smartphones and computers are two of the most common high-tech technological devices that most students with visual impairment use. It is of paramount importance that such assistive technologies cater specifically for the needs of individuals with blindness, so that they do not become an additional barrier (de Souza & de Freitas, 2012). A phone survey in Turkey found that 46% of participants who are visually impaired identified computer screen readers as the assistive product most frequently used. Cell phone screen readers were desired by 25% of the participants with

visual impairment, but was not considered affordable enough (Bengisu, 2010). The study also revealed that, though there are many screen readers, the majority are expensive commercial versions (de Souza & de Freitas, 2012) being an access barrier to those without the means to purchase them (Brophy & Craven, 2007). Bengisu's phone survey however cannot tell the frequency of lived experiences of how well they can use it to access and send information. Also, these findings were based on the experiences of students with visual impairment in relation to preference and accessibility of assistive devices in their learning and the barriers students face as a result of the visual impairment and how they manage when they are faced with such limitations without saying much about experiences in terms of usability of the technological devices in their learning. However, this study focuses on the experiences of students with visual impairment in technology integration in their studies in UEW.

By exploring the experiences of students with visual impairment in studying ICT as a general course may reveal some challenges and barriers in studying and acquiring ICT skills and will therefore need step-by-step training, a highly effective teaching method and resources to manage those barriers and improve effective study of the course. It can be stressed that learning of ICT is mostly practical and may need some sort of visual perception on how a computer and other technologies should be used (Chaidi et al., 2021). Therefore, per the experiences of these students, educational activity will be tailored to suit each student, based on their individual needs as far as the study of ICT is concerned.

It should also be noted that, a search at the University of Education, Winneba library by the researcher at the University indicated that, there has been a study to explore ICT knowledge and competencies of students with visual impairment in UEW (Atta, 2019)

and computer competencies of students with disabilities in UEW (Teye, 2014) however, there has not been any empirical study on the experiences of students with visual impairment in studying ICT in terms of computer literacy, information literacy, integrating technology in their learning and measures to improve effective study of ICT at the University of Education, Winneba. To fill this gap, the researcher finds it imperative to conduct this study to unravel these issues.

### 1.1 Statement of the Problem

The University of Education, Winneba admits averagely 40 students with visual impairment every academic year and has an enrolment of over one hundred students with visual impairment at the University. Although over the years, there has not been any record of a student with visual impairment admitted to pursue the elective ICT programme, however, it is mandatory and a requirement for every student including those who are visually impaired pursuing a degree or diploma in any programme of study to take ICT as a general course in their first academic year.

As a student who read ICT as an elective (second area) with other colleagues with visual impairment from 2015 to 2018, it exposed me to the fact that, the general ICT in its nature is practical and basically has to do with following series of visual demonstrations, instructions and manipulations. Hence, it is necessary to explore the experiences of students with limited or no vision in studying such a course. I observed throughout the years of the programme that my colleagues who were blind were not attended to during lectures and as a result they stopped coming to lectures.

Also, I have worked at the Resource Centre for Students with Special Needs (RCSSN) at UEW for almost four years now and it has exposed me to varying views from the students with visual impairment such as being segregated from the mainstream class,

left out of practical sessions and assessment with the intention to 'attend to them later'. By this, students' grades were affected since a score is allocated for practical sessions in the assessment and also, they were left with little or no skill at all which in turn affected how they integrated technology in their learning process. An interaction with an ICT instructor also indicated that students with visual impairment sat down idle in class due to their inability to follow the projected slides so they were disadvantaged in the information literacy class. This resulted in limited access to information and skills acquisition.

It is also important to note that, several studies have investigated the basic ICT skills and ICT usage of students with visual impairment (Haneefa & Syamili, 2014; Şimşek et al., 2010; Soman & Sudhier, 2015; Yılmaz, 2019), their technological needs (Fuglerud, 2011), as well as the challenges they face related to technology access and concerns on their studying of ICT. At UEW, Atta (2019) conducted a study on ICT knowledge and competencies of students with visual impairment in UEW and Teye (2014) on computer competencies of students with disabilities in UEW. These studies did not pay much attention to their general experiences in learning computer literacy skills, information literacy and how they integrate technology in their learning of which when explored carefully, will help take some critical and informed decisions about their exposure to resources made available for them and also their classroom experiences in improving their studies in ICT.

### 1.2 Purpose of the Study

The purpose of this study was to explore the experiences of students with visual impairments in learning ICT at University of Education, Winneba.

### 1.3 Objectives of the Study

The study sought to;

1. Describe students' with visual impairment experiences in learning computer literacy skills at UEW.
2. Explore the experiences of students with visual impairments in learning information literacy skills at UEW
3. Describe the experiences of students with visual impairment in technology integration in learning at UEW
4. Establish measures to improve learning of ICT for students with visual impairment at UEW.

### 1.4 Research Questions

1. What are the experiences of students with visual impairments in learning computer literacy skills at UEW?
2. What are the experiences of students with visual impairment in learning information literacy skills at UEW?
3. How do students with visual impairment experience the integration of technology in their learning process at UEW?
4. How can the study of ICT be improved for students with visual impairment in UEW?

### 1.5 Significance of the Study

The result of the findings from this study would expose the learning experiences of students with visual impairment in learning computer literacy skills at UEW. This would help lecturers and stakeholders understand the needs and feelings of students with visual impairment when it comes to studying computer literacy skills, whether

good or bad, which would inform all stakeholders involved in providing a sound learning environment and necessary assistive technology, resources and support that would enhance students' with visual impairment computer literacy skills. Again, it would reveal experiences in learning information literacy skills, what they encounter in applying the skill, how they decipher from valid, authentic, reliable and false information. This would encourage lecturers, and other stakeholders in improving on some good methodologies, resources they provide, and techniques in teaching students with visual impairment or reform and modify these resources and strategies to meet the leaning needs of students with visual impairment as far as information literacy is concerned.

Also, this study would expose how students with visual impairment go about integrating technology in their learning. The encounter and experiences they have integrating both computer and information literacy skills in their learning which would in turn reveal areas they struggle or thrive. This would enable the ICT Department, the school library, the Resource Centre for Students with Special Needs and the university management to understand the needs of the students and improve in the support, assistive technologies available and strategies for the students.

The experiences of students with visual impairment in these areas will also expose some of the positives and negatives about the method of teaching and how the ICT curriculum has been structured generally. This would inform some possible reforms that can be made to ensure that the course addresses diversity of needs of students especially those with visual impairment.

Finally, the study would also serve as a source of reference to other researchers who may conduct studies in a similar topic.

## 1.6 Delimitation

This study only focused on students with visual impairment in the University of Education, Winneba, even though there are students with visual impairment in other Universities in Ghana. This is because the University of Education, Winneba has the largest number of students with visual impairment in Ghana. Also, the study concentrated on ICT as a general course. Again, the study was delimited to students with visual impairment who were in level 200 and 300 and had read the general ICT course in their first year of study. This was because, they would have completed the ICT course most recently and could also provide their experiences over the years. The study was delimited to cover the following variables; the experiences of students with visual impairment in learning computer literacy skills, information literacy skills, technology integration and measures to improve the study of ICT at UEW. This was because, to complete a degree or diploma in any programme of study, every student is required to have taken the core ICT and gained skills in the variables captured.

## 1.7 Limitation of the Study

I faced difficulties in getting students together in each focus group due to it being the beginning of the semester and some of the students had not reported and also, most had not settled in. Also, as I waited for them to settle, there was another challenge with the schedule for the interview due to the students' different second area lectures. Therefore, I took their timetables and compared them to get a time that was favourable for each group. Again, a participant did not grant permission to be recorded through the interview process, therefore, all interactions were noted down. This however affected the analysis of the data since tone and other gestures were not captured through recording.

### 1.8 Operational Definition of Terms

**Experience:** An event or encounter that individuals with visual impairment go through which leaves an impact or impression on them.

**Students with visual impairment**: Students with visual impairment is a generic term for students with all forms of vision loss. They include; students with low vision and students with blindness. Students with low vision are those with residual or functional vision whiles students with blindness are those with no perception of light.

**Computer Literacy:** Computer literacy in this study refers to students with visual impairment having knowledge and understanding of computers and other peripherals and their uses.

**Information Literacy:** The ability of students with visual impairment to know how to locate, retrieve, analyze, and use information effectively.

**Technology integration:** The ability of students with visual impairment to use computers and other technologies combined with a variety of teaching and learning strategies.

### 1.9 Organization of the Study

In line with the in – house style of the University of Education, Winneba, this thesis was presented in six chapters. Chapter one comprised the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, delimitations of the study, limitations, operational definition of terms and general layout of the study. Chapter two focused on the literature review taking into account the research objectives and the theoretical framework of the study. Chapter three dealt with the methodology including research approach, research design, population, sample size, sampling technique, instrument used in data collection and analysis, description and distribution of instruments. Chapter Four covered the presentation and analysis of data collected and chapter five focused on interpretation and discussion of results. Chapter six dealt with the summary, conclusions and recommendations.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This chapter presents reviews of related literature on the experiences of students with visual impairment in studying ICT. The literature reviewed included research articles, journals and books. The literature reviewed also included empirical studies and the theoretical framework supporting the main issues addressed in this study. The areas that were discussed were: Students' with visual impairment experiences in learning computer literacy skills, information literacy skills, experiences of students with visual impairment in technology integration, measures to improve the study of ICT for students with visual impairment, and summary of the literature review.

## 2.1 Theoretical Framework

### 2.1.1 Transactional Distance Theory (TDT)

The theory underpinning this study is the Transactional Distance Theory (TDT). The experiences of students in learning a particular phenomenon centres around the strategies and attitudes of the lecturer towards the course and his or her students, the assistive resources to aid smooth study of the course and finally the tendency of the student to be able to apply the phenomenon. Propounded by Michael Moore (1993, 1996), based the above on three essentials of structure, dialogue and autonomy (Moore, 1993:23), "it is based on his previous theory of independent learning and teaching, the crux being student-centredness in facilitation of education". Moore and Kearsley (1996:664) argue that the structural distance is created by the designed course structure, with the interaction (dialogue) between the lecturer and the student constituting an important part of the learning process. In the case of paper-based learning this could be in a form of written feedback on the assignment sheet, and the dialogue could also be

exchanges in a discussion forum on v-class, an internet-based learning tool. Autonomy is about the students with visual impairment's capacity to learn independently and integrate technology in their academics. Moore (1993: 79) "postulates that autonomy is determined by the student's personality, learning styles, prior experience and the way he or she engages with the learning material". The learner's capacity has much to do with personality, learning styles, prior experience, and the content to be learned.

### 2.1.2 Structural Distance (Computer Literacy)

Structure has to do with the materials and resources that aids the smooth learning of complex skills and ideas. When the structure (computer and its related materials) are not relatable and appropriate for the learners it is intended to be used on, a structural distance is created. According to Moore (1993:23), "structural distance is caused by the way the learning material is designed, so as to enable the student to reach his or her learning goals. If there is continuing dialogue between the student and the lecturer and the learning content and the system is well-structured the transactional distance is reduced". Conversely, if there is less communication (dialogue) and the learning is not well designed the transactional distance widens. The process of TDT is reciprocal and requires all the parties in the learning system to play a positive and active role. Figure 1 (below) depicts the relationship of cause and effect between dialogue and structure.

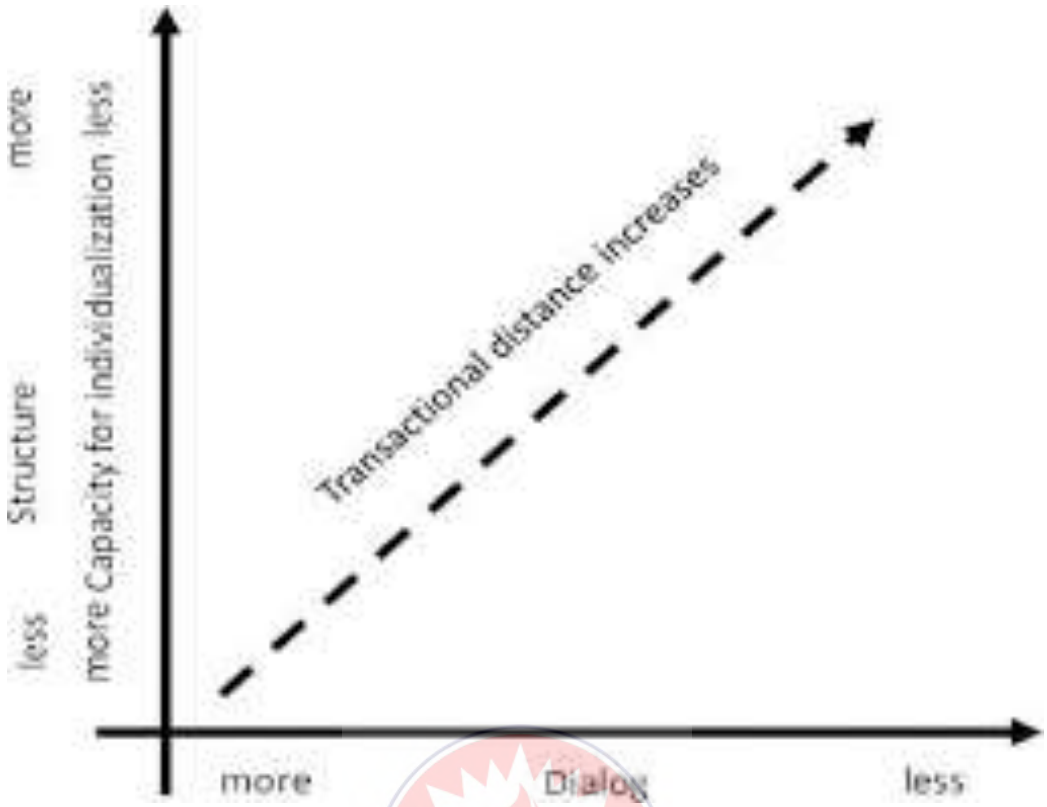


**Figure 1 : Dialogue + Structure determines TDT (Moore, 2006)**

### 2.1.3 Dialogue (Information Literacy)

Moore (1993:24) argues that dialogue is about the interaction between the students and the lecturer, the communication that takes place between the lecturer and the student and the reaction that this process provokes. It becomes effective if the student does not take too long to respond to the lecturer and vice versa. The way the students with visual impairment communicate with their lecturers and the way their learning material is designed determine the transactional distance. The higher the dialogue the less the transactional distance, which supports the students' chances of having a positive learning experience and succeeding in their studies. The lower the dialogue the higher or wider the transactional distance, which lessens the chances of the students having a positive learning experience and succeeding in their studies.

### 2.1.4 Autonomy (Integration of ICT in Learning)

Moore (1993:31) defines autonomy as the different ability levels of the students and the extent to which they can engage with their learning material and incorporate it in their academics. Moore (1993:31) stated that student autonomy is also about them generating ability to self-regulate and self-direct their learning. Moore (2018) argues that when the student becomes autonomous then the transactional distance increases because he or she can learn without depending greatly on the lecturer. ICT offers increased opportunities for interaction between the students and academics, hence increasing student autonomy.

Transactional Distance Theory (TDT) is suitable for framing this study because it is holistic in its approach. Crawford (2009) asserts that it provides a lens for analyses of both the organisational and the transactional matters of learning, especially in the context of ICT education for students with visual impairment which in turn influences the manner of experiences they encounter. The TDT is also suitable because it can be used to examine ways and means of enhancing the learning process for computer and information literacy. It makes both the student and the lecturer realise the importance of bridging the gap created by pedagogical distance so they can plan accordingly. It also highlights the importance of ensuring that learning material is designed properly, giving the student a chance to engage and become a critical thinker. In taking away the responsibility of directing the learning process from the lecturer it puts it on the student who should thus determine his or her own fate.

## 2.2 Experiences of Students with Visual Impairment in Learning Computer Literacy Skills

In recent times, computer literacy has become a necessary skill for individuals to acquire in order to function effectively in the digital age. However, for students with visual impairments, learning computer literacy skills can be a challenging experience. This literature review aims to explore the experiences of students with visual impairments in learning computer literacy skills

As a result of advancements in computer technology and its widespread adoption, governments and educational institutions now have a duty to instruct their citizens in computer literacy. All members of society should be afforded equal opportunities and advantages while using computers, but notably those who are visually impaired. In order to continue living successful and fulfilling lives, it is crucial for individuals who are visually impaired to have computer literacy training.

Computer literacy education seeks to familiarize people with computers and their basic concepts, to help them learn how to use computers while keeping in mind their goals and expectations, and to help them develop the habit of staying up to date on developments in the information and communication industries (Keser, 1999). Training people to be computer literate is one of the most crucial steps in becoming abreast with modern world, knowing how to gather information in their society, as one of the essential prior goals of computer and information literacy.

According to Smith (2007) in Derkye (2019), the loss of eyesight has a significant impact on the person, limiting mobility, access to printed material, independence, and use of modern technology like ICT. In fact, it is possible for students with visual

impairment to have trouble "utilizing" ICT resources, and the specific challenges they face may differ greatly depending on how severe their visual impairment is.

Basic Computer Skills

This includes learning how to navigate a computer's operating system, understanding file management, using a keyboard and mouse, and performing basic tasks such as creating, saving, and deleting files. The capacity to navigate and give commands via the keyboard is essential for computer users with visual impairments. They would use keyboard shortcuts rather than mouse clicks to do computer tasks, especially if they use a screen reader. Access to public libraries, home banking, and email for correspondence are just a few of the many additional areas of life where having information technology skills is crucial. As a result, everyone in society, including those who are visually impaired, benefits from computer literacy. Having computer literacy skills as students who are visually impaired enables them to read all onscreen text, including emails, spreadsheet columns, and application tool bars, making such a highly visual environment accessible to people unable to see a computer monitor with their eyes. One can utilize assistive technology to open and operate programmes, navigate their keyboard and desktop, and browse the internet.

The software applications Job Access with Speech and magnification are the pieces of technology that allow for this navigation (Gerber & Kirchner, 2007). These screen readers give computers voices through software that creates human-sounding speech from written text and keyboard input so that those who are blind or visually impaired can hear and see what is printed on the screen. Thus, the use of computer assistive technology has become a part of the core curriculum in junior high schools in Ghana. Ampratwum et. al. (2016) asserted that, in Ghana's quest to equip students with the

needed competencies in computer usage, many professionals have been trained to help individuals with visual impairment gain adequate knowledge in information technology programmes. Among the reasons for this is that most students with visual impairment at one point in time find themselves in environments where the use of computer will be needed to make a living and gain independence. In spite of these benefits, students with visual impairment are likely to encounter some problems in its usage. Some of these problems are that students with visual impairments appear to exhibit errors in keyboarding skills. This appears to be due to student's inability to remember keyboard shortcuts, as well as difficulties in having access to license speech software and inability to discrimination voice of Job Access With Speech (JAWS).

Challenges to the use of computer assistive technology do not only pertain to developing countries like Ghana. In fact, a study conducted in the United States suggests that individuals with visual impairment are not fully benefiting from the use of computer assistive technology at home, school and community (Gamble & Hirsch, 2003). Similarly, Kapperman and Sticken (2002) reported that 60% of students with visual impairments were not benefitting from computer assistive technology as a result of the challenges and lack of the needed competencies for using these technologies. Again, it appears that there are also inadequate qualified personnel with regard to teaching computer assistive technology. Furthermore, it seems the difficulties faced by persons with visual impairment in the usage of computer assistive technology in school is due to lack of adequate computers to meet the needs of students who are blind. Besides, it appears that the huge impact of technology has not impacted on teaching and learning of those with visual impairment. Many professionals appear to understand, at least anecdotally, that computer use could make a tremendous difference in the lives of students with visual impairments by improving their educational and employment

opportunities, enhancing their social networks and facilitating their independence, yet, little research has been conducted to document the challenges to computer usage among students with visual impairments in Ghana.

Experiences with Software Applications

Interaction with software applications is a crucial aspect for individuals with blindness to effectively use digital tools and participate in various activities. Assistive technologies such as screen readers and screen magnifiers play a significant role in facilitating this interaction. Screen readers, such as JAWS and NVDA, provide users who are blind with auditory feedback by reading out the text displayed on the screen (Hansen & Rødje, 2019). These screen readers use synthesized speech or braille displays to convey information about the software interface, menus, buttons, and other elements. This allows users who are blind to navigate through different sections of the application and perform tasks with the help of keyboard shortcuts or voice commands (Hansen & Rødje, 2019). In addition to screen readers, screen magnifiers are another assistive technology that aid individuals who are blind in interacting with software applications. Screen magnifiers enlarge the screen content, making it easier for users with low vision to read text, view images, and navigate through the software interface (Hansen & Rødje, 2019). This feature helps students with visual impairment to locate and interact with different elements within the application.

Moreover, software developers have a role to play in enhancing accessibility by following accessibility guidelines and incorporating features that support interaction for users who are blind. For example, ensuring proper labelling of buttons and form fields, providing alternative text descriptions for images, and using accessible colour schemes are some practices that can make software applications more usable for

individuals who are blind (World Wide Web Consortium, 2020). A study by Atoyebi and Adeyemi (2017) in Nigeria revealed that, students who are blind faced several challenges in learning computer literacy skills, including the lack of accessible computer software and hardware, inadequate training and support, and negative attitudes and stereotypes from teachers and peers. However, the study also found that students with visual impairment used various strategies to overcome these challenges, such as seeking support from friends and family, using assistive technology, and developing their own learning strategies. Also, Students who are blind face significant challenges in learning computer literacy skills due to the lack of accessibility of computer software and hardware.

Presley and D' Andrea (2008) highlighted that, it seemed there were no other inventions, besides braille, which had made it possible for students with visual impairment to interact as successfully as assistive technologies that have opened up computers and the internet to them. Assistive technology includes both assistive technology devices and assistive technology services.

Schiff (2009) revealed that, after a few exercises in a study she conducted, she was able to determine that some students with visual impairment were engaged and participating effortlessly in computer literacy class experience while other students had a rough time of it. They needed the help of the tutor because they had either forgotten a particular keyboard command or were tactilely missing the key they needed to press in order to activate the necessary computer function. Even the more fluent students needed extra time for certain exercises. Also, students were not able to locate something as basic as the search button because of the design complexity of the screen. Unfortunately, some screens that go out of their way to be friendly to sighted users can overstep the bounds

of what can be “read” by assistive technology users. Schiff’s study conducted in New York where ICT education and attention for individuals with visual impairment are very critical made such revelations which will help to improve upon some teaching strategies and resources as far as computer literacy skill is concerned.

Also, the study findings of Ampratwum et. al. (2016) indicated that, rather than being caused by outside factors, the difficulties raised by the students are a product of their own reactions to using computer assistive technology for computer literacy skills. These difficulties result from how each student reacts to their training and familiarity with using computer assistive technology as they grow their competencies. This does not, however, include the JAWS application failing or misbehaving. This issue has an external influence, and it manifests as a lack of funding, expensive equipment, and problems with eligibility for device ownership (Fifield & Fifield, 2002), as well as a lack of understanding and support from educators (Alper & Rahrinna, 2011). However, the situation is different for the kids at Akropong School for the Blind. This was so because the numerous approaches that the students mentioned as being employed to deal with their difficulties show that their ICT teacher has understanding about and support for them (Ampratwum et. al., 2016). According to Johnson’s (2011) findings from a different study, underuse of devices for computer literacy is largely due to a lack of knowledge and awareness among people with visual impairment, reluctance to use the devices, poor device performance, changes in needs or priorities, and feelings of stigmatization.

The study by Ampratwum et. al., was conducted in a basic segregated institution for students who are blind whiles currently in Ghana, advocacy is at its heights to push for a high level of inclusion among all manner of people regardless of their diversity.

However, this study was situated in an inclusive setting and a tertiary institution which will exposes a deeper experience from students with visual impairment in a setting with different categories of people.

Furthermore, findings from a study conducted by Eligi and Mwantimwa (2017) revealed that, tape recorders and computers were frequently accessed and used by most of the students with visual impairment at the surveyed units at the study area. Also, a notable minority of the respondents indicated that the Closed Circuit TV (CCTV) and scanner were also accessed. Other facilities mentioned to be accessed to support learning among students with visual impairment were the Braille embosser and the note-taker. Accordingly, other students with visual impairment cited special software such as NVDA and JAWs. This implies that the frequency of accessing ICTs facilities depends on the availability and the functionality of such facilities when it comes to supporting learning for the students with such special needs. In this regard, the findings of the study are in line with the conceptual framework on information seeking behaviour that shows that students with visual impairments make use of ICTs and other information systems available in their environment before looking for other alternative sources. The facilities frequently accessed were also those which are tailored to meeting the needs of the students with visual impairment in terms of content provided for a specific period. Independently through observation, the researchers were able to confirm the availability at the University's Special Education Units of the ICTs facilities the respondents mentioned. The available special ICT facilities for students with visual impairment at the University Special Education Unit were based on the nature and specific needs of the users. They had specific features and functionality. The findings signify that the administrative or University of Dar es Salaam Management recognise the role ICTs play in supporting the learning process of the students with

visual impairment. ICT facilities allow students with visual impairment to gain from the learning process through seeking and accessing information and other learning materials.

Internet and Web Browsing

For individuals who are blind, accessing the internet and browsing the web can be challenging due to the visual nature of most websites. However, advancements in assistive technologies, such as screen readers and screen magnifiers, have made it possible for users who are blind to access and navigate web content (World Wide Web Consortium, 2020). Screen readers, like JAWS and NVDA, read out the text and describe the elements on a webpage, allowing users who are blind to interact with the content using keyboard shortcuts or voice commands (Hansen & Rødje, 2019). Eligi and Mwantimwa's (2017) study used the quantitative instruments such as questionnaires to gather data for ICT facilities accessed and used, preferred tools in supporting learning, and the frequency of using ICT facilities for learning computer skills. Questionnaires may not reveal thoroughly their in-depth experiences in terms of access, use and preferred tools in supporting them to learn computer literacy skills.

Again, a study conducted by Gatiti (2021) aimed to investigate the challenges faced by students with visual impairment in learning computer literacy skills. The study was conducted in Kenya, and the researchers used a qualitative research design. The results showed that students with visual impairment faced various challenges, including lack of assistive technology, lack of accessible learning materials, and inadequate training for teachers on how to teach students with visual impairment. The study recommended the provision of assistive technology and accessible learning materials and training for teachers to improve the learning experiences of students with visual impairment.

Similarly, Ogunbodede and Oribhabor (2022) investigated the impact of e-learning on students' academic achievement in tertiary institutions in Nigeria. They found that e-learning had a positive impact on students' academic achievement. Both studies highlight the potential of technology to improve education outcomes in developing countries. They also emphasize the importance of ensuring that students have access to the necessary technology and infrastructure to fully benefit from e-learning. Additionally, both studies suggest that e-learning can provide a solution to some of the challenges faced by traditional education systems in developing countries, such as limited resources and insufficient teacher training.

Digital Creativity

Individuals who are blind can engage in digital creativity through the use of assistive technologies and accessible software applications. For example, screen readers can read out the content of digital documents, allowing users who are blind to write, edit, and format text (Hansen & Rødje, 2019). Accessible graphic design tools and software, like Adobe Illustrator and CorelDRAW, provide alternative text descriptions for visual elements, enabling users who are blind to create and manipulate digital graphics (World Wide Web Consortium, 2020). A study by Gichuhi and Wario (2016) aimed to investigate the effectiveness of using screen readers in improving digital creativity skills for students with visual impairment. The study was conducted in Kenya, and the researchers used a quasi-experimental research design. The results showed that the use of screen readers significantly improved digital creativity skills of students with visual impairment. The study recommended the use of screen readers in guiding students with visual impairment in a way to motivate them to improve upon such skills. Similarly, a study by Alves and Nunes (2019) aimed to investigate the experiences of students with visual impairment in learning computer programming. The study was conducted in

Brazil, and the researchers used a qualitative research design. The results showed that students with visual impairment faced challenges in accessing the necessary software, lack of assistive technology, and inadequate training for teachers on how to teach students with visual impairment. The study recommended the provision of assistive technology and accessible learning materials and training for teachers to improve the learning experiences of students with visual impairment in computer programming.

The findings of Gichuhi and Wario (2016) suggested that screen readers can be effective in teaching computer literacy skills to students with visual impairment. On the other hand, Alves and Nunes (2019) focused on the experiences of students with visual impairment in learning computer programming. While the two studies have different areas of focus, they both highlight the challenges faced by students with visual impairment in learning computer-related skills. Additionally, both studies emphasize the need for accessible technology and accommodations for students with visual impairment in order to provide equal opportunities for learning and success in these fields.

### 2.3 Experiences of Students with Visual Impairment in Learning Information Literacy Skills

The expansion of digital information has made it expedient for students to now place a high priority on information literacy. Information literacy refers to education that develops learning opportunities to improve students' independence in accessing and using information. Knowing where to look for information, how to locate it, and how to participate successfully in the research process are all part of the information literacy skill (ACRL, 2016). As a result, they will be able to possess the necessary information literacy skills and enough knowledge of the latest information technologies' tools,

procedures, and instruments. The ability to read and write gives students the chance to comprehend the availability of knowledge as well as how to locate it and how to use it effectively (American Library Association, 2015). Literacy skills foster learning opportunities that improve students' access to, evaluation of, organization of, and autonomous use of information as a key component of learning, scholarship, and research. Information literacy, according to SCONUL (1999), is the ability to use and manipulate information in the context of learning, teaching, and research concerns in higher education. It also includes library user education. Because they live in a world of instant communication where they can discover answers to so many topics that excite them, students no longer need to rely on teachers, textbooks, or libraries to acquire the knowledge they need to make decisions or complete assignments (O' Connell, 2007).

Information literacy skills are crucial for students in accessing, evaluating, and using information effectively and ethically. However, students with visual impairments may face unique challenges in developing these skills. This literature review aims to explore the experiences of students with visual impairments in learning information literacy skills.

According to Kebritchi and Hirumi (2008), students with visual impairments face significant challenges in accessing and using digital information. They also highlighted the importance of providing accessible technology and training to help these students learn information literacy skills effectively. Similarly, Al Anzi and Alqurashi (2019) found that students with visual impairments often encounter difficulties in navigating online resources, such as databases, due to the lack of accessibility features. In a study conducted by Liao and Chang (2014), it was found that students with visual impairments face challenges in developing information literacy skills due to the lack of

resources and support. They also noted that teachers and librarians need to be trained in providing accessible information and teaching strategies for students with visual impairments.

In contrast, a study by Stowell et al. (2019) found that students with visual impairments can develop information literacy skills, but it requires a different approach. They suggested that teachers and librarians should provide hands-on experiences and use tactile materials to help these students learn effectively. The studies in the literature review show that students with visual impairments face challenges in learning information literacy skills due to the lack of accessibility features, resources, and support. Kebritchi and Hirumi (2008) and Al Anzi and Alqurashi (2019) both highlighted the importance of accessible technology and resources to help these students learn effectively. Liao and Chang (2014) emphasized the need for teachers and librarians to be trained in providing accessible information and teaching strategies. However, Stowell et al. (2019) found that students with visual impairments can develop information literacy skills with a different approach.

Source Evaluation and Information Analysis

Ilogho, and Nkiko (2014) stated that the information literacy skills include the capacity to identify when information is required as well as the capacity to find, assess, and use necessary information. Similar to this, people with higher education levels are anticipated to have varying levels of information literacy proficiency. In support of this assertion, Brand-Gruwel, Wopereis, and Vermetten (2005) divided participants into expert and novice groups based on their experience with information problem-solving processes. They discovered differences in the participants' abilities. He also stated that having access without knowledge is useless, making the development of information

literacy skills a fundamental requirement for every citizen. Information literacy was also defined by Lenox and Walker (1993), who are cited in Okore and Njoku (2012). They defined information literate individual as having the analytical ability to develop research questions and assess findings.

Different information literacy ability levels are anticipated for those with increasing education degrees. Additionally, he or she should have the abilities to find and access a variety of information sources to suit their information needs. Therefore, the importance of information literacy as a means of achieving academic success cannot be understated. The ability to recognize, locate, assess, organize, and effectively use information to meet current challenges or problems is hence a component of information literacy skills. And doing so is a requirement for properly engaging in the information society. Additionally, according to Dike (2009), the capacity to acquire, assess, and apply data from a range of sources; to analyze, sort, and combine relevant items into a knowledge base with critical judgement and thinking is essential if knowledge societies are to be learning societies and if change is constant.

A study by Hill (2018), found out that students who are blind faced several challenges in accessing and using digital technology, including inaccessible websites, lack of accessible technology for information retrieval. Also, the study also found that students who are blind use a variety of strategies to navigate the digital world, including using screen readers, seeking assistance from peers and instructors, and adapting their learning strategies. Thompson and Chawner (2019) explored the experiences of students with visual impairment in information literacy instruction in New Zealand universities. They conducted interviews with students with visual impairment and

analyzed their responses to identify the challenges they faced and the strategies they used to overcome those challenges. Some of the key findings from their study include:

1. Students with visual impairment face unique challenges in information literacy instruction, such as navigating inaccessible websites and materials, and difficulty with visual concepts like diagrams and charts.
2. Students with visual impairment require specialized training and support to effectively use assistive technology for information literacy instruction.
3. Students with visual impairment often feel marginalized and excluded in information literacy instruction due to lack of accessibility and inclusion.

The study further suggested that collaboration between librarians and disability support services can improve the accessibility and inclusivity of information literacy instruction for students with visual impairment. In New Zealand where Thompson and Chawner conducted their study is a much more developed country as compared to Ghana. Therefore, the level of inclusiveness when it comes to individuals with disabilities may differ from that of Ghana. Moreover, technology may be more common and of a higher use than in Ghana. This makes it relevant to seek the view of students with visual impairment in computer literacy instruction in UEW.

Use of Technology to Access Digital Information

A study conducted by Lewis (2004) on the experiences of students with visual impairment using electronic information services also revealed that, students with visual impairment face barriers to accessing and using digital information, including limited access to assistive technology and lack of accessibility features in digital resources and lack of awareness and training on assistive technology. They often feel isolated and excluded in information literacy instruction due to negative attitudes from

instructors and peers, lack of attention and inadequate support from library attendants, lecturers and their sighted colleagues. They often rely on alternative sources of information, such as audio books or braille materials, variety of assistive technologies to access and use information, including screen readers, magnifiers, and braille displays**.** Lewis further discussed that, the use of assistive technologies can create additional challenges such as compatibility issues, slow processing speeds, and limited functionality. The experience of students with visual impairment in information literacy is shaped by a range of factors, including the level of support provided by instructors and institutions, the quality of assistive technologies, and the attitudes and perceptions of instructors and peers. To improve the experiences of students with visual impairment in information literacy, it is important to address the barriers they face, provide appropriate training and support, and foster a culture of inclusion and accessibility.

Hall and Prosser (2021) also reported that, students who are blind face unique challenges in learning to read information, including the need for specialized software and hardware, and the need to develop alternative reading strategies. He noted that students who are blind often learn to read through a combination of braille, audio, and tactile formats, and may need to adapt to different formats depending on the type of information they are accessing. Hall and Posser reported that students who are blind face social isolation and lack of access to materials, which can impact their ability to develop reading skills.

Similarly, Eldredge and Riddle (2021) revealed from a study on information literacy instruction for students who are visually impaired, focusing on the challenges and strategies for effective instruction that, students with visual impairment face unique challenges in information literacy instruction, including accessing and using digital

resources, developing effective search strategies, and evaluating sources for accuracy and relevance. They added that, instructors may lack the knowledge or resources to effectively support students with visual impairment in information literacy instruction, which can lead to further marginalization and exclusion. A study by Ahmed et al., (2009) also found out that, even with fairly recent versions of JAWS (Job Access With Speech), students tend to find it difficult to browse through large documents such as e-books, and they express difficulty in effectively organizing these documents or sections for future use. Students with visual impairment also experience greater difficulty when requested to complete online tests, quizzes and CD-ROM tutorials (Fichten, et al., 2009). However, studies have shown that digital resources that could enhance effective information literacy skill acquisition may be hypothetically accessible, yet navigational difficulties may persist for students with visual impairment.

### 2.4 Students' with Visual Impairment Experiences in Technology Integration

Technology integration refers to the incorporation of technology tools and resources into the teaching and learning process to enhance and support learning outcomes (Roblyer & Doering, 2014). It involves the deliberate use of technology to engage students, promote critical thinking, and facilitate collaboration and communication (ISTE, 2017).

Over the past few decades, ICT has evolved into the most important resource for the advancement of society and the economy and has significantly aided the development of new modalities of instruction, learning, and training (Samuel & Zaitun, 2005). Several studies have explored the experiences of students with visual impairments in integrating technology in their studies. Hakkarainena, et al. (2006) found that being able to use ICT tools such as computer, mobile phones, braille translators, scanners,

printers, television, radio, audio recorders, software, internet and others effectively have become critical indicators of a good quality of life.

Findings by Hackett and Parmanto (2006) in a study conducted using six computer users with visual impairment (two men and four women, aged 40 and older) participated in usability for web site accessibility. Six think-aloud tests were undertaken in the study to compare access with the typical web display with the aim of finding usability problems and enhancing the design of access. The findings indicated that the adults who are visually impaired were happier with the updated website. This was due to the fact that the altered websites provided participants with an alternative method of accessing the information on the original websites. Additionally, Bayer and Pappas (2006) discovered that screen reading and navigation were particularly challenging for blind internet users. Another study on how students with visual impairment access and use the web suggests that website designers should take into consideration the demands of users who are visually impaired while creating their informational websites. Skills are now important benchmarks for a high quality of life.

According to Peterson and Palmer (2011), the majority of their participants thought they were well-equipped to use technology in their teaching and to integrate it into it in the future. Additionally, 516 student teachers participated in a study by Albion (2007) regarding their ability to use technology to find information online. Due to their extensive ICT knowledge and experience with assistive technology, the participants were found to have high levels of competence and confidence. This implied that when a person has a high level of ICT knowledge and proficiency, they typically feel competent and confident utilizing the technology. The two studies employed the

quantitative approach which may not explore into details the students' level of confidence and other experiences in integrating technology in their academic lives.

A related study indicated that students were more likely to use computers and online library resources if they had better levels of computer literacy (Tella & Mutula, 2008). Yu, et al. (2001) also found that the participants' ICT knowledge and abilities were insufficient in a study of 257 students. They suggested that apprehension about using computers is caused by a lack of information, but bettering one's understanding of computers and becoming more accustomed to them is crucial for ICT usage. In order to facilitate learning, they argued for the provision of some fundamental ICT knowledge and skills. Additionally, Edwards et al. (2012) conducted a study with 26 students and discovered that when students completed a computer course with access to the necessary ICT tools, their level of ICT knowledge and competence increased. The findings show that ICT proficiency is a talent that can be developed with expertise gained from a basic computing training.

A recent national survey in the United States revealed that almost one-third of assistive technology devices for people with disabilities were unused due to various factors. These include a lack of consideration and willingness to use the devices, selection of technology tools by family members rather than users, complicated design, unreliable equipment, insufficient funding, and lack of technical support. Johnson (2011) reported that people's with disabilities lack of knowledge and awareness, reluctance to use the devices, poor device performance, changes in needs or priorities, and feelings of stigmatization are major reasons for underused assistive technology devices.

Kapperman et al. (2002) indicated that between 59 to 71 percent of students with visual impairment who had had potential to use reading devices in elementary schools and

high schools in Illinois, did not have opportunities to adopt the assistive technology devices. This presents major challenges to students with visual impairment in using ICT, and is somehow confirmed by Copley and Ziviani (2004), who identified six barriers to effective use of ICT devices among students with multiple disabilities. These include: (a) lack of appropriate staff training and support, (b) negative staff attitudes, (c) inadequate assessment and planning processes, (d) insufficient funding, (e) difficulties procuring and managing equipment, and (f) time constraints. Soderstrom and Ytterhus (2010) researched into the symbolic values and use of assistive technologies from the world of ICT in the daily lives of 11 young Norwegians who were visually impaired. The outcome of the study showed that participants who are visually impaired rejected the use of ICT assistive technologies to improve their academic and social life. The participants who were partially sighted and were capable of participating in online interactions with their peers without ICT assistive technologies also reject them.

The participants who were blind were unable to participate in online activities without the help of ICT assistive technologies, so they agreed to use them. This highlights the importance of regulations to ensure that students with visual impairment have access to assistive technology to develop their ICT skills. People with visual disabilities encounter unique challenges when using ICT, beyond issues of access to materials and computer training. Bayer and Pappas (2006) identified technical accessibility problems as one of the obstacles that students with visual impairment face and need to be addressed. Bayer and Pappas discovered that students with visual impairment encountered issues with screen reading and navigation when using the internet. They also observed a lack of computer training for those with visual impairments, which they considered to be at a crisis level. It is recommended that Level 100 students with visual

impairments take an introduction to computer course to develop ICT competencies for educational purposes. Despite the availability of advanced assistive technologies, those with visual impairments still face accessibility challenges. Even though there are more advanced, technology-enhanced assistive devices available, there are still a number of accessibility issues that need to be resolved (Burzagli, et al, 2004).

Sicilia (2005) hypothesized that the difficulty of gaining access to ICT resources, such as computers, software, and the internet, is an example of a complicated barrier to the development of knowledge and abilities. Despite efforts to improve web accessibility, there is a lack of research on how such measures affect the browsing behaviour and mental frameworks of users who are blind. This indicates that users who are blind are not adequately considered in this area (Kouroupetroglou et al., 2008). While a study on the effectiveness of Web Content Accessibility Guidelines (WCAG) 2.0 in enhancing the online performance of visually impaired users showed positive results in terms of usability and efficiency (Leporini & Paternö, 2008), there is still much room for improvement. Given that the internet is a globally accessible platform, it is evident that there is a universal need for better accessibility, which would benefit all users who are blind.

Smartphones and computers are two commonly used high-tech devices that can be enhanced with additional software and hardware options. It is crucial that assistive technologies cater specifically to the needs of blind people to avoid creating additional barriers for them (de Souza & de Freitas, 2012). In Turkey, a phone survey found that 46% of participants with visual impairment use computer screen readers as their most frequently used assistive product, while 25% desired cell phone screen readers but found them too expensive (Bengisu, 2010). However, many screen readers are

expensive commercial versions, making them inaccessible to those who cannot afford them (Brophy & Craven, 2007). JAWS is a popular commercial screen reader among users who are blind.

As a result of the high cost of assistive programmes, a significant percentage of communities with individuals who are visually impaired in South Africa could not afford them without external funding. Screen readers are the primary interfacing device for most computer users who are blind (Bengisu, 2010), and JAWS 14 offers several features, including a customizable Flexible Web feature, a Vocalizer Direct Synthesizer, and suppression of unwanted flash and frame announcements. However, blind learners still face challenges when using computers, such as difficulties in browsing large documents and effectively organizing them for future use (Ahmed et al., 2009).

Students who are blind also face challenges when completing online tests, quizzes, and CD-ROM tutorials (Fichten et al., 2009), and navigating complex email interfaces and ineffective HTML heading tags (Wentz, Hochheiser, & Lazar, 2012). They also struggle with visual CAPTCHAs and do not make use of the calendar functionality in email clients (Wentz et al., 2012). Poor page layout, screen reader and software conflicts, forms not designed for screen readers, pictures without alternative text, confusing links, inaccessible PDFs, and screen reader crashes are some of the top causes of frustration for users of screen readers who are blind (Lazar et al., 2007). Users who are blind tend to seek alternative solutions to problems instead of restarting their computers, and nearly a third of their time is spent troubleshooting while browsing the internet (Lazar et al., 2007).

According to studies conducted in North America, teachers of students with visual impairments still prefer using human readers during evaluations rather than technology (Johnstone et al., 2009). The lack of planned courses was cited as the main barrier, and the educators added that they did not use information technology because they believed students with visual impairment could not use computers or that there were no facilities or appropriate software available. In order to ensure fair access to computers, both educators and students acknowledged a need for advisors (Alves et al., 2009) and a sufficient number of computers. According to research by Nam et al. (2013), instructors' perceptions of the effectiveness of the assistive technology play a significant role in how often it is used in schools. In a study of educators' self-reported proficiency in assistive technology, Zhou et al. (2012) discovered that 39.05% of the educators had some confidence in the technology and 18.81% had little confidence. Additionally, there was a direct association between the age of instructors and their self-reported low proficiency with assistive technology. According to Kamei-Hannan et al., (2012), educators who want to use the essential assistive technology for learners who are blind or visually impaired must undergo extensive training.

Many students do not have access to a home or school computer, let alone the necessary assistive applications, in sub-Saharan nations like Zambia and South Africa (Akakandelwa & Munsanje, 2012). This obstacle is referred to as the "digital divide" by Shane et al., (2012), which is representative of the disparity in access across localities and socioeconomic levels. Ineffective control of alternative augmentative communication technologies, limited access to online information and services, and not being raised in a digitally savvy family are further ways that people face the digital divide (Shane et al., 2012).

In terms of information access, employment, leisure, and socialization, the blind community may profit from the usage of computer technology (Shane et al., 2012). Unfortunately, a large number of people with visual impairments either do not see the value of assistive technology or are constrained by hurdles that they perceive to exist both internally and externally (Douglas, Corcoran, & Pavey, 2007). Access continues to be a fundamental obstacle to efficient computer use. A need for independence is something that the majority of students with visual impairment express (Khadka et al., 2012). Context (locality) and function (intended use) are constraints on the adoption of alternative and augmentative communication technologies (Shane et al., 2012). Learners who are blind or visually impaired would not be able to achieve the level of independence they want if they did not have access to the right assistive technology in the suitable setting. Regarding the attitudes, perceptions, and experiences of computer use by individuals with visual impairment, the International Classification of Functioning (ICF) can be used as a valuable framework for understanding disability. In their examination of the opinions and experiences of individuals with visual impairment with personal computers, Douglas et al. (2007) discovered that many of these people lacked understanding about the advantages of computers, which prevented them from wanting to use them. It has been determined that computer use is related to age groups, and that senior people who are visually challenged are far less likely to use computers. The influence of psychological concepts like a lack of confidence as a perceived barrier to computer use was another discovery. People who lacked the funds to obtain the necessary tools or training also had to forsake access (Douglas et al., 2007). Benefits like online shopping, online socializing, and information access are not available to those who abstain from computer use. People who don't use assistive software miss out on a variety of helpful features (Douglas et al., 2007).

In a study by Kouroupetroglou et al. (2008), the authors found that students with visual impairments face several challenges in accessing and using technology. These challenges include difficulties with screen reading software, navigating websites, and using specialized technology such as Braille displays. However, the authors also found that students with visual impairments can benefit greatly from technology, as it allows them to access information and participate in activities that would otherwise be inaccessible.

Similarly, a study by Burzagli et al. (2004) found that students with visual impairments face significant challenges in accessing and using technology, particularly due to the lack of accessibility features in many software applications and websites. The authors note that while some assistive technologies are available, they may not be sufficient to fully overcome the barriers faced by students with visual impairments.

In contrast, a study by Leporini and Paternò (2008) found that students with visual impairments can benefit from technology that is specifically designed to be accessible. The authors investigated the effectiveness of the Web Content Accessibility Guidelines (WCAG) 2.0 in improving the online task performance of users who are visually impaired. They found that the WCAG 2.0 guidelines were effective in improving both the usability and efficiency of the websites tested.

Overall, these studies suggest that while students with visual impairments face significant challenges in integrating technology into their studies, there are also opportunities for technology to improve their access to information and participation in activities. However, more research is needed to fully understand the experiences of students with visual impairments in using technology, and to develop effective strategies for improving their access and use of technology.

## 2.5 Improving Learning of ICT for Students with Visual Impairment

It is important for educators and course designers to ensure that all learning materials are accessible to students with visual impairment. This can include providing alternative formats for course readings, such as audio recordings and Braille documents, as well as ensuring that all visual content is described in alternative formats, such as audio descriptions or tactile graphics (Shrestha & Shrestha, 2018). Providing accessible learning materials can help ensure that students with visual impairment have equal access to course content and can participate fully in the learning process.

Provision of Assistive Technologies: Assistive technology is a critical tool for facilitating effective learning of ICT among students with visual impairment. According to Bajpai (2017), assistive technology such as screen readers, magnifiers, and Braille displays can help students with visual impairment access and navigate ICT tools and applications. Screen readers, for example, convert on-screen text into synthesized speech or Braille, allowing students with visual impairment to access and interact with digital content. Magnifiers can enlarge on-screen text and graphics, while Braille displays provide tactile feedback for students who are blind or have low vision.

Assistive technology can also help students with visual impairment collaborate with their peers and participate in group projects. For example, video conferencing tools can allow students with visual impairment to communicate with their peers and teachers in real-time, while screen sharing and remote desktop tools can enable them to participate in group projects and presentations (Bajpai, 2017).

In addition to providing access to digital content, assistive technology can also help students with visual impairment develop their ICT skills and competencies. For example, specialized software such as JAWS and NVDA can help students with visual

impairment learn how to use popular software applications such as Microsoft Office and Adobe Creative Suite (Alghamdi, 2022).

Assistive technology is an essential component of effective learning of ICT among students with visual impairment. It can help students access and interact with digital content, collaborate with their peers, and develop their ICT skills and competencies. Educators and policymakers should consider the use of assistive technology when designing and implementing ICT courses and programmes for students with visual impairment.

Provision of Accessible Learning Materials**:** Providing accessible learning materials is another important measure for improving effective learning of ICT among students with visual impairment. According to Alqurashi and Alghamdi (2019), accessible learning materials such as audio recordings and Braille documents can help students with visual impairment understand and engage with course content. Additionally, providing accessible learning materials can help students with visual impairment develop their ICT skills and competencies. Audio recordings can provide students with visual impairment with an alternative way of accessing course content, while Braille documents can provide tactile feedback for students who are blind or have low vision.

In addition to providing alternative formats for course content, accessible learning materials can also help students with visual impairment develop their ICT skills and competencies. For example, Braille documents and tactile graphics can help students with visual impairment learn how to navigate and use digital interfaces, while audio recordings can help them develop their listening and comprehension skills (Alqurashi & Alghamdi, 2019).

It is important for educators and course designers to ensure that all learning materials are accessible to students with visual impairment. This can include providing alternative formats for course readings, such as audio recordings and Braille documents, as well as ensuring that all visual content is described in alternative formats, such as audio descriptions or tactile graphics (Shrestha & Shrestha, 2018). Providing accessible learning materials can help ensure that students with visual impairment have equal access to course content and can participate fully in the learning process.

Therefore, accessible learning materials are a critical component of effective learning of ICT among students with visual impairment. They can help students' access and understand course content, develop their ICT skills and competencies, and participate fully in the learning process. Educators and course designers should consider the needs of students with visual impairment when creating and delivering learning materials.

Inclusive Teaching Practices**:** Inclusive teaching practices are also critical for improving effective learning of ICT among students with visual impairment. According to Shrestha and Shrestha (2018), inclusive teaching practices such as providing clear and concise instructions, using multisensory teaching methods, and promoting collaborative learning can help students with visual impairment engage with course content and develop their ICT skills. Additionally, inclusive teaching practices can help create a supportive and inclusive learning environment for all students**.** Providing clear and concise instructions is an important component of inclusive teaching for students with visual impairment. This can involve breaking down complex tasks into smaller steps, providing written instructions in accessible formats such as Braille or large print, and providing verbal instructions in a clear and consistent manner (Shrestha & Shrestha,

2018). Clear instructions can help students with visual impairment understand what is expected of them and can help them navigate digital interfaces and applications.

Multisensory teaching methods are also important for inclusive teaching of ICT for students with visual impairment. This can involve using audio descriptions or tactile graphics to describe visual content, providing alternative formats for course readings, and using hands-on activities to reinforce concepts and skills (Shrestha & Shrestha, 2018). Multisensory teaching methods can help students with visual impairment access and understand course content and can help them develop their ICT skills and competencies.

Promoting collaborative learning is another important component of inclusive teaching for students with visual impairment. Collaborative learning can involve group projects, peer, and other activities that encourage students tutoring to work together and learn from one another (Shrestha & Shrestha, 2018). Collaborative learning can help students with visual impairment develop their communication and social skills, as well as their ICT skills and competencies.

To conclude, inclusive teaching practices are critical for improving effective learning of ICT among students with visual impairment. Providing clear and concise instructions, using multisensory teaching methods, and promoting collaborative learning can help students with visual impairment engage with course content and develop their ICT skills and competencies. Educators and course designers should consider the needs of students with visual impairment when creating and delivering courses and should strive to create a supportive and inclusive learning environment.

Curriculum Adaptation: Adapting the ICT curriculum to meet the needs of students with visual impairment is an important measure for improving effective learning.

According to Kassahun et al. (2018), adapting the ICT curriculum to include Braille and audio-based content, as well as providing hands-on learning opportunities, can help students with visual impairment develop their ICT skills and competencies.

Including Braille and audio-based content in the ICT curriculum can help students with visual impairment access and understand course content. Braille materials can provide tactile feedback for students who are blind or have low vision, while audio-based content can provide an alternative way of accessing course content (Kassahun et al. 2018). Additionally, providing alternative formats for course content can help students with visual impairment develop their listening and comprehension skills.

Providing hands-on learning opportunities is another important component of adapting the ICT curriculum for students with visual impairment. This can involve using tactile materials or models to represent ICT concepts and tools, providing opportunities for students to explore and manipulate ICT tools and applications, and providing opportunities for students to engage in project-based learning (Kassahun et al., 2018). Hands-on learning opportunities can help students with visual impairment develop their ICT skills and competencies and can help them apply what they have learned in a real-world context.

Therefore, adapting the ICT curriculum to meet the needs of students with visual impairment is critical for improving effective learning. Including Braille and audio-based content, as well as providing hands-on learning opportunities, can help students with visual impairment access and understand course content, develop their ICT skills and competencies, and apply what they have learned in a real-world context.

In conclusion, there are various measures that can be implemented to improve effective learning of ICT among students with visual impairment. These measures include the

use of assistive technology, providing accessible learning materials, and promoting inclusive teaching practices. It is important for educators and policymakers to consider these measures in order to ensure that students with visual impairment have equal opportunities to learn and succeed in the field of ICT.

### 2.6 Summary of Literature Review

The literature review underscored the applicable literature in ICT education for students with visual impairment, empirical literature and the theoretical context. The chapter addressed the experiences of students with visual impairment in terms of computer literacy, information literacy and technology integration. Nevertheless, numerous studies in the literature provided ample evidence to indicate that through their experiences, students with visual impairments encounter multiple difficulties when it comes ICT education. Therefore, appropriate adaptations which were highlighted by other studies must be made to improve effective study of ICT for students with visual impairment. Even though there is a paucity of literature on the topic, it was evident from the available literature that studies have been conducted on the proficiency and competencies of ICT skills for the individuals who are visually impaired. However, most of these studies did not pay attention to the experiences of students with visual impairment in studying ICT. Again, from the literature, it was observed that there is some level of attention paid to the topic broadly in studies elsewhere in Asia, South American and Europe with very little information in Ghana especially in the University of Education, Winneba on the topic under study. This study therefore seeks to bridge the gaps that exist in the literature.

# CHAPTER THREE

# METHODOLOGY

## 3.0 Introduction

This chapter presents the methodology and procedures that were used to gather data to investigate the experiences of students with visual impairment in learning ICT at the University of Education, Winneba. The section covers the, research approach, research design employed for the study, the population of the study, instrumentation, transferability, dependability, confirmability, credibility, the procedure for data collection, method for data analysis, and ethical considerations.

## 3.1 Philosophical Position

The philosophy driving this study is the interpretivism paradigm. In researching the experiences of students with visual impairment in studying ICT, I chose to use the interpretivist paradigm. This paradigm is well-suited to exploring the subjective experiences of individuals and understanding the meaning they attach to those experiences (Creswell, 2013). As such, it allowed me to gain a deeper insight into the unique challenges faced by students with visual impairment in studying ICT, as well as the coping strategies they employ. The interpretive paradigm recognizes that individuals are not passive recipients of information, but active meaning-makers who construct their own realities (Denzin & Lincoln, 2018).

In the case of students with visual impairment studying ICT, it is essential to understand their experiences, perspectives, and attitudes towards the subject matter. Furthermore, the interpretive paradigm is well-suited to qualitative research methods, such as interviews, focus groups, and participant observation, which enable me to gather rich, detailed data from the participants (Denzin & Lincoln, 2018).

With this paradigm, an effort was made to "get inside the heads of the subjects being studied," so to speak, in order to comprehend and interpret what the subject is thinking or the meaning the subject is assigning to the situation (Kivunja & Kuyini, 2017). It is always attempted to understand the topic being observed from their point of view rather than the observer's point of view. Therefore, this study, in line with the interpretivist paradigm seeks to understand the subjective views of the experiences of students with visual impairment in their learning of ICT to interpret their feelings as students with the underlying impairment who are required to study a course that is mostly studied practically.

### 3.2 Research Approach

The study adopted the qualitative approach. Qualitative research approach establishes the meaning of a phenomenon from the views of participants (Creswell & Creswell, 2017). The study's use of a qualitative methodology was suitable since it focused on the lived experiences of students with visual impairment with regards to their study of computer literacy, information literacy, integrating technology into their learning and measures to improve effective study of ICT. In qualitative research, the researcher and the research subject engage within a sociocultural context (students with visual impairment) of this study (Kusi, 2012; Stake, 2010; Patton, 2015). Again, Creswel and Creswel (2018) highlighted that, in qualitative study, researchers tend to collect data in the field at the site where participants experience the issue or problem under study. By this, I had a face-to-face interaction with the participants (students with visual impairment) in their natural setting (UEW).

According to Creswell (2013), qualitative research is one that is convenient for investigating and understanding an underlying phenomenon. The experiences of students with visual impairment in studying ICT served as the study's main phenomenon. The researcher engaged the students with visual impairment in a variety of general and specific questions in order to learn more about ICT and to get a sense of their individual viewpoints. Qualitative research approach enabled me to represent the views, experiences and perspectives of the participants in a study (Yin, 2015). The students with visual impairment shared their thoughts on how they perceived the topic since the study's main focus was on their experiences in studying ICT. To obtain a thorough description of their experiences, the study consequently adopted a qualitative approach.

### 3.3 Research Design

The design that drove this study was the phenomenological design. Phenomenological research is a design in which the researcher describes the participants' lived experiences related to a phenomenon per the descriptions of the participants based on philosophy and psychology (Creswell & Creswell, 2017). This captured the essence of the experiences for a number of Students with visual impairment who have all encountered the phenomenon (learning of ICT).

In this study, students with visual impairment were given the freedom to openly discuss their experiences relating to the study of computer literacy, information literacy, integrating technology into their learning and measures to improve effective study of ICT through semi-structured interviews. Only issues concentrating on these factors in relation to students with visual impairment at UEW were subject to discussion in the study by the researcher. Creswell made emphasised that the researcher needs to

combine many techniques, including interviews and observation when conducting phenomenological research. The researcher sought to learn more about the experiences of the students with visual impairment who read ICT as a general course at UEW, hence choosing a phenomenological research design for this study.

### 3.4 Population

The population for the study was made up of fifty (50) students with visual impairment and two (2) ICT assistant instructors. The fifty students with visual impairment were from levels 200 and 300 in seven Departments namely; (Special Education, Social Studies, Political Science, History, French, English and Counselling Psychology). The two staff were also assistant ICT instructors in the University who were involved in the instruction of ICT involving students with visual impairment. The Departments listed were used because they had students with visual impairments. The level 100s were not included in this study because, they may have limited experiences in the variables under study. Again, other groups of Departments in level 100 were yet to read the course as at the time the study was conducted. Also, the level 400s were excluded in the study because, they might have faded or diminished experiences in the ICT they studied in level 100 and therefore might not be able to provide vivid and current accounts of their experiences.

### 3.5 Sample

The sample for the study was thirty-eight (38) participants. It was made up of 36 students with visual impairment comprising of seventeen (17) from the Department of Special Education, fourteen (14) from the Department of Political Science, one (1) from the Department of History and four (4) from the Department of English. The sample further comprised two ICT assistant instructors who were staff from the University. The

two were sampled because they had close interactions with students with visual impairment in the instruction of ICT lessons. The 36 students with visual impairment were sampled because they studied the general ICT in their 1st academic year, unlike some students who joined their departments in level 200 and 300 as post-diploma students. Sample size of students with visual impairment is indicated in table 1;

**Table 1: Departments of Students with Visual Impairment.**

| Department | Frequency | Percentage |
|---|---|---|
| Special Education | 17 | 47.2% |
| Political Science | 14 | 38.9% |
| English | 4 | 11.1% |
| History | 1 | 2.8% |
| **Total** | **36** | **100** |

**Source: Field Data, May 2023**

**Table 2: Class Level of Students with Visual Impairment.**

| Levels | Frequency | Percentage |
|---|---|---|
| 300 | 13 | 36.1% |
| 200 | 23 | 63.9% |
| **Total** | **36** | **100** |

Source: Field Data, May 2023

### 3.6 Sampling Technique

Sampling technique is a method of selecting a group of subjects for a study in such a way that the individuals represent the larger group from which they were selected (Yount, 2006). Heterogenous purposive sampling was used to sample students with visual impairment for the study. Mugenda and Mugenda (2003) explained that purposive sampling allows the researcher to use cases and characteristics that have the required information concerning the objectives of the study. Fraenkel and Wallen (2009) also explained that the purposive sampling technique is a technique in which

researcher use their judgement to select a sample that they believe, based on prior information, will provide the data they need. The sample was selected based on students with visual impairment who were in level 200 and 300 and have read the general ICT course in their first year of study. I purposefully selected the sample by going through the records of students with visual impairment at the Resource Centre for Students with Special Needs to identify students who were admitted as post-diploma students. I followed up to give each of them a phone call to confirm whether they read the general ICT course or not. The rest were purposefully sampled because the students with visual impairment from the departments in Table 1 had taken ICT as a general course in either the first or second semester in their first year of study. Also, students who had not returned from vacation as at the time the data was collected were excluded from the study. The selected sample provided me with their recent experiences they have had from their study of ICT in UEW and how they were incorporating it in their learning with the experiences that comes with the incorporation. Since the purpose of the study was to explore the experiences of students with visual impairment in studying ICT, the participants were sampled based on heterogeneity or maximum variation because participants represented different characteristics, perspectives, or variations relevant to the research question or objectives. In heterogeneous purposive sampling, researchers seek out participants who possess a wide array of attributes, experiences, or viewpoints, in order to capture the complexity and diversity of the phenomenon under investigation. (Robinson, 2014). Participants had different levels of vision, encountered their impairment at different times in life, were from different departments and academic levels.

## 3.7 Instrumentation

### 3.7.1 Semi-structured Interview Guide

Data for the study was collected from the participants using a semi-structured interview guide. Semi-structured interview was employed for data collection in order to prevent participants from deviating from the study's focus (Nieuwenhuis, 2007). Interviews are one of the primary methods for gathering data in qualitative (Fraenkel & Wallen, 2009). A qualitative interview employs the researcher as a dynamic instrument of data collection (Merriam, 2002) to make meaning of the participants' reality and perceptions regarding a specific social phenomenon.

The semi-structured interview was administered to two of the participants who were ICT assistant instructors. It was administered to them individually to find out measures they suggest to effective study of ICT for the students with visual impairment. One of the pitfalls of semi-structured interviews is that a researcher might get sidetracked by the conversation (Nieuwenhuis, 2007). However, a clear set of guiding questions and researcher attentiveness aided the researcher in addressing this challenge. An adaptation of a set of questions used by Douglas et al. (2007) and Grobler (2014), due to their relevance, served as guidelines for this research investigation.

### 3.7.2 Focus group interview guide

According to Krueger and Casey (2000), focus group interviews are group interviews that aim to comprehend the thoughts and feelings of participants about the research topic. This method allows for collaborative feedback and brainstorming, which can result in more comprehensive data being collected (Delport & Fouche, 2002). In this study, the researcher used a focus group discussion to extract rich data from participants who were group based on their degree of impairment. Creswell (2009) and

Nieuwenhuis (2007c) cautioned against potential bias that may result from mediation during focus groups. The researcher used semi-structured interviews for the focus group discussions. Focus groups were used by the researcher because they stimulate participation and allow for the collection of a range of participants' viewpoints, allowing for the creation of a collective rather than an individual interpretation of a phenomenon (Bogdan & Biklen, 2007; Cohen et al., 2007).

The researcher used mediation and coordination skills to prevent some participants from dominating the discussion (Greef, 2002). According to O'Donoghue (2007), a focus group interview guide is a face-to-face discussion between a researcher and a group of participants with the goal of learning about the participants' perspectives on their lives, experiences, or circumstances as expressed in their own words on the key variables raised in each of the research questions. The researcher guided the conversation to ensure equal opportunities for participation and assumed.

The focus group interview guide was made up of four sections (refer to Appendix A). The four sections emphasized the research questions. Part 1 was primarily concerned with the learning experiences of students with visual impairment in computer literacy. Part 2 was on students' with visual impairment experiences in learning Information literacy skills. Part 3 concentrated on the experiences of students with visual impairment in technology integration in learning and finally the Part 4 focused on measures to improve effective learning of ICT for students with visual impairment. Each of the four sections had a major question item which asked about their respective research questions. Under the major questions were sub questions that sought to get the students to give their insights more on the research questions. I used probes and prompts during the interviews to help me further explore my line of questioning. The probes and

prompts assisted in exploring and shaping the participants' opinions and helped keep them on-topic (Rodgers, 1999). The topics brought up by the research questions served as a guide for the interview questions.

### 3.7.3 Observation guide

Observation is a valuable qualitative instrument employed in data collection across various research domains. It involves systematically watching and recording behaviours, events, or interactions as they naturally occur in their context, without direct interference (Denzin, 2017). In this study, observation was used to complement the other qualitative data from the interviews, by providing additional context and validation of the findings (Patton, 2002).

The observation exercise was an overt-active participant observation kind. This is where the researcher takes part in the participant's activities, while they know they are being understudied for research (Williams, 2022). An observation checklist adapted from a designed list from the Perkins School for the Blind to determine the basic ICT skills of students with visual impairment was used. The researcher gave series of tasks for them to complete. The researcher observed with the checklist as a guide whiles the students with visual impairment executed those tasks.

## 3.8 Trustworthiness

Trustworthiness is used to describe four criteria for judging qualitative research. They are; credibility, transferability, confirmability and dependability (Yeh & Inman, 2007).

### 3.8.1 Credibility

Credibility refers to the extent to which the findings are believable and trustworthy. It is one of the four criteria of trustworthiness, which are used to evaluate the quality and rigour of qualitative research (Shenton, 2004). Credibility demands that the research

findings accurately reflect the participants' experiences and perspectives, rather than being influenced by the researcher's biases or preconceptions. To achieve credibility, qualitative researchers use various techniques to ensure that the data are trustworthy and accurate. These techniques include prolonged engagement with the participants, member checking, peer debriefing, and triangulation (Creswell, 2013)

The themes that emerged from the data were discussed with a professional in the field of blind and ICT education. Transcripts from the data were made available to the participants to confirm whether transcriptions accurately reflect their views. The process of peer review included colleagues reviewing some of the audio tapes and assessing whether or not the findings were consistent with the data. This process also helped to ensure the soundness of the findings. Also, videos of the forum interviews in addition to the audios were captured in order to ensure credibility of the study. Again, an observation was done in combination with interviews to enhance the validity and reliability (triangulation) of the findings.

### 3.8.2 Transferability

According to Shenton (2004), transferability has to do with applicability. The purpose of providing a detailed account of the participants and the processes of the study, or "thick description," is to allow the reader to determine if the findings are applicable to their own context. This is known as the "transferability judgement," I described each individual in this study who is blind or has vision impairment in great detail, as well as the inclusion and exclusion criteria that were applied to choose the participants. A thorough description of the research area and the procedure for data collection as well as analysis of the study results were described to ensure transferability.

### 3.8.3 Dependability

Shenton (2004) explained dependability as consistency and the smoothness of processes, results, and their interpretations. To ensure dependability of the study, I chose the research design (phenomenology) that allowed participants to provide their own personal lived experiences of the research phenomenon (studying ICT in UEW as a general course). To gather information from participants, the researcher employed literature-based interview questions that were related to the research questions. The researcher had the opportunity to modify all the interview questions before it was administered because the interview items were offered in a forum.

### 3.8.4 Confirmability

Confirmability describes how impartial the researcher is in order to prevent biases. Confirmability is a problem when conducting qualitative research in a field the researcher is familiar with (Creswell, 2007). For four years, I have worked with students with visual impairment hence, before and during the data collection process, I clearly identified my role and explained the purpose of the study to participants in order to promote confirmability, gain their trust, and gain their willingness to support my role as the researcher.

## 3.9 Procedure for Data Collection

Permission and Communication: Permission was sought from the Coordinator for the Resource Centre for Students with Special Needs, University of Education, Winneba, prior to the conduction of the interviews. Permission was also obtained from the students with visual impairments. According to Creswell (2012), it is important to respect the research site, and this respect is demonstrated by obtaining permission before entering the site. A letter of introduction from the Head of the Department of

Special Education at the University of Education, Winneba, was used to obtain permission to the site (refer to Appendix C). After obtaining the approval of the study's primary stakeholders, I placed a phone call to students with visual impairment to have an informal introduction of the study to them and to seek for their assurance to be available and part of the study. This informal introduction was made during the vacation for the first semester of the 2022/2023 academic year, thus, a week to the reopening of the second semester. I got the assurance of some students although others informed me of their intention to delay in returning to school which automatically got them excluded from the study. This was because, I planned to use two weeks for data collection. I arranged with students and agreed on the times for the forum discussions which were mostly done after their lectures.

Interview Schedule and Group Formation: For all the groups, it was agreed on to hold the group discussions at the resource ICT lab for the students with special needs since they were more comfortable and used to that setting. Seven focus groups were formed based on student's academic levels and level of visual impairment. Four (4) groups were formed from students with low vision consisting of five members each in three groups and the other group with six members. Three (3) groups were formed from students who are blind with five members each in a group.

Focus Groups Interview Process: The focus group interviews took place during free period mostly after their lectures. I presented each group with braille and large printed copies of the interview consent form (refer to Appendix D) of which I read through with them and the thumb-printed and signed. Each forum section lasted for averagely 35 minutes. I sought for each groups' permission to interview them and had the permit accordingly. I used my phone as a recorder and a colleague's phone as back up.

One-on-one Interview Process: The two staff were interviewed individually. I gave them phone calls to inform them about my intention to include them in my study and sought for their consent and then made arrangements to have a face-to-face interaction with them.

Staff 1's interview was held at his office. The interview took about 8 minutes long. I took notes of his responses since he did not permit me to record the interaction. Staff 2's interview was also held at his office. His interview took about 10 minutes long. I recorded the interview with my phone. For the sake of validity, both staff were asked to give accounts on what goes on at the lecture hall in connection to teaching students with visual impairment ICT and some complains they received from them with the intention of getting a confirmation of the student's experiences. They also suggested various measures to improve upon the effective study of the course.

The data collection process lasted two weeks as planned, despite the challenges it presented.

Observation Data Collection: To ensure triangulation, an observation was conducted using a checklist (refer to Appendix B) adapted from an assessment checklist designed by the Perkins School for the Blind in determining the ICT skills of students with visual impairment. Data was collected through observation for students with visual impairment who through the interviews, noted that they own and use computers for most of their academic tasks. Sixteen students in total were selected for the observation exercise. This exercise was held at a different day from the interview day. The students who had their personal computers came along with them while the others worked with the computers at the resource centre. Since I used the overt-active participant observation kind, I was involved in the participant's activities, while they were made

aware of being understudied for research. The observation was mainly to ascertain the computer literacy skills students have and how they interact with the technology devices and software applications.

### 3.10 Ethical Consideration

Research ethics educates and monitor researchers conducting a study to ensure a high ethical standard.

Informed Consent: I sought consent from staff and students with visual impairment under study through a consent form (refer to Appendix D) that was present in braille and large prints before collecting the data (Resnik, 2010). The researcher fully informed the participants about the purpose of the research. I sought the permission of the students and staff to record their responses during the interview.

Confidentiality and Anonymity: Stringent measures were taken to ensure anonymity and confidentiality, safeguarding the participants' privacy. Participants' details such as names and addresses were substituted with codes or pseudonyms throughout the study. The researcher took steps to ensure that recorded information, data collection tools, and research outcomes were devoid of any identifiable participants' data. Exclusive access to the recorded data was granted solely to the research team, who diligently implemented stringent measures to maintain participants' confidentiality.

Voluntary Participation: The participants were given assurance that their involvement in the study was entirely voluntary, and they retained the right to withdraw at any time without encountering any adverse outcomes. The researcher underscored the significance of ensuring participants' comfort and welfare throughout the research journey.

Data Storage and Protection: All audio recordings of the interviews were securely stored in a dedicated recorder and subsequently transferred to my google drive of which only the researcher could access. The data remained exclusively accessible to the research team and was maintained in strict confidentiality throughout the duration of the study. Comprehensive precautions were implemented to avert any unauthorized entry, potential loss, or inadvertent disclosure of the data.

### 3.11 Data Analysis

Data was analyzed using deductive thematic analysis which involves the systematic identification and analysis of recurring themes or patterns within qualitative data, guided by pre-existing theoretical frameworks or concepts (Braun & Clarke, 2015). Nowell et al. (2017) stated that using this method, researchers start with a set of predefined themes which serve as a foundation for analyzing the data. I started the analysis by thoroughly reading and becoming familiar with the qualitative data, such as interview transcripts, notes and observation data. By using my research questions as predefined themes, I systematically assigned codes to the relevant sections of the data. These involved marking or highlighting text segments that correspond to each theme. I divided the data into manageable segments or chunks, such as paragraphs, sentences, or phrases, that corresponded to the coded themes. I organized the coded segments into groups based on the predefined themes. This process helped me to identify patterns, similarities, and variations within each theme. I then reviewed and refine the predefined themes by examining the data within each theme to ensure that the themes accurately captured the content and meaning of the data. (Braun & Clarke, 2020).

# CHAPTER FOUR

# PRESENTATION AND ANALYSIS OF FINDINGS

## 4.0 Introduction

This chapter presents the results and analyses of findings from the study. The analyses reflected on the themes that emerged from the interview data collected on the themes of the research questions.

## 4.1 Demographic Information of Respondents

The study was carried out at the University of Education, Winneba, main campus, with a sample size of 38. Two (2) staff and thirty-six (36) students with visual impairment.

**Table 3: Class Level of Students with Visual Impairment.**

| Levels | Frequency | Percentage |
|---|---|---|
| 300 | 13 | 36.1% |
| 200 | 23 | 63.9% |
| **Total** | **36** | **100** |

Source: Field Data, May 2023

Table 3 shows the levels of students with visual impairment used for the study. They were from level 200 and 300 with 12 students from level 300 representing 34.3% and 23 students from level 200 representing 65.7%. This shows that there was a higher number of students with visual impairment in level 200 than level 300 in this study,

### 4.1.2 Level of Visual Impairment

Data was collected on the type of visual impairment of the students with visual impairment.

The result is shown in Table 4.

**Table 4: Students' Level of Visual Impairment**

| Levels of impairment | Frequency | Percentage |
|---|---|---|
| Low vision | 21 | 58.3% |
| Blind | 15 | 41.7% |
| **Total** | **36** | **100** |

Source: Field Data, May 2023

From Table 4, it was revealed that 21 (58.3%) out of the 36 students had low vision and 15 (41.7%) were blind. Those with low vision included students with moderate to severe visual impairment whiles those with blindness included students with no light perception. This indicates that the majority of the respondents had low vision.

### 4.1.3 Time of Onset of Visual Impairment

Data was collected on the visual impairment of the students based on the time of onset. From the analysis, it was found that 24 (66.7%%) out of the 36 students which represents the majority had the visual impairment after birth (adventitious) and 12 (33.3%), had the visual impairment from birth (congenital). The result is presented in Table 5:

**Table 5: Time of Onset of Visual Impairment**

| Time of Onset | Frequency | Percentage |
|---|---|---|
| Adventitious | 24 | 66.7% |
| Congenital | 12 | 33.3% |
| **Total** | **36** | **100** |

Source: Field Data, May 2023

**Table 6: Distribution for Staff by Years of Service**

| Staff | Years of Service |
|---|---|
| Staff 1 | 3 |
| Staff 2 | 5 |

Source: Field Data, May 2023

Table 6 indicates the number of years the staff included in this study have served in their outfit as ICT instructors. Staff 1 indicated that he has been in service for 3years whiles Staff 2 has also been in service for 5years.

**RQ. 1. What are the experiences of students with visual impairment in learning computer literacy skills at UEW?**

Five themes emerged from research question one. The themes were; knowledge and use of basic computer skills, experiences with internet and web browsing, interaction with software applications, experiences in practical sessions and assessment and collaboration with peers in computer use.

**Knowledge and Use of Basic Computer Skills**

This includes learning how to navigate a computer's operating system, understanding file management, using a keyboard and mouse, and performing basic tasks such as creating, saving, and deleting files. The students shared their experiences regarding their knowledge in basic computer skills and their ability to use the skills. They revealed;

> *Normally, because of technology advancement such as the NVDA. It helps us a lot to locate where the system keys are. And before that, we are being taught in the lecture hall or I mean by the lecturer and how to operate and how to manipulate with the keys so that you will be able to do with it. And sometimes normally, we have to get assistance because sometimes you don't know the keys cos of the impairment, it makes it very slow or for instance if you need to manipulate with the timetable so sometimes our friends also help with it. But as for using the phone, it is very easy because of the voiceover on it, I can use it to go to the internet, download and read documents, receive information on it without any assistance.* (Student from group 2).

> *I use it very often, although I can say that I'm very poor in it. Because pertaining to all the aspects either typing, using the Microsoft Word, Excel and others I am not that good at them although I try my best to use it to read documents, slides when it comes to using the word to draw tables, and powerpoint for presentations, I really struggle. Even though I do try my best but very poor so at times unless I my sighted colleagues*

*assist me. But the little skills I have assists me a lot because that is what I use even in reading my slides.* (Student from group 7).

*The IT assistant took us through how to open and work with Microsoft word, how to create a new folder. So we use the keyboard shortcuts to open the file explorer, and if let's say I have received a document on pendrive then I open the location and copy and paste.* (Student from group 4).

*The IT person at the resource centre taught us how to located each key on the keyboard, how to identify each keys on the keyboard and how to combine them to make words and sentences. I use the JAWS and the NVDA to manoeuvre through the computer, he taught us a lot of shortcuts and how to use them too.* (Student from group 5).

*By the help of the NVDA, it also helps us a lot to access the phone and the computer. But it's not all that easy to access the computer as compared to the phone. Navigating through the phone is easier than navigating through the laptop or the computer. Because of the system keyboard on the computer or the laptop. And then let me say, the instructions or the things you have to use, let's say you have to memorize a whole lot of shortcuts before you can go use it. So it makes that a bit challenging.* (Student from group 6).

*Through what I learnt at lectures, I know how to navigate through the computer to read books. So you go to the start menu, then you go to this PC, then you go to where the books are located, whether desktop or document, then you enter, then you use the down arrow to locate the book that you want to read. Then when you see it, then you enter, then you press the down arrow. If you want it to read one by one, it will read to you. So I've benefited a lot from it.* (Student from group 4).

Comments from the students revealed that, with the help of the voice reader software on the phones and computers, students with visual impairment were able to use some basic computer skills such as, booting and logging into a computer, creating folders, saving their files and documents. However, it was observed from their comments that, some did not have much confidence in the computer skills they have acquired hence, they relied on the assistance of their sighted colleagues to complete some tasks. Also, it was clear that, they found it easier accessing and using their mobile phones as compared to the computer. They revealed concerns about difficulties in navigating their ways through the computer keyboard due to their impairment. Therefore, it made the

completion of tasks very slow. Generally, the students had basic computer skills that at least assisted them in their academic and social life. However, majority had limited skills of which they associated to their impairment. It was also noted that, students with blindness and those with low vision had similar experiences in the knowledge of basic computer skills, although students with low vision had a little advantage over their blind colleagues when there was no speech software. They could rely of their residual vision.

**Analysis of Data from Observation on Knowledge and Use of Basic Computer Skills**

The observation exercise included sixteen students with visual impairment. The observation checklist had items in determining the knowledge of basic computer skills. All students were capable of booting their computer and putting their monitors on with the help of the speech software. However, after putting on the computer, majority asked me to confirm whether the computers were on.

Keyboarding and Typing: Eight students (50%) out of sixteen were able to locate keys captured in the checklist appropriately. They were capable of combining the keys in typing accurately albeit being a little slow. The others mainly located only the navigation keys which they used to read and go through documents and files. They could not locate a number of keys to enable them to type accurately.

Working with Files, Folders and Documents: Seven of the students (43.8%) were capable of using hot keys and keyboard shortcuts to open files, folders, documents and interact well with the computer to issue and execute commands accurately. They were able to save files and documents, copy and paste, launch programmes, run and work with multiple applications simultaneously. However, it is important to note that the students intermittently asked for confirmation of correct arrangement of texts,

documents and also if outcomes were correct per the commands they entered. The rest of the nine students (56.3%) could not exhibit these skills appropriately. They asked for assistance frequently. Majority of them just used the navigation keys for reading documents. Also, majority of the students with visual impairment were able to close programmes and shut down computers properly.

**Experiences with Internet and Web Browsing**

Students with visual impairment shared their experiences with internet usage and social media. Experience with internet usage involves connecting to the internet, using web browsers to access websites, conducting online searches and navigating websites. Also, their experience using social media platforms like Facebook, Twitter, Instagram, LinkedIn, and others for socializing, networking, and sharing information with others. The students revealed;

> *I use NVDA and JAWS for the computer. Whether you are using Google, you are using Opera Mini and others, you just go and then type or key in the information you need. And with the easy way of sliding through the screen, you go through and then check and then see that maybe the content you are looking for. And after seeing the content, If only you want to download, you get the PDF aspect of that, then you download. But if you just want to just read and then get an information, you just read it. Some diagrams, images and pdf that the JAWS cannot read, I usually zoom it and with my little vision, I manage. But comparing the phone to the computer, the phone is very very easy.* (Student from group 1).

> *I use my phone to access the Internet. Normally, you have to, put on your data before you can go to the Internet. And actually, you have to get a good network connection meanwhile sometimes the network is not as stable like that. Also, by the help of the assistive device or the system software which has been provided on the phones, it helps us a lot to access the Internet with the phone. At times too, you have to call someone who is sighted for them to help you. If it is video you want to go and get help to understand something, you can easily get access to it.* (Student from group 5).

> *I don't use a smartphone so I use my phone to listen to music and calls.* (Student from group 6).

> *Most times I don't hear and understand the speech well so I let my sighted colleagues help me in using the internet.* (Student from group 7)

> *When I go to the websites and I'm reading something and I find it interesting, I screenshot and I later do more of the research on it. I screenshot and I later do more of the research on it. Sometimes when I go to platforms on WhatsApp, telegrams and other things like that, yes, that's what I do.* (Student from group 3).

The students with visual impairment commented on their experiences on internet, websites and social media. Their comments indicated that, with the use of the JAWS, NVDA and other software on their phones and laptops, they could navigate their ways through some websites they noted. They used them for their academic tasks by looking for information and keeping the relevant information they come across. They were also able to interact socially on various social media platforms as well. Majority of students who used the internet and web browsing were those with low vision and those who acquired their impairment later in life. They were more confident in using their devices and also had other magnifying alternatives when the speech application failed. Meanwhile, majority of the students with blindness noted that, they depended on their sighted colleagues to conduct searches on the internet.

**Analysis of Data from Observation on Internet and Web Browsing**

Using the computer to open browsers to conduct a search, it was observed that few students with visual impairment were able to use the computer for that purpose. Only three students (18.8%) out of the sixteen could open the internet browser, navigate to a given URL, navigate between open tabs, open and navigate browser history, conduct basic search and navigate for images, diagrams and tables, download files appropriately from internet and websites using their computers. However, majority of the rest could

use their mobile phones to perform same commands and tasks with internet and websites.

**Interaction with Software Applications**

Interacting with various software applications is a significant aspect of computer literacy. This involves using word processors, spreadsheets, presentation software, email clients, media players, and other productivity tools.

> *Because you are not using your eyes to read, it's a bit difficult because the voice, when you are looking for something, it takes time before you get the meaning. But when the sighted people, they are looking for something, maybe just one minute, then you get the thing, but when you are using the voice. It takes time. Yes, a lot of time. And It doesn't give you the clear pronunciation of the words. Even the spelling of that word is difficult. So mostly it limits you in getting rich information.* (Student from group 4)

> *Actually, it's not easy for us. When they give us something like the Excel and PowerPoint, because already they will project something while our sighted colleagues will be following the procedures. We are visually impaired, we can't see far from the projector to be doing that. So normally when it comes to doing it myself, I actually struggle in.* (Student from group 3).

> *I can manage to type using Ms Word but mostly, my challenge is the editing. So, there are always mistakes. As for tables, excel and powerpoint, I am very poor in that.* (Student from group 6).

> *So the last time I can remember, I sent my machine to the lecture and I proved to him that I can merge a cell. So he was like, are you sure? I said yeah. So after that I just select the cell, the number of cells that I want to merge and I press on Alt H. And after pressing on Alt H it will move me to the upper ribbons. So my machine will assist me and would alert me that I'm at the upper ribbons. So after that, I'll press on MC. The MC means merge cell. After selection, you press on the MC and you click on enter. So he was like, ah, so who taught you all these? And I told him that maybe if you get an assistance and if you get someone who understands and knows how to use the software, which is the JAWs, we can do everything as you sighted can.* (Student from group 1).

Comments from the students highlighted their experiences in using basic software applications as far as computer literacy is concerned. It was clear that, they had challenges in accessing and using the software applications due to its complexity.

Therefore, they had to depend on their sighted colleagues to manoeuvre their ways through them. Aside all their challenges, they managed to use the software applications for their academic tasks.

**Analysis of Data from Observation on Interaction with Software Application**

Word Processing: Majority of students with visual impairment could open and navigate documents using arrow keys, select texts, copy/cut/paste characters/words/paragraphs from documents and navigate to the beginning or end of a document. They were able to read through documents with the help of the navigation keys, use word suggestions, save documents, open new documents and alternate among multiple documents. Meanwhile, only a few of them were able to utilize the title, menu and tool bars to edit and format documents.

PowerPoint: Majority of students with visual impairment were able to open powerpoint files and read through them using the navigation keys by the aid of voice applications. However, all students could not create or design presentations using the features of the application. They struggled with locating slides with their customized themes (title and content) and assigning texts to their respective placeholders and editing them.

Excel: Students with visual impairment could not utilize the features of the application. They did not understand majority of the tools and features of the application hence not use the application. Therefore, from the observation of the students, it was noted that, majority of the students with visual impairment had skills and command over Microsoft Word in typing, numbering, navigating through menu options and using them, saving documents, copy/cut and pasting. However, they lacked skills in other applications such as powerpoint and excel. They were unable to work with the application to achieve any outcomes.

**Experiences with Practical Sessions and Assessment**

Under this theme, participants shared their experiences on how practical sessions and assessment in computer literacy was held. Students with visual impairment exposed different ways they experienced these sessions. The students encountered difficulties in participating fully in practical lessons due to the visual impairments. This led to referrals to the resource centre for alternative assignments and adjustments in exams. The students had this to say;

> *The practical side, that is where the problem lies. That is why the lecturer informed us that for him, he said, he can't do anything to help us. So we came to the resource, for one resource IT assistant for him to conduct the practicals for us so that we can submit it to them, for them to also assess us. But it couldn't come on. So what they did was, we came to take question, I mean the theory aspect, and we took that theory aspect and they submitted it to the lecturer himself.* (Student from group 2).

A student also revealed;

> *For the practical side hmm, we didn't take part, but it was the resource IT assistant who made us do oral questions that he asked us. And also he gave us the laptop for us to create a folder. So when we created the folder, then after that he gave us an assignment to do. That was for the mid-semester exams. For exams, the practical, we didn't do it at all. We only did oral question and answers. And it didn't help us to gain any practical skill at all.* (Student from group 2).

Another reported;

> *For me, even though I tried during the practicals sessions in class, but for assignments, because of how the practicals was held, it wasn't favourable to us the visually impaired. So we couldn't do it. So actually we reported to the lecturer as well. And he said we shouldn't worry and that, he knows what to do. And I did the theory aspects, leaving the practical aspect and we were sorted out.* (Student from group 5).

The views from the students made it obvious that, lectures excluded students with visual impairment from the ICT practical sessions which in turn affected their grades and assessments. Additionally, it was indicated that, some lecturers had limited skills in

teaching or guiding students with visual impairment in the practical sessions so, they relieved such responsibilities and duties to the resource centre or used oral and theory tests to substitute for the practical sessions, assignments and examination. In the long run, the students were unable to acquire any skill from the computer literacy class as their sighted colleagues acquired.

Another student elaborated on how the practical sessions were held and how it benefitted the sighted than the students who are visually impaired. He noted that;

> *Our inability to cope with the lectures was because, for the sighted, they use the mouse. Whenever they are doing everything, they use the mouse. But we as visually impaired, we can't even use the mouse but the keyboard. So, therefore, even though I created the awareness of the lecturer that, when he's given the direction, he should get the shortcuts. Meanwhile he just mentions, click on this while we are using the keyboard.* (Student from group 7).

The experiences of the students were confirmed by Staff 1 when he gave his views on how practical sessions were held. He had this to say;

> *Our major challenge is the practical session. Practical sessions carry a bigger part of the ICT course and here is the case they can't see and respond to some practical instructions. Also, the computers we have here at the lab are not adapted enough to suit such students. They do not have the software that can assist them. Another factor is that, we use the mouse most at times and the use the keyboard so it conflicts with the instructions because I may say click on this and that but how will they also follow with those particular instructions.*

These comments confirmed how proper measures were not put in place to cater for the academic needs of students with visual impairment when it came to the study of ICT. When students with visual impairment were referred to the resource centre for separate lectures, it in turn breached the inclusivity hallmark of the University. By those measures, they seem to be encouraging segregation rather than inclusion.

**Collaboration with Peers in Computer use**

Under this theme, students with visual impairment expressed their experiences with the support and collaboration they received from their sighted course mates. This seemed crucial in facilitating the learning process for the students with visual impairment. Concerning collaboration and support from their sighted classmates, they revealed that;

> *Our sighted colleagues come to us and help us. So they normally assist us in using the computers a lot. Sometimes, even if you are sitting there, maybe you can't reach a certain point whereby you may need their help. For instance, go to minimize or go to maximize or use the toolbar to locate where the arrow point is. So maybe because they are using the mouse and we are using the keyboard, he will help us with the mouse to locate things on the computer.* (Student from group 2).

> *The sighted colleagues, they used to assist me in class. They don't tell me to do this or do that. So after the class you have no skill to take home.* (Student from group 5).

> *For our colleagues, for instance, when the lecturer asked us to, draw a timetable, or something like that and if our colleagues realize that we are not participating, they try to get close and also try and do it for us or teach us how to go about it. But they use the mouse a lot and because we cannot see and use the mouse, we use shortcuts. At the end, although they are trying to help us but we don't get any skill.* (Student from group 6).

> *Actually, when I go to the ICT class, there is no sighted colleague who is seated close to me. We always sit in front and we will be struggling.* (Student from group 4).

The responses indicated that, in class they had support from their colleagues if only they happened to sit closer to them. However, some students with visual impairment were not too happy with the kind of support their sighted colleagues gave to them as they did all activities for them without giving them the needed guidance, assistance and chance to also practice. Additionally, due to the fact that their colleagues were not really trained on how to appropriately assist or guide them in such sessions, they resulted to

how best they thought they could help their colleagues who were visually impaired. So, it did not really help them to acquire any skill in class since they did not follow the practical instructions on their own through guidance.

**R.Q. 2. What are the experiences of students with visual impairment in learning information literacy skills at UEW?**

This research question sought to explore the experiences of the participants in learning information literacy skill at UEW. Four themes emerged from the data gathered. They were; use of technology for information access, ability to evaluate and select relevant information, collaboration and support from peers in information access, experiences in accessing information on websites and libraries

**Use of technology for information access**

Under this theme, the participants noted that, they relied on various technologies such as phones, laptops, and software like Talkback and Voiceover to access information from sources like Google, websites, WhatsApp, and social media platforms. These assistive technologies enabled them do their assignments, research and other academic related tasks. They depended on them in order to use their phones and computers. By the use of these technologies, they were at par with their sighted colleagues in their academic progress rather than handicapped and dependent. Below are some of their comments;

> *Some of us, we use our phone to search. So if you use your phone to search for the question, then you can be scrolling through. After getting the concept, you can start with your typing too as well.* (Student from group 1).

> *Those applications like G-Show Plus and others. The G-Show Plus is an app that helps with your navigation through the internet. It is like the TalkBack but it is more advanced. It reads diagrams and others, even links and what the Google TalkBack cannot do, that one does it. With*

*that, I do get a lot of information through the Internet.* (Student from group 5).

*I use NVDA and JAWS for the computer. Depending on the website you want to go. If you just go and then click at the website, whether you are using Google, you are using Opera Mini and others, you just go and then type or key in the information you needed. If I found any digital information on the website or any WhatsApp or Facebook or Twitter or I mean TikTok or whatever site If only you want to download, you get the PDF aspect of that, then you download. But if you just want to just read and then get an information, you just read it. But comparing the phone to the computer, the phone is very very easy.* (Student from group 2).

*So depending on the kind of information I'm searching for, I normally use, the Google Chrome, the Phoenix, the Opera Mini to search or research for whatever I may be in need online or on the internet. I am very comfortable with the phone.* (Student from group 4).

Similarly, an individual with low vision depended on their phone's magnification feature in order to read through documents to get information. The student opined;

*With the help of magnification, I can use the phone. I need to magnify the size of the text. Then I'll be able to manoeuvre through. Also, when I have to read PDFs, I use InstaReader. It reads PDFs and all that. So it makes it very easy to use them.* (Student from group 3).

**Ability to evaluate and select relevant information**

The students discussed the process of evaluating and selecting relevant information from search results, using references, and relying on reliable sources for accurate and meaningful content. They stated;

*If I read and I see it goes in line with the question. And since you already have knowledge about what you are searching for, your knowledge will tell you that what you are reading is not what you need. If It's not in line, then you Google on another one, then it will read to you. Then the one that you want, you just land on it or use it.* (Student from group 5).

*When my friends help me in getting the information, I ask where he has gotten the search from, which site? Then she will explain and if you see it's in line, then you add it to the work if not then you know that's wrong. Then you have to look for someone else to come and read a different*

*thing too. Then you compare before you get the right answer.* (Student from group 1).

*You have to read, go through the material and see which topic is linked to what you've been taught and you settle on that information. If you search then when you go through, you by all means see or find the one which will link with the question.* (Student from group 4).

*Normally, let me say for example, a topic like, they can ask you what is government, you can search what is government, but different meaning and explanations will pop up. But as you have been assigned to search for the meaning of government, you can find the first example as government as an institution of state. Another example to also tell you that government also inspires all the terms of government. So you see that one is more relevant than the other. Actually, when you see that something is relevant, you will know that that thing is relevant for you to use it. Also, we have references when you go and then you check the author, because there are some sites you can't really get any proper reference.* (Student from group 2).

*Lecturers help us by telling us the website to go to, for example; search for let's say Shakespeare's background, he or she, sometimes even give the kind of author too. So sometimes they do help us out by giving us a very good resource in order not to stress ourselves much.* (Student from group 5).

*Actually, we get to know that by maybe the introduction they will give before the content, because before you get a PDF or something of that sort, they may have given you the source of the material. So the source will determine that this isn't a reliable one. So you get the source that is reliable and then go for your information there.* (Student from group 3).

The responses indicated that, students were confident in getting valid and authentic information for their academic works through their friends, references from lecture notes, reference from lecturers and prior knowledge of the particular information they were searching for.

**Collaboration and support from peers in information access**

The participants revealed that, they sought assistance from friends, colleagues, and resource persons to access and understand information. They engaged in group study,

received help with assignments, and relied on others to upload or access materials on online platforms.

Below were some of their comments;

> *Using the phone is sometimes slow and it makes doing your work keep very long so my sighted colleagues search for me, then I will now be typing. I type them inside the computer, and I go and print.* (Student from group 1).

> *Normally, when they give us assignments, we give it to our sighted colleague to do the research for us. Sometimes too I go to them and we do it together. Like I will be sitting and they will be asking me questions, they will Google it, then we will do it. They will read the answers so you know which one is good and which one is not good.* (Student from group 6).

> *When we are being given research assignment or we need course materials, we go to the resource centre, the resource persons also help us to get more information.* (Student from group 4).

> *The Vclass site was a complicated one that which you can go there easy to download copies. Unless you let a friend of yours to download the slides which has been uploaded. Where there are diagrams and images, at times we have to call on our sighted colleagues to help us in describing what is there.* (Student from group 2).

> *Because I don't have a smart phone, my friends who are sighted do it for me so I don't even go to the internet myself.* (Student from group 5).

The results explained the support and collaboration students with visual impairment get from their friend, sighted colleagues and the resource centre in terms of getting information for their academic work.

Students with visual impaired shared their thoughts, feelings and what they went through in learning information literacy skill and how their experience with the use of the skill in their academic work. In getting information, they relied on ICT resources, technologies as well as support from their colleagues in completing academic tasks.

Even though access to these resources came with their own limitations, they managed to utilized it to achieve their academic success.

**Experiences in accessing information on websites and libraries**

Participants were asked how they access information on the websites as it was a medium of which forums and lecture notes were uploaded. They noted that they faced challenges related to network connectivity, slow typing speed, complex apps and websites, poor image description and inaccessible websites. They revealed;

> *As you are using the talkback, sometimes the typing is very slow. And the V-class, if you are not fast, there is time on it. So, if you are doing it and your phone is disturbing you, sometimes if you want to type P, then nyour hand will be on maybe A or after deleting and doing those things, the time will be up.* (Student from group 4).

> *Some sites will just give you raw explanation to whatever you search for, for instance, if there is an image, and with the speech on the computer, it can't describe the image that is pasted on the site. It will just say that 'image'. So you don't even know the kind of image they put there but for those who have sight, they just know how to go by it. So sometimes you need to call for assistance.* (Student from group 1).

> *Some of the websites are very complex in nature so assuming when you log in, the JAWS or the TalkBack cannot describe everything that is in there, it cannot describe how some pictures and diagrams look like so honestly I get frustrated sometimes when I come across such instances. Because sometimes you are really in need of information for an assignment or presentation and you can't get anything. Some website too will not also permit the talkback to even access the pdf too.* (Student from group 7)

The responses showed that, some students lacked some skills to be able to navigate their way through the websites, therefore resulted not to use it at all, while others depended on their sighted colleagues for assistance in downloading materials. Meanwhile others tried to access these sites but were handicapped at a point due to the complex nature of some sites, they could not get access to information which made some students frustrated. Others expressed their challenge in accessing some sites for

their quizzes and assessments but due to how slow their devices worked with the voice application, it went against them in terms of time limits.

Concerning access to information from the libraries, they revealed;

> *Concerning the Braille library, whenever there is an academic work, let's say the lecturers have forwarded slides to our sighted colleagues. Actually, if we don't come to the resource centre, we would go to the braille library and they would tell you they have a lot of work to do. And I've experienced it, for example, our liberal course, we sent a book to the library for it to be embossed but they couldn't do anything about it. They also do not have computers we can do research from.* (Student from group 3).

> *In our department, we do read a lot. And when we are told to get the materials, we are supposed to give it to the library so that they will turn it to audio or soft copies. And with that, it takes a lot of time. By the time you get it, it's almost end of the semester. And you have to rush. And it is something that is disturbing us a lot. So sometimes, they label us that we don't read.* (Student from group 5).

> *The library at the top of the story building, the location we the students with visual impairment sometimes find it difficult to locate the place because of how it is situated.* (Student from group 6).

> *I've not even gone there before, haha. Where it is, it doesn't even ginger me to even go there since I was in level 100. How can our library for students who are blind be at 3rd or 4th floor? It doesn't motivate us to go there* (Student from group 7).

Students with visual impairment faced challenges concerning delays in services from the library, lack of resources such as computers and difficulties getting to the library due to it being located at the topmost floor of the university facility.

**R.Q. 3. How do students with visual impairment experience the integration of technology in their learning process at UEW?**

Four themes emerged from the data gathered under research question three. The themes were; ability to access and use technology for academic work, ability to use Learning

Management Systems (LMS), experiences with the use of student online portals, challenges and resource limitations in technology integration.

**Ability to access and use technology for academic work**

The comments from the participants indicated how they depended much on voice applications on their phones and computers in order to get access to information and materials for their academic work and also helped them navigate through their devices. However, they also came with some challenges associated with accessibility and usability of the apps and devices. They also emphasized on how using such assistive technologies have helped them improve in their level of independency and securing their privacy. These were some comments;

> *First when I was not having a smartphone, and if I have some documents which are soft copy. So, I used to keep them on my friends' phone. But now I have some, I put them inside my Gmail account. So that if I want any document, I can go there.* (Student from group 1).

> *Sometimes when you are using your phone, for me, the software that I'm using on my phone is VoiceOver. So sometimes it doesn't allow you to do certain things, unless you deactivate the speech. So. if you deactivate the speech, there are lots of things that you can't do with your phone.* (Student from group 5).

> *Sometimes you will need assistance because if you search for something on the net, and you chance on a pdf document which has been posted on the site and you'll like to read through, some of our devices do not allow us to get that access to such files, so you will need assistance or you magnify and manage to see through.* (Student from group 2).

> *Like for the first time, I didn't even know I could use the smartphone with the TalkBack. But when I had the phone, then I set the accessibility. I'm able to enter the phone myself. If I want to WhatsApp videos and making calls and other stuff, I have to use the TalkBack and then go through. But first, I thought it is difficult. But now I see that, the more you use it becomes very easy. Also, your phone is a secret for you, it's not everything you need to make your friends aware that, oh, come and do this, do this, and then they will be getting access to your private stuff, So sometimes you do yourself, then you'll be able to protect your privacy.* (Student from group 4).

> *Initially, I wasn't all that good in using the phone, but now with the help of some friends and others, I'm now even the guru haha. Now, people bring their phones and others and I help them fix or navigate through. Because as a visually impaired, there are some apps that you have to get installed into the phone that will make your access to information very easy. Those applications like G-Show Plus and others. The G-Show Plus is an app that helps with your navigation through the internet. It is like the TalkBack but it is more advanced. It reads diagrams and others, even links and what the Google TalkBack cannot do, that one does it. With that, I do get a lot of information through the Internet.* (Student from group 5).

The students seemed excited with certain technological skills and abilities they had acquired with time through practice and assistance from lecturers and colleagues. They seemed enthusiastic to learn more skills to improve upon their usability skills.

**Ability to use Learning Management Systems (LMS)**

Students with visual impairment described their experiences with the use of LMS platforms such as V-Class. They commented on their experiences in accessing course materials, submitting assignments, participating in online discussions, and receiving feedback from instructors.

> *The V-class, although it was an app which was very good, that we were using. Normally I go there to download, soft copies which lecturers already upload there. But I, for instance, I'm even visually impaired. The site or the app was a complicated app that which you can't go there easy to download softcopies. Unless you let a friend help out. So, it normally becomes complicated by using the V-class. So, it normally affects our way of style of learning. Because if you don't get a slide, there's no way that you can, I mean, learn. And also, normally to, some lectures can ask you to do some assignments and upload it on the V-class. And for example, if you don't know how to use the V-class, first question you have to ask yourself, are you going to upload the information or the answers on the V-class? Or have to be a third person to do that for you.* (Student from group 2)

> *I think my experience, getting course materials being uploaded there is very easy. I do get it if I go. The challenge is just that when it is quiz, the time limit for it is a challenge because, for you to manoeuvre and then pick your answer, time is already up.* (Student from group 5)

> *For me, I've never tried. I've never gone there because I hear even the sighted people complaining so how much more me haha.. so I don't even*

*venture. And I've never done an assignment on Vclass. I always do it at the resource, so I don't know how they manipulate that one.* (Student from group 6)

*Yes, I've tried it before. If only you have an internet connection on your laptop, you can use the Vclass by using your arrow keys but it also depends on the typing skills and how fast you are, because there maybe some quiz there, and the duration may be 10 minutes. So if you're not fast enough, I don't think you can cope with it. But if you want to use your phone, I mean you can't.* (Student from group 1)

*my challenge is that mostly because some of us can't go to the vclass for notes because I cannot interact with the system, so when the lecturers give the slides to the sighted then they bring it to the resource to be brailled then I use it.* (Student from group 6)

*You know, the V-class, there are so many processes you go through before you can finally register. And if you are not having a sighted colleague who will be helping you, you find it difficult to do it. And the network issues are also part of the difficulty.* (Student from group 7)

*If only you have an internet connection on your laptop, you can use the Vclass by using your arrow keys but it also depends on the typing skills and how fast you are, because there maybe some quiz there, and the duration may be 10 minutes. So if you're not fast enough, I don't think you can cope with it. But if you want to use your phone, I mean you can't. (Student from group 2).*

*What I can add is, as you are using the talkback, sometimes the typing is very slow. And the V-class, if you are not fast, there is time on it. So, if you are doing it and your phone is disturbing you, sometimes if you want to type P, then your hand will be on maybe A or after deleting and doing those things, the time will be up.* (Student from group 5).

The experiences the students shared with regards to LMS indicated that, although some tried to use the system to access course materials and uploaded assignments, they faced some difficulties in doing that due to the complex nature of the system. Other students on the other hand did no attempt to use the system at all with the notion that even their sighted colleagues complained with the apps' responsiveness, therefore they relied on the traditional way thus, using brailled books and braille for assignments. Also, having to have extra applications like the voice synthesizers on their phones and laptops before they could get access to the system and used it also posed a disadvantage since it turned

to slow down the system especially when they were to use the v-class for timed assessments.

**Experiences with the Use of Student Online Portals**

The students shared their encounter with the online portal for student for registration, results checking and other academic related records. The commented;

> *I remember I last checked my results at the ITS, and the format was in the form of a table, that's how the results have been inserted. So when I was able to get access to it with my phone. It was reading everything just like that without describing how the format is.* (Student from group 1).

> *In one of the semesters, I was able to log in unto the ITS and I did my registration myself. I logged into the system and I went to the registration side. There were a lot of courses there so I went through the course code and title by the help of the NVDA to fish out the ones I was doing that semester and I registered. I was very glad I was able to do it myself. I even registered for some of my colleagues too.* (Student from group 6).

> *Because if you check your CA in the portal, it just says to you column one, its like it would be reading everything without reading heading for you, so you don't really get what it means, and you don't get what you are looking for.* (Student from group 2).

> *As for me, going to the OSIS is a problem because there were many instructions to follow so I haven't even registered yet since last semester. I'm waiting for someone to help me do it.* (Student from group 5).

Comments from the participants indicated that they were able to access the online portals and interacted with commands to achieve results. Meanwhile, due to unfamiliarity and lack of knowledge about the portals, some students struggled to access the portals.

**Challenges and Resource Limitations in Technology Integration**

The individuals faced difficulties in completing assignments, conducting research, and accessing resources due to the volume of work, limited availability of materials, lack of ICT skills training, and inaccessible learning environments.

*Normally it becomes a challenge because when we are being given an assignment which I do not have any knowledge about it, it becomes a challenge in using my laptop. Normally, you have to find a friend to help you because you cannot rely only on yourself because when using the computer or the laptop, you can type but you can make some mistakes that you will not know that it's an error. But if a friend is with you, he can be able to locate that this one is an error or you've typed something which is not right. So he can correct it and that one is also a challenge for me if any assignment is given to me.* (Student from group 2).

*I don't have problem in searching for information on an assignment, but sometimes you see the assignment is too many, but we have to braille it. Sometimes it will be more than ten sheets and you have to braille all. And limited materials for our assignments.* (Student from group 3).

*Although I wish to use these technological and assistive devices very often because it makes you look smart. Because when I always see people handling it and using it, it is nice and makes you look more academic. So I am still practicing and I hope to get better.* (Student from group 5).

*I can say that I'm very poor in it because of the way we were being introduced to the ICT. Because pertaining to all the aspects either typing, using the Microsoft Word, Excel and others I am not that good at them. Even though I do try my best and I do bring something, but very poor. So I have to still depend on my other sighted colleagues.* (Student from group 5).

*I actually don't often use the computer, as a result of how I was being introduced to at first. When I wanted to start using it, there wasn't any effective, guidance and practical at lectures as to how to use the computer as a visually impaired so it doesn't really encourage me to use it that much.* (Student from group 5).

*Even though the resource centre have some computers, but they are very few so even when you want to use it to write your exams or quiz, they are not enough for all of us so I just manage and use the braille. As for the library, there is no computer at all so it doesn't help us.* (Student from group 4).

*You see some of us, we can't even feel the braille again so we can't read it during exams or quizzes. And also because we lack the typing skills, we cannot use the computer to answer questions through typing. That is why we always listen to question using the JAWS or NVDA then we will braille.* (Student from group 6).

Some students associated their inability to integrate technology properly in their studies were as a result of the poor manner of which they were introduced to ICT and its use. Therefore, they were not encouraged to use assistive technologies as they lacked

adequate skills to use and manipulate the devices and software. Others who wished to practice and use the assistive technologies too were faced with limited availability of resources and inaccessible environment.

Comments under the themes summed up to explain students' with visual impairment experiences in integrating technology in their learning process. Some students were able to use the limited technology and resources available to help them achieve academic success whiles others struggled in getting the assistive technologies due to lack of finances and others due to lack of technical skills. Comments under technology integration also indicated that individuals with low vision constituted the majority of students with visual impairment who incorporated technology into their academics due to the extra advantage they got through screen magnification and other optical aids.

**R. Q. 4. How can the study of ICT be improved for students with visual impairment in UEW?**

Students with visual impairment and staff who supported the teaching of ICT suggested measures to improve effective study of ICT. Six themes emerged from the data gathered. They were; accessible technology and software, specialized ICT support, resource availability, teacher knowledge and training, content accessibility.

**Accessible Technology and Software**

The students with visual impairment made emphasis on the need for the computers at all ICT labs to have speech software such as JAWS and NVDA to ensure that students with visual impairment could effectively study ICT and also make libraries accessible for easy reach. They made the following statements;

> *When coming to teach an ICT class with VIs included, the most important thing is that there must be a computer speech software on the computers. So that we can also follow instructions.*

> *They should install the JAWS and NVDA on all the computers so that whenever the lecture gives a task for us to do, we can follow and also do some.*
>
> *The braille library should be situated at where it will be easy to access. It's not that now that we'll have to climb two or four more steps before we reach that particular point.* (student from group 2)

The staff also commented on the need for the computers to be modified and adapted with software and application to suit the needs of the students with visual impairment.

> *There should be computers set aside to have all the application and software like the speech that assists the students who are blind so that they will use it when they come to class.* Staff 1

**Specialized ICT Support**

This theme highlights the need for an ICT lecturer who is specialized in special education and can provide the necessary guidance and support for students with visual impairment to study ICT effectively. The students opined;

> *I suggest that there should be an ICT lecturer who is specialized in special education that can take us through the ICT. So, it's like someone who understands our needs and is also good in ICT so that they can attend to us properly.*
>
> *If the school could provide an ICT lab basically for the visually impaired with a lecturer who understands our needs more, so that we can be taken separately with the needed attention. That would be the best way.*
>
> *We need to have a facilitator, maybe the lecturer who understands us, who will join the main lecturer to take the entire group, both the visually impaired and our sighted counterparts.*

Staff 1 iterated the need to get specialised ICT support to assist lecturers who could pay more attention to the students with visual impairment. He stated;

> *I think when the university should bring on board resource teachers who understand the needs of the students with visual impairment and also are trained in ICT, they can be present during the ICT lectures and simultaneously attend to them as we attend to the sighted students just like how the sign language interpreters are present to guide the deaf students.*

These comments indicated that, for the effective teaching and learning of the ICT course to take place, there must be some active professionals who could collaborate and cooperate together to address the unique needs of students with visual impairment in learning ICT.

**Resource Availability**

The participants highlighted on the need for adequate computers, assistive devices, and well-equipped resource centres to facilitate practice and remedial teaching for students with visual impairment studying ICT. They students said;

> *So we will need more computers at the resource lab for more practice and doing our research and assignments.* (Student from group 2)

> *Provide a strong network system so that the use of the phone will not be difficult for the visually impaired. Like the WiFi. They should provide enough recorders. And also bring more laptops and desktops to the resource centre so that the visually impaired can do lots of practice.* (Student from group 6)

> *I've heard of this device. There is a machine which takes soft copies, it can also translate into different different languages. When you have your hard copy, it can do the transcription, that is with the braille, it can do the audio, it can do the soft copy and it can also do translation into other languages. So if they get more of that it will help a lot.* (Student from group 5)

Staff 2 also added;

> *For the resources and materials, what we have are very few. So, we need more computers, and not just any but very robust ones. Also, if we can get internet cables at the resource here, it will help a lot.*

Comments made by the participants indicates that, they believed that effective teaching and learning of ICT for the students who are visually impaired would be achieved if the resources they highlighted were made available by the University.

**Teacher Knowledge and Training**

This theme emphasizes the importance of teachers having knowledge of assistive devices, software, and alternative methods of accessing information, as well as receiving training on supporting students with visual impairment effectively in ICT. Some of the comments are outlined;

> *There should be a resource person who will assist the lectures so that they will be able to know much about our assistive device so that it will also help us to improve on the ICT level. And the lecturers also have to be abreast with our system software so that they can assist us in class.* (Student from group 3)

> *And then the lectures, you know, we have some lectures who knows how to use the JAWS, who are mostly with visually impaireds, So they should, even if they don't know, but they should try as much as possible to bring some of the lectures who knows how to use the JAWS and others stuff that we use so that when visually impaired are included, then those lectures will be taking them through.* (Student from group 7)

> *Assuming if the lecturer knows a bit of braille, he can explain and guide us for example, with a particular topic in braille you can do this and that. But if the lecture doesn't know the braille, he cannot explain in braille.* (Student from group 1).

**Content accessibility and curriculum adaptation**

The theme addressed the need for accessible content, including descriptions of tables, diagrams, and images, to ensure students with visual impairment could understand and access information effectively. Also, the need to modify the content of the syllabus for the ICT course to enable the students with visual impairment benefit from the course equally like their sighted colleagues. These were statements from participants:

> *Most times when you open word and there is a table with it's a column like this, then the speech will tell you that it's a wide column or long or short. Then you get how you want to create the tables yourself. But if the computer is not talking, then during the practical aspect, the computer can only mention the name, but it will not tell you how wide the tables.* (Student from group 2)

> *I remember I last checked my results at the ITS, and the format was in the form of a table, that's how the results have been inserted. So when I was able to get access to it with my phone. It was reading everything just like that without describing how the format is. Per my view, i think the IT directorate should help us with that one too. the IT director should input something like that to describe certain tables, certain diagrams. Because if you check your CA at the ITS it just says of you column one, its like it would be reading everything without reading heading for you, so you don't really get what it means, and you don't get what you are looking for. Same when it comes to the image and table form too.* (Student from group 1)

> *This will all mean that the content will have to be refined first where, not to eliminate but minimize the imagery aspect, the aspect that comes with vision. So that the keyboard, you know, because there are a wide range of things that the keyboard can do, almost everything through shortcuts, whether if it's not picture related, if it's not design related, if it's not to draw or to colour or something. Or, they can equally have a separate content for the VI's, where it is designed to suit or include them because I know that people who sometimes do languages, certain aspects of the course is refined a bit, is designed to suit them students with the impairment.* (Staff 1)

To ensure the effective practice of inclusion in ICT education, UEW would have to put some measures in place to ensure that from the content through the delivery to the assessment of the course would include and address all unique needs of students. Students with visual impairment and staff related to the course delivery shared their views in the themes explained so far to ensure the effective study of ICT for students with visual impairment.

# CHAPTER FIVE

# DISCUSSION OF FINDINGS

## 5.0 Introduction

This chapter presents the discussion of findings. The discussion highlighted the major findings of the research and inferences made from them in view of findings from related previous studies, the discussion was guided by the research questions that were raised to guide the study.

## 5.1 Research Question 1: What are experiences of students with visual impairment in learning computer literacy skills at UEW?

The findings highlighted the students' with visual impairment experiences and challenges related to their knowledge and use of basic computer skills. The use of assistive technologies such as NVDA and voice features on phones was mentioned as helpful in accessing and using computers independently. However, some students expressed difficulties in operating certain computer applications such as Microsoft Word, Excel, and PowerPoint. They relied on assistance from their sighted colleagues to overcome these challenges. Keyboard shortcuts were mentioned as a useful tool in navigating and performing tasks on computers. These findings resonate with the existing literature on the importance of providing training and support in basic computer skills for individuals with visual impairments. Assistive technologies, such as screen readers like NVDA and voiceover features, have been recognized as valuable tools in facilitating computer access for students with visual impairment (Bryant & Bryant, 2016; Gupta, 2014). Training programmes and workshops that focus on keyboard shortcuts and navigating computer interfaces have shown to be effective in enhancing computer literacy among students with visual impairment (Vanderheiden, 2007; Monteiro et al., 2014).

Furthermore, the need for ongoing support and assistance from peers or IT professionals in utilizing specific software applications aligns with the concept of social support and collaborative learning in inclusive education (De Witte et al., 2010; Karunanayaka et al., 2016). Providing comprehensive training programmes that address the specific challenges faced by students with visual impairment in computer use can contribute to their independence and participation in educational activities (Oye et al., 2019; Walker et al., 2014).

The findings from the students' experiences highlighted the challenges faced by students with visual impairment in practical sessions and assessments within the context of computer literacy classes. The students reported that the lectures did not actively involve students with visual impairment in the practical aspects of the course, resulting in limited opportunities for them to develop practical skills. Analysis of the findings revealed that the lack of involvement was as a result of lecturers lacking the necessary skills to effectively teach or guide students with visual impairment in practical sessions. As a result, the responsibility of conducting practicals was often transferred to the resource centre or replaced with oral and theory assessments. This suggests a gap in the inclusive teaching practices and training of lecturers in accommodating students' with visual impairment needs in computer literacy classes. In a study by Parette et al., (2010), it was found that teachers often lack confidence and expertise in adapting instruction and materials for students with visual impairments. The study highlighted the importance of providing ongoing professional development opportunities that focus on building teachers' knowledge and skills in inclusive practices.

Moreover, the students' testimonies indicated that the practical instructions provided by the lecturers were often geared towards sighted students who primarily use the mouse, while students with visual impairment relied on keyboard-based interactions. This discrepancy in instructional methods further hindered the students' with visual impairment' ability to participate fully in the practical sessions. The experiences shared by the students align with existing literature that highlights the challenges faced by students with visual impairment in accessing and participating in practical activities in the field of ICT. For example, a study by Kulyukin and Gharpure (2005) emphasized the importance of designing inclusive software and adapting computer interfaces to accommodate the needs of students with visual impairment. Similarly, Buzzi et al. (2006) discussed the significance of providing alternative methods of interaction, such as keyboard shortcuts and audio-based interfaces, to facilitate users' with visual impairment engagement in computer-related tasks. To address these challenges, it is crucial to enhance the accessibility of computer labs and software used in practical sessions by incorporating assistive technologies and adaptive software. This aligns with the recommendations put forth by other researchers, such as Sánchez-Gordón et al. (2017), who highlighted the importance of developing accessible educational materials and providing training for instructors to effectively teach students with visual impairment in computer science disciplines.

The experiences and strategies used by students with visual impairment in accessing the internet and browsing websites were also highlighted in the findings. Students mentioned using screen readers such as NVDA and JAWS to navigate websites and gather information. They also emphasized the importance of a stable network connection and the availability of assistive software on their phones to facilitate internet access. Some students mentioned the practice of saving digital information for later

access, either by downloading it to their devices or taking screenshots. These findings align with existing literature on the experiences of students with visual impairment in using the internet and accessing web content. Screen readers, such as NVDA and JAWS, have been widely recognized as essential tools for users with visual impairment to access online information (Gupta, 2014; Vanderheiden, 2007). They enable users to navigate websites, read text, and interact with digital content. The importance of a stable network connection is crucial for an uninterrupted internet experience, and the availability of assistive software on mobile devices has significantly improved accessibility (Adeyemo et al., 2019; Karunanayaka et al., 2016).

Additionally, the practice of saving digital content for offline access is a strategy employed by students with visual impairment to ensure continued availability and convenience (Oye et al., 2019). Taking screenshots or downloading information allows users to retrieve and review content without having to navigate back to the website. These strategies demonstrate the adaptability and resourcefulness of students with visual impairment in optimizing their online browsing experiences.

Furthermore, the use of communication platforms such as WhatsApp, Telegram, and social media sites for interacting with others and accessing information is consistent with the growing trend of digital communication among students with visual impairment (Karunanayaka et al., 2016). These platforms provide opportunities for social connection, information sharing, and collaborative learning.

Again, the findings shed light on the challenges faced by students with visual impairment when interacting with software applications. The use of voice-based interfaces and screen readers can result in slower information retrieval compared to sighted individuals. The pronunciation and spelling of words can also pose difficulties,

limiting the ability to access and comprehend information fully. When it comes to software applications like Excel and PowerPoint, the absence of visual cues and reliance on projection could make it challenging for students with visual impairment to follow procedures independently. As a result, they struggled to perform tasks and activities within these applications. In some cases, students with visual impairment required assistance from others, particularly when accessing PDFs or working with complex documents. These findings align with existing literature on the challenges faced by students with visual impairment in interacting with software applications. The use of voice-based interfaces and screen readers, while essential for accessibility, can introduce delays in information retrieval and may not always provide clear pronunciation or spelling (Arif et al., 2020; Gupta, 2014). Students with visual impairment often encounter difficulties when working with visual-centric applications like Excel and PowerPoint, as these applications heavily rely on visual cues and interfaces (Karunanayaka et al., 2016). The lack of visual feedback and the need for alternative approaches to understand and navigate these applications could impede independent use.

Moreover, the need for assistance when accessing PDFs or working with specific document formats is commonly reported among students with visual impairment (Arif et al., 2020). This highlights the importance of collaboration and support from others in overcoming accessibility barriers and ensuring access to information.

In conclusion, the findings highlighted the importance of tailored training and support programmes to enhance the computer skills of students with visual impairment, enabling them to access educational resources and engage in independent learning. Students with visual impairment heavily rely on screen readers and assistive software

for internet access, with a stable network connection playing a crucial role. Saving digital content and utilizing communication platforms further enhance their online experiences. However, challenges arise when students with visual impairment interact with software applications, such as difficulties with voice-based interfaces and limitations in accessing visually-oriented elements. Inclusive design and collaborative support are essential to address these challenges and improve the overall interaction of students with visual impairment with technology.

### 5.2 Research Question 2: What are experiences of students with visual impairment in learning information literacy skills at UEW?

The findings on the experiences of students with visual impairment in learning information literacy skills suggested that students with visual impairment utilized mobile phones and specific applications to overcome challenges in accessing information and navigating the internet. These tools enabled them to search for questions, read diagrams, access links, and gather information online. Students mentioned using apps like G-Show Plus, which offers advanced features beyond traditional screen readers like TalkBack.

Additionally, they mentioned using mobile browsers such as Google Chrome, Phoenix, and Opera Mini for their internet research. The students expressed comfort and proficiency in using mobile devices, highlighting the importance of magnification features for text enlargement and apps like InstaReader for reading PDFs. The use of mobile phones and specialized applications by students with visual impairment aligns with existing literature on assistive technologies for accessibility. Mobile devices, with their built-in accessibility features and a wide range of apps, provide a portable and versatile solution for information access (McCarthy, 2017). Screen magnification and

text-to-speech applications are commonly used by students with low-vision to overcome visual barriers and access digital content (Barrett et al., 2018). These tools empower students to independently engage with online resources, enhancing their learning experiences and supporting their academic pursuits.

Moreover, the use of mobile devices as assistive tools aligns with the principles of universal design for learning (UDL), which emphasizes providing multiple means of representation, action and expression, and engagement (Rose & Meyer, 2002). By leveraging mobile technology, students with visual impairment can access information, communicate, and participate in educational activities on par with their sighted peers.

However, it is important to note that the effectiveness of mobile devices and applications may vary depending on individual preferences, needs, and the accessibility of specific apps. Continuous evaluation and improvement of accessibility features and the availability of assistive technology resources are crucial to ensuring equitable access and meaningful participation for students with visual impairment in ICT education.

Again, the findings highlighted the challenges and limitations faced by students with visual impairment in accessing information on websites. Students expressed difficulties in navigating complex websites, particularly in accessing and interacting with learning platforms like Vclass. They mentioned the limitations of screen reader technology in describing images and the need for assistance in understanding visual content. Additionally, accessing materials from libraries, especially in Braille format, posed challenges due to resource limitations and time-consuming processes. The challenges faced by students with visual impairment in accessing online platforms and libraries aligned with existing research on accessibility barriers. Complex website designs and inaccessible content can hinder the effective participation of students with visual

impairment in online activities (Brajnik et al., 2019). Insufficient alternative text descriptions for images and other visual elements limit their comprehension and access to information (Hurst et al., 2020). These barriers underscore the need for web developers and content creators to adhere to accessibility guidelines, such as providing descriptive text alternatives and ensuring proper navigation structures (World Wide Web Consortium, 2018). To promote equitable access to information, it is crucial to prioritize inclusive design practices, develop accessible websites and digital platforms, and ensure that libraries have the necessary resources and infrastructure to support the diverse needs of students with visual impairment.

Students also emphasized the importance of aligning the content with the given question or topic and using their prior knowledge to assess the relevance and accuracy of the information. They mentioned relying on search results that match their expectations and comparing multiple sources to ensure consistency and reliability. Additionally, students acknowledged the assistance of lecturers in guiding them towards reputable sources and providing specific websites or authors for their research. These findings aligned with existing literature on information evaluation and selection, particularly in the context of web searching. Evaluating the relevance and reliability of information is a critical skill for all researchers, including students with visual impairment. Research has shown that individuals with visual impairments can employ various strategies to assess the quality of information, such as comparing multiple sources, considering the source's credibility, and aligning the content with their existing knowledge (Bierhoff et al., 2019). These strategies contribute to effective information evaluation and help individuals make informed decisions about the information they select.

Moreover, the role of instructors and peers in guiding students with visual impairment in the information evaluation process is vital. Studies have highlighted the importance of supportive guidance from teachers, librarians, and peers in enhancing information literacy skills among students with visual impairment (Bierhoff et al., 2019; Pavešić & Mikulec, 2018). Providing clear instructions, suggesting reliable sources, and encouraging critical evaluation can empower students with visual impairment to navigate the complexities of information retrieval effectively.

In conclusion, students with visual impairment employ strategies such as aligning content with the given question, using prior knowledge, comparing multiple sources, and seeking guidance from instructors and peers to evaluate and select information. These strategies reflect the students' efforts to ensure the relevance, accuracy, and reliability of the information they use for their research.

### 5.3 Research Question 3: How do students with visual impairment experience the integration of technology in their learning process at UEW?

Concerning the experiences of students with visual impairment in integrating technology in their academic work, the findings suggested that the students had varying experiences in accessing and using technology for academic work. Storing and retrieving documents have become more convenient with the use of smartphones and cloud storage platforms like Gmail. However, certain limitations arise when using assistive software, such as VoiceOver, which may restrict certain functionalities unless speech is deactivated. Assistance is sometimes required to access PDF documents or overcome device limitations. The use of accessibility features like TalkBack and G-Show Plus can enhance the usability of smartphones for students with visual impairment, allowing them to navigate the internet and access information more easily.

Findings also revealed some advantages students with low-vision have over their blind colleagues in integrating technology. Even though students with low vision may have difficulties with reading and writing activities, even when they use optical aids (that magnify the image) and non-optical resources (material adaptation and changes in the environment), they could benefit from the combined use of these resources with information technology, such as screen enlargers (systems that magnify the characters on a computer) and speech synthesizers (specific adaptations with voice output, which convert screen content to speech) (Alves et al., 2009). These findings align with existing literature on the importance of assistive technologies and accessibility features for individuals with visual impairments in academic settings (Burgstahler, 2015; Seale, 2006).

The findings presented in the provided excerpts highlighted the experiences the students with visual impairment encountered in using Learning Management Systems (LMS), specifically the V-class platform, for accessing course materials, participating in quizzes, and completing assignments. They outlined some challenges which include difficulties in navigating the platform, time constraints during quizzes, reliance on sighted assistance, and issues with network connectivity. The students expressed frustration with the complexity of the V-class platform, particularly when it comes to downloading course materials or submitting assignments. These experiences align with related literature that highlights the importance of accessible design and usability in LMS platforms for individuals who are blind. Research emphasizes the need for LMS platforms to adhere to accessibility standards, such as proper labelling of elements, clear navigation structures, and compatibility with assistive technologies (Hansen & Rødje, 2019). Additionally, studies suggest the incorporation of alternative methods for

completing quizzes and assignments, such as extended time limits or alternative formats, to accommodate the needs of students who are blind (Burgstahler, 2015).

The challenges faced by individuals who are blind in using LMS platforms reflect the broader issue of accessibility in educational technology. It is crucial for educational institutions to prioritize inclusive design and provide necessary support and resources to ensure equal access and participation for all students.

Moreover, the findings revealed the diverse experiences of students with visual impairment in the use of student online portals in their academic journey. While some students were able to access and navigate the portals successfully, others faced challenges that impeded their independent use of the platforms. One student expressed frustration with the lack of descriptive information in the format of the online portal, making it difficult for them to comprehend the presented data fully. On the other hand, a student with visual impairment shared a positive experience of registering for courses independently with the assistance of screen readers like NVDA. However, another student expressed difficulty in accessing the online portal and following the instructions, leading to a delay in their registration process. These findings resonate with existing literature on the experiences of students with visual impairment with student online portals. Accessibility barriers, such as inadequate description of data and navigation challenges, have been highlighted in previous research (Burgstahler, 2015; Lang, 2017). The positive experience of one student using assistive technology aligns with the studies emphasizing the significance of accessibility features and adaptive technologies in enhancing the user experience for students with visual impairment (Cahill et al., 2019; Cooper & Colwell, 2018).

To address the challenges faced by students with visual impairment in using online portals, universities and educational institutions should prioritize inclusive design principles and ensure that their platforms are compatible with screen readers and other assistive technologies (Abascal et al., 2019). Moreover, providing comprehensive and descriptive information in a structured manner within the portals can significantly improve the experience for students with visual impairment (Deb et al., 2017). Additionally, offering personalized support and training sessions for using the portals can empower students with visual impairment to navigate through the platforms independently (Burgstahler, 2015).

### 5.4 Research Question 4: How can the study of ICT be improved for students with visual impairment in UEW?

Ways of improving effective study of ICT were investigated and findings highlighted the importance of accessible technology and software in facilitating the inclusion of students with visual impairment in ICT classes. One of the key recommendations is to have computer speech software, such as JAWS and NVDA, installed on all computers. This enables students with visual impairment to follow instructions and actively participate in tasks during the class. Additionally, the suggestion is made to dedicate specific computers with the necessary applications and software that assist students who are blind, ensuring their accessibility needs are met.

These findings align with existing literature emphasizing the significance of accessible technology and software in supporting students' with visual impairment education. Research has demonstrated the effectiveness of screen readers like JAWS and NVDA in providing auditory output and enabling individuals with visual impairment to interact with computers and digital content (Brajnik et al., 2018; Das et al., 2019). These

assistive technologies enhance access to information and facilitate participation in academic activities for students with visual impairment.

Moreover, studies have emphasized the importance of providing dedicated resources and equipment for students with visual impairment to ensure their access to assistive technology (Burgstahler, 2015; Leporini et al., 2019). Having computers equipped with the necessary software and applications specifically designed for users who are visually impaired can contribute to an inclusive learning environment.

To implement these recommendations, educational institutions should prioritize the provision of accessible technology and software across their computer labs and classrooms. This includes installing screen reader software like JAWS and NVDA on all computers, as well as designating a dedicated set of computers with the necessary assistive technology for students with visual impairment. Additionally, staff training on the use of these technologies and their integration into teaching practices can further enhance the inclusive learning experience for students with visual impairment (Lozano et al., 2020).

In the context of ICT education, research has also emphasized the need for specialized training for teachers to effectively teach students with visual impairment. Buzzi, Leporini, and Akhter (2017) discussed the importance of training teachers in using accessible technologies and software that cater for the needs of students with visual impairment in ICT-related subjects. They highlighted that teachers should be familiar with screen readers, accessible interfaces, and alternative input methods to facilitate the inclusion of students with visual impairment in ICT education.

To address the lack of knowledge and expertise among lecturers, it is crucial to provide comprehensive training programmes that focus on inclusive teaching strategies, assistive technologies, and accessibility tools specifically tailored to the needs of students with visual impairment. This training should equip educators with the necessary skills to adapt instruction, materials, and assessments to meet the diverse needs of visually impaired learners.

The findings highlighted the challenges faced by students with visual impairment in accessing and comprehending content that includes tables, diagrams, and images. Some students mentioned that when the computer speech software is not functioning, it becomes difficult to understand the structure and dimensions of tables. Another student mentioned the lack of description for tables and diagrams in the online student portal, making it challenging for students with visual impairment to interpret the information accurately. The suggestion is made for the IT directorate to improve content accessibility by providing descriptions or alternative formats for tables, diagrams, and images. These findings align with existing literature on content accessibility and curriculum adaptation for students with visual impairment. Research has emphasized the importance of making educational materials inclusive and ensuring that they are accessible to students with visual impairments (Brajnik et al., 2018; Burgstahler, 2015). Specifically, when it comes to tables and diagrams, providing alternative text descriptions or tactile representations can enhance understanding and engagement for students with visual impairment (Hersh et al., 2018; Petrie et al., 2008).

The use of alternative text descriptions, also known as alt text, is a widely recognized practice for making visual content accessible. Alt text provides a textual description of the content, allowing students with visual impairment to understand the purpose and

context of tables, diagrams, and images (W3C, 2017). Similarly, providing tactile representations of graphical information through embossed diagrams or raised-line drawings can enhance the comprehension and exploration of visual content for students with visual impairment (Leporini et al., 2019; Petrie et al., 2008).

Furthermore, curriculum adaptation is crucial in ensuring that students with visual impairment can fully participate in educational activities. This may involve minimizing reliance on visual elements and providing alternative learning materials or resources that cater for the needs of students with visual impairment (Burgstahler, 2015). The suggestion made by Staff 1 to refine the content and create separate materials or versions specifically designed for students with visual impairment aligns with the principles of inclusive education and curriculum adaptation.

To address the challenges identified in the findings, the IT directorate and educators should consider implementing strategies for content accessibility and curriculum adaptation. This includes providing alt text descriptions for tables, diagrams, and images in digital materials and online platforms, as well as exploring the use of tactile representations where applicable. Collaborating with students with visual impairment and disability service providers coul also provide valuable insights and feedback on the accessibility of educational content.

Again, the findings highlighted the need for the IT directorate to improve content accessibility by providing descriptions or alternative formats for tables, diagrams, and images. These findings align with existing literature on content accessibility and curriculum adaptation for students with visual impairment. Research has emphasized the importance of making educational materials inclusive and ensuring that they are accessible to students with visual impairments (Brajnik et al., 2018; Burgstahler, 2015).

Specifically, when it comes to tables and diagrams, providing alternative text descriptions or tactile representations can enhance understanding and engagement for students with visual impairment (Hersh et al., 2018; Petrie et al., 2008).

# CHAPTER SIX

## SUMMARY, CONCLUSION AND RECOMMENDATIONS

### 6.0 Introduction

This chapter presents the summary of key findings, conclusions and recommendations of the study. Also, the contribution of the study to existing knowledge on the subject matter is presented, as well as suggestions for further research. The purpose of the study was to explore the experiences of students with visual impairments in learning ICT at University of Education, Winneba. The study specifically sought to;

a. Describe students' with visual impairment experiences with learning computer literacy skills at UEW.
b. Explore the experiences of students with visual impairment in learning Information literacy skills at UEW
c. Eescribe the experiences of students with visual impairment in technology integration in learning at UEW
d. Establish measures to improve the learning of ICT for students with visual impairment at UEW.

Four research questions were raised from the objectives to guide the collection of data for the study. The Transactional Distance Theory propounded by Michael Moore (1973, 1996) was the theory that guided the study. The study followed the qualitative approach, using the phenomenological design to explore the experiences of students with visual impairments in learning ICT at University of Education, Winneba. Data was collected with a semi-structured interview guide, focus group interview guide and through observation. Data was coded and analysed using thematic approach.

## 6.1 Summary of Major Findings

The following were the key findings of the study.

**Students' with visual impairment experiences in learning computer literacy skills**

The findings emphasized the experiences and challenges faced by students with visual impairment in computer use, internet browsing, and use of other technology and skills to support their academic work. It was revealed that, some students with visual impairment had limited knowledge and skills in accessing and using computers and its related peripheries. Majority of the students associated their limited skills to the poor introduction and lack of practice in the computer literacy class. Other students however, managed to utilize some basic computer skills with the help of speech software such as the NVDA, JAWS, VoiceOver and collaboration with their sighted colleagues to interact with computers and phones for optimum results and satisfaction. However, they encountered difficulties with certain software applications such as powerpoint and microsoft excel. The students mentioned the importance of assistive technologies like screen readers and voice features in accessing computers independently. Also, they revealed that they were mostly neglected during practical sessions due to lack of inclusive teaching practices and support from lecturers. The students emphasized the need for tailored training programmes, assistive technologies, and accessible educational materials to enhance their computer skills and engagement in education.

**Experiences in learning information literacy skills**

The study revealed that, students with visual impairment utilized mobile phones and specific applications to access and retrieve information from the internet. They relied on apps and mobile browsers such as Google Chrome for their research. These tools empowered students to independently engage with online resources and support their

academic pursuits. However, students experienced varying effectiveness of mobile devices and applications, highlighting the need for continuous evaluation and improvement of accessibility features. The study also highlighted challenges faced by students with visual impairment in accessing information on websites, particularly in navigating complex platforms and understanding visual content. Limited alternative text descriptions and resource constraints in accessing materials posed additional barriers. The students also indicated that, they did not utilize the libraries in the school due to it being situated at the topmost floor of the school facility and also its lack of resources. The students' strategies in evaluating and selecting information involved aligning content with the given question, utilizing prior knowledge, comparing multiple sources, and seeking guidance from instructors and peers.

**Experiences with technology integration in academic process**

The findings indicated that students with visual impairments had varied experiences in integrating technology into their academic work. The students revealed that, the majority of them used smart phones for their academic work. Accessibility features such as TalkBack and G-Show Plus enhanced the usability of smartphones for the students. However, some students with visual impairment revealed that, they still depended on the traditional way of learning, which is the use of braille entirely for their academics. They attributed their inability to integrate technology in their learning due to lack of these technological devices and their high cost of purchase. Also, students with low vision had advantages over their colleagues who were blind by incorporating tools like screen enlargers, and magnifying options which magnify texts, diagrams and images.

Moreover, regarding Learning Management Systems (LMS), specifically the V-class platform, the findings highlighted challenges faced by the students. Navigating the platform, time constraints during quizzes, reliance on sighted assistance, and network connectivity issues were identified as obstacles. The complexity of the V-class platform, especially in downloading course materials and submitting assignments, caused frustration. The challenges faced by students with visual impairment in using LMS platforms reflect the broader issue of accessibility in educational technology.

In the use of student online portals, some students with visual impairment successfully accessed and navigated the platforms for their course registration, and checking of results, while others faced challenges. The lack of descriptive information within the portals hindered comprehension for some students. Positive experiences with screen readers and assistive technology were shared, but difficulties in accessing and following instructions were also reported.

**Measures to improve the study of ICT**

The research investigated ways to improve the effective study of ICT for students with visual impairments. The findings emphasized the importance of accessible technology and software to facilitate their inclusion in ICT classes. Students with visual impairment emphasized on the need to install computer speech software like JAWS and NVDA on all computers, as well as dedicating specific computers with necessary applications for students who are blind.

Specialized training for teachers was also highlighted as crucial for effectively teaching students with visual impairment ICT-related subjects. This training should focus on using accessible technologies, assistive software, and alternative input methods. Providing comprehensive training programmes for educators can help them adapt

instruction and materials to meet the diverse needs of learners with visual impairment. Lack of description and functionality of computer speech software posed difficulties. To address these issues concerning inaccessible content, diagrams and images on online platforms, it was suggested to provide alternative text descriptions or tactile representations for visual content.

The staff who were interviewed also emphasized that, UEW should prioritize inclusive design principles and ensure compatibility with assistive technologies. Providing comprehensive and descriptive information, offering personalized support, and conducting training sessions can improve the experience for students with visual impairment using online portals.

### 6.2 Conclusion

Acquiring ICT skill is very crucial in this era of modernization. In view of this, accessibility and usability of ICT tools for students with visual impairment must be prioritized in ICT education. The experiences of students with visual impairment in learning ICT underscored their ability to use mobile technology and computer with the aid of speech and voice applications. According to their experiences during ICT lessons, they encountered neglect from lecturers due to the special need and attention they may require in class. In view of this, some students lacked certain technical skills in using technology devices, application and software.

Students with visual impairment encountered challenges in utilising their information literacy skills. These challenges could be addressed making online portals and websites blind-friendly. Addressing accessibility barriers and promoting inclusive design practices are essential in creating an inclusive learning environment. In view of this,

measures to improve study of ICT for students with visual impairment were highlighted.

### 6.3 Recommendations

Based on the findings of the study, the following recommendations were made:

1. Management of the University should prioritize providing accessible technology and software such as NVDA and JAWS across computer labs and libraries. Lecturers should also accord students with visual impairment same level of attention and engagement in class and practical sessions as their sighted colleagues.
2. The management of the University should relocate the braille library to a location that is easily accessible and furnish the school libraries and resource centres with robust computers and other assistive devices to encourage and motivate students with visual impairment to use the facilities to improve their information literacy skills.
3. Students with visual impairment are encouraged to upgrade themselves in the use of modern technology tools and devices in their academics. Furthermore, the IT System Administrators together with lecturers at the University should take special care in designing the content of online portals, LMS and learning materials posted on the platforms to cater for the needs of students with visual impairments. This approach will significantly mitigate the various challenges they encounter while accessing and utilising online systems.
4. Lecturers together with stakeholders should make arrangements for the continuous adaptation of content for teaching ICT to cater for the unique needs of students with visual impairment especially when it comes to imagery and visual contents as well as appointing personnel equipped with the use of

assistive devices for the students with visual impairment to assist lecturers during practical sessions and lesson delivery. This will ensure the sustainability and improvement of inclusive learning environment for students with visual impairment in ICT education.

### 6.4 Suggestion for Further Research

There is a need to conduct a study to investigate the proficiency of ICT skills of students with visual impairment. Further studies could also be conducted to investigate the impact of the use of ICT resources on the academic performance of students with visual impairment. Finally, further studies could be conducted on the experiences of lecturers in teaching ICT to students with visual impairment.

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# APPENDICES

## APPENDIX A

**SEMI-STRUCTURED INTERVIEW GUIDE FOR STUDENTS WITH VISUAL IMPAIRMENT AT UNIVERSITY OF EDUCATION, WINNEBA ON THEIR EXPERIENCES IN STUDYING ICT.**

**Department:** **Impairment Level:**

**Date:** **Duration:**

This interview is aimed at collecting information from students with visual impairment in studying ICT at the University of Education, Winneba. The items were developed on the themes in the research questions.

1. **What are the experiences of students with visual impairment in learning computer literacy skills at UEW?**
   - How did your lecturer introduce a computer and its parts to you.
   - What is your understanding of what a computer is?
   - How will you describe the first time you were made to manipulate a computer and its parts?
   - What are some of the basic computer skills you have and how do you use them?
   - Describe your interaction with Ms. Word, Powerpoint, Excel and any other software you use most often
   - When given practical assignments in connection with computer literacy how do you go about them?
   - How will you describe the attention or engagement given to you during practical lessons from lecturers? From your colleague students?
   - Share some challenges you face in learning computer literacy skills.

2. **What are the experiences of students with visual impairment in learning information literacy skills at UEW?**

   - Describe what you go through when you assigned to locate and retrieve information for your projects and assignments.
   - How do you access information from the internet? Using your phone; how? Using your computer; how?
   - Sources you get information from in the university community and how
   - How does your impairment affect you in getting information from the internet and libraries?
   - How do you keep digital information you see relevant when you come across them?
   - How do you evaluate the validity and authenticity of an information before using them?
   - Describe any challenges you have encountered in locating, retrieving and using information for your academic tasks.

3. **How do students with visual impairment experience the integration of technology in their learning process at UEW?**

   - Apart from the ICT facilities the school has provided, which other technologies do you use more often to support your academic work?
   - Computers, cellphones and tablets are the most common assistive devices around here; How are you experiencing these devices concerning accessibility; usability options?
   - Share your experiences the: Use of Learning Management Systems (V-Class); Use of Student Online Portal.
   - What are the challenges you face in using ICT technology to support your academic work?

4. **How can the study of ICT be improved for students with visual impairment in UEW?**

    - What strategies or approaches do you suggest should be done during lectures to help meet your needs during ICT class?
    - Which ICT tools and resources' do you suggest if made available would help you as visually impaired in the study and integration of ICT in your academics?
    - Which adaptations and modifications can be made to ICT tools and resources to meet the needs of students with visual impairment?
    - In what ways do you suggest lecturers should improve upon classroom engagement for students with visual impairment during ICT lessons?

**GUIDE FOR ICT INSTRUCTORS**

- Share some of the complaints students with visual impairment bring to you with regards to studying the course.
- Challenges you have observed them go through with regards to studying the course.
- Measures to improve the study of ICT for students with visual impairment.

# APPENDIX B

## OBSERVATION CHECKLIST

## BASIC COMPUTER SKILLS

| ITEM | Y | N |
|---|---|---|
| Turn on the computer | | |
| Turn on the monitor | | |
| Adjust volume on the monitor | | |
| Identifies location of all arithmetic keys on the numeric keypad | | |
| Identifies location of function keys (f-keys) | | |
| Identifies location of all numbers on the *alpha* keyboard | | |
| Identifies location of all punctuation keys on the *alpha* keyboard, including secondary keys (with shift-key as modifier) | | |
| Identifies location of all letters on the *alpha* keyboard | | |
| Identifies location of all navigation keys on the keyboard | | |
| Identifies location of all modifier keys on the *alpha* keyboard (Ctrl, Alt, Tab, Backspace, Enter, Shift, Window key, Application key, Caps Lock, Escape, etc.) | | |
| Find and launch programmes/applications (start menu) | | |
| Use of Hot Keys and Keyboard Shortcuts | | |
| Create new folders and files | | |
| Open and Close window/application/document | | |
| Copy/paste files | | |
| Run multiple applications simultaneously, alternating among them [Task switching (cycle between open windows)] | | |
| Create new window/document | | |
| Properly shut down computer | | |

## INTERNET AND WEB BROWSING

| | | |
|---|---|---|
| Open the internet browser | | |
| Navigate to a given URL | | |
| Navigate between open tabs | | |
| Open and navigate browser history | | |
| Open and navigate bookmarks menu | | |
| Conduct basic search for web-sites | | |
| Conduct basic search and navigate for images, diagrams and tables | | |
| Conduct basic search for news | | |
| Download images from Internet | | |
| Cite sources, acquire exact url | | |
| Download files appropriately | | |

## INTERACTION WITH BASIC SOFTWARE APPLICATIONS

### Word Processing

| | | |
|---|---|---|
| Navigate a document using arrow keys | | |
| Navigate to the beginning or end of a document | | |
| Select Text | | |
| Copy/paste characters/words/paragraphs from documents | | |
| Cut/paste characters/words/paragraphs from documents | | |
| Change alignment | | |
| Change font/font style/font size/font color/font effects | | |
| Manipulate line spacing | | |
| Insert items (tables, images etc) | | |
| Use word wrap with images | | |
| Utilize header and footer | | |

| | | |
|---|---|---|
| Insert footnotes | | |
| Conduct word count | | |
| Determine number of pages | | |
| Manipulate margins | | |
| Add page breaks to a document (bibliography) | | |
| Add page numbers to a document | | |
| Select page orientation (portrait or landscape) | | |
| Print in accessible format (e.g. print, large print, Braille, Braille and print) | | |

**PowerPoint**

| | | |
|---|---|---|
| Navigate an existing presentation using page up and page down | | |
| Navigate through individual slides using tab and shift+tab | | |
| Navigate to the beginning and end of a presentation | | |
| Add text to pre-defined areas (i.e. *title* and *subtitle*) | | |
| Create new slide | | |
| Create new slide with customized theme (other than default title and content) | | |
| Change font/font style/font size/font color/font effects | | |
| Remove outline format (default bullets) | | |
| Adjust or add outline format varieties (numbering or bullets) | | |
| Use WordArt styles including text fill, text outline, and text effects | | |
| Insert items (pictures, shapes, sound, videos, tables etc) | | |
| Use header and footer (including inserting date and slide number) | | |
| Adjust slide orientation (portrait or landscape) | | |
| Change slide design them (understand built-in design themes) | | |
| Change slide design colors (understand built-in design color concepts and be able to articulate asking for help in selecting a design color) | | |
| Include Animations to slide and within slide transitions | | |

| | | |
|---|---|---|
| Adjust when animation begins (on click, with previous slide, after previous slide) | | |
| Utilize transition (direction, speed) | | |

**Excel**

| | | |
|---|---|---|
| Navigate spreadsheet using arrow keys, tab, shift+tab, and enter | | |
| Enter texts/numbers into desired cell(s) | | |
| Create a simple table using spreadsheet | | |
| Edit content of individual cells by writing over existing content | | |
| Edit content of individual cells using the (F2) key | | |
| Select multiple cells using navigation keys + shift key | | |
| Knowledge of definitions and function of sum, difference, product, and multiple | | |
| Use of function *=sum(b2,e2)* to total a row also be able to total a column, i.e. *=sum(b2,b6)* | | |
| Use of functions =product(*cell,cell*), =quotient(*cell,cell*), *=cell-cell* for subtraction | | |
| Be able to use formulas from #207 and #208 as well as be able to use *=cell+cell, =cell-cell, =cell*cell, =cell/cell* | | |
| Use of format punctuations within a formula, i.e. *=sum(A1:A4,A8)* | | |
| Insert or delete columns and rows | | |
| Insert Chart using data from spreadsheet | | |
| Copy Chart from spreadsheet and paste into Word, PowerPoint, e-mail, or other applicable application | | |
| Edit chart items and style | | |
| Add/edit data labels, legend of chart | | |
| Navigate and understand *Formulas* ribbon | | |
| Sort columns and rows using automatic sorting option | | |
| Change number type (i.e. dollar, percent) | | |

| | | |
|---|---|---|
| Change place value before and after decimal | | |
| Edit Cells | | |
| Use multiple sheets | | |
| Print choice selection (i.e. entire workbook, active sheet, selection) | | |

# APPENDIX C

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF SPECIAL EDUCATION
P.O. Box 25, Winneba, Ghana
+233 (020) 2041069

19th May, 2023

**TO WHOM IT MAY CONCERN**

Dear Sir/Madam,

***LETTER OF INTRODUCTION: MS. ALBERTA KORANKYEWAA KYEI***

I write to introduce to you, **Ms. Alberta Korankyewaa Kyei** an M.Phil. student of the Department of Special Education with index number 220031968.

She is currently working on her thesis on the topic: **"Experiences of Students with Visual Impairment in Studying ICT at the University of Education, Winneba."** She needs to conduct interview in your Institution.

I would be grateful if you could give her the needed assistance.

Thank you for the consideration and assistance.

Yours faithfully,

.....
**MRS. FLORENCE AKUA MENSAH**
***(Ag. Head of Department)***

# APPENDIX D

## INTERVIEW CONSENT FORM

**Invitation**

You are being invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

**What is the purpose of the project?**

The project seeks to explore the experiences of students with visual impairments in studying ICT in University of Education, Winneba.

**About the researcher**

I am Alberta Korankyewaa Kyei, a final year MPhil Special Education student from the University of Education, Winneba, and I am undertaking my thesis which is an independent research study. I am undertaking research in the topic area of **"Experiences of students with visual impairments in studying ICT at the University of Education, Winneba".**

**What do I have to do? / What will happen to me if I take part?**

Having shown interest and having received information about the study, potential participants will be invited to discuss the study with the researcher by face-to-face interview session in an environment conducive for the participant.

**What will happen to my personal information?**

Your personal information will be anonymized and will be treated confidentially.

**What are the possible disadvantages and risks of taking part?**

There are no anticipated risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.

**What are the possible benefits of taking part?**

There are no direct benefits for your participation, however, your input will contribute to the development and modifications of policies concerning ICT education to suit the learning needs of students with visual impairment.

**Use, dissemination and storage of research data**

Information gathered will be use strictly for academic purposes and all data will be destroyed as soon as the research has been approved and research candidate is cleared.

**Will I be recorded, and how will the recorded media be used?**

Interview session will be recorded. The audio recordings of the interview during this research will be used only for analysis and for illustration in conference presentations and lectures. No other use will be made of them without your written permission, and no one outside the project will be allowed access to the original recordings.

**Agreement**

- I confirm that I have read and understand the information sheet explaining the above research project.
- I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline.
- I understand that members of the research team may have access to my anonymized responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that may result from the research.
- I understand that my responses will be kept strictly confidential.
- I understand that the data collected from me may be stored and used in relevant future research in an anonymized.
- I understand that relevant sections of the data collected during the study, may be looked at by project supervisor and individuals from the Department of Special Education, University of Education, Winneba where it is relevant to my taking part in this research.
- I agree to take part in the above research project and will inform the lead researcher should my contact details change.

_____ _____

**Participants Signature** **Date**

_____ _____

**Researchers Signature** **Date**