UNIVERSITY OF EDUCATION, WINNEBA

ASSESSING COMPUTER TECHNOLOGY USAGE BY STUDENTS WITH VISUAL IMPAIRMENT AT THE UNIVERSITY OF EDUCATION, WINNEBA

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DECLARATION

Student's Declaration

I, Farrouk Okyere, declare that this thesis, except for quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my 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 were supervised by the guidelines for the supervision of theses 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, Abass Abdulai and Hajarah Adam, for their love and support, and to my siblings, Sadick, Osman, and Nafisah.

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I express heartfelt appreciation toward Dr. Awini Adam because he provided constant guidance throughout my research investigation from beginning to end. Interacting with him enabled me to gain deeper knowledge in research, and I will always express my gratitude.

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ABSTRACT

The study focused on assessing computer technology usage among students with visual impairment at the University of Education, Winneba (UEW). The sample was made up of 20 students with visual impairment from various departments and one staff member responsible for supporting students' use of computer technology. The researcher collected data through semi-structured interviews, together with focus group discussions and observational methods, within a qualitative research approach and a case study design. The findings unveiled several noteworthy outcomes. Students needed assistive technologies such as JAWS and NVDA screen readers to use computer technology. Many students faced challenges with high-level computer skills because they received insufficient training in advanced document preparation, web usage, and software tweaks. Students who demonstrated independent computer use existed along with individuals who needed peer assistance because their institution's support was not enough. Students faced additional challenges when striving to use computer technology because they lacked personal computers and experienced unreliable assistive programmes in addition to financial limitations. The research pointed out several limitations that ranged from limited access to university digital interfaces to insufficient technological equipment and limited skills in using assistive tools and an inadequate support structure. The study recommends strengthening institutional provisions through sustained training in computer and assistive technologies, improved access to functional devices and updated accessibility software, and the enhancement of reliable internet services. It further emphasises the need for adequate technical support structures, integration of assistive technology training within the curriculum, and the establishment of financial support or device loan schemes.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

Assessing computer technology usage by students with visual impairment is essential to ensure that students with varying abilities can have equal access and opportunities to higher levels of education and enhance their academic success at the University of Education, Winneba (UEW). Computer technology is more than just an electronic device for students with visual impairment. It is a vital academic tool that promotes inclusion and independence. It allows students with visual impairment to actively participate in all aspects of academic work, such as access to information from both offline and online sources, and interact with instructional materials such as slide presentations and Word documents. Looking into computer technology usage among students with visual impairment would highlight meaningful insights into the skills they have on computer technology, how they access and use computer technology features, the available support they require to use the computer technology in their studies, and the barriers they face in using computer technology in their academic activities.

Integrating computer technology into education has brought a change in today's teaching and learning methods. Computers, together with the internet and a variety of software applications, have reshaped the educational landscape, providing educators and learners with advanced tools for the teaching and learning process (Hussain et al., 2024, pp. 21–30). In recent years, technological advancements have transformed the educational sector, offering different opportunities and challenges for students with different abilities across different backgrounds (Kalyani, 2024). Amongst these students, those with visual impairment face unique challenges that hinder their access to information and learning resources (Gamage et al., 2023). Souza et al. (2024) described computer technology for individuals with visual impairment as a specialised integration of hardware and software components designed specifically for a certain group of individuals (partial or complete vision loss) to enable them to access digital information, communication and learning materials.

Computer technology for individuals with visual impairment is made up of both adaptive hardware and software designed to facilitate easy access to digital content. Hardware components often consist of Braille displays, which translate input text into tactile Braille (raised dots), and specialised adapted keyboards embossed with markings for easy usage and navigation (Zeng & Weber, 2025). About software, applications specifically developed for individuals with visual impairment include screen-reading programmes such as JAWS (Job Access with Speech) and NVDA (Nonvisual Desktop Access). These tools transform on-screen text and interface elements into synthesised speech output, thereby enabling users to navigate, access information, and interact effectively with computer systems through auditory feedback (Maćkowski et al., 2023). Software such as magnification software, voice recognition tools, and text-to-speech converters are also integral components of this technology (Gamage et al., 2023). The integration of specialised assistive software with conventional computer hardware enables individuals who are blind or partially sighted to use computer technologies in ways comparable to their sighted peers (Štemberger & Konrad, 2021).

UEW located in Ghana, which turns to be one of the recognised leading universities in West Africa practicing inclusive education, computer technology is essential for ensuring that students with visual impairment can fully participate in academic programmes and various activities. However, it is essential to know whether these students with visual impairment have the needed skills for the use of computer technology and its related applications in their academic journey. For instance, Teye (2019) examined the computing knowledge and skills of students with disabilities, including those with visual impairments.

The findings from their study revealed that while many students possessed some knowledge and skills in basic computer operations, their competencies as students were inadequate for higher education-level academic work. Specifically, students demonstrated limited proficiency in using some software applications, word processing documents and formatting, email communication platforms, and internet and web browsing. Similarly, another study conducted by Ofori-Atta et al. (2023) at the UEW investigated the computing knowledge of students with visual impairment. Their study concluded that while participants were knowledgeable in some aspects of basic computer operations, they lacked competence in using software applications. These findings highlighted the importance of assessing the current knowledge of students with visual impairment regarding the use of computer technology at UEW. Despite these findings, existing research has largely focused on general computing knowledge rather than providing a comprehensive understanding of students' practical skills, actual usage of computer technology, support requirements, and barriers within the UEW learning environment. Consequently, there is limited context-specific evidence on how students with visual impairment at UEW use computer technology in their academic activities.

Popular and most used screen readers among students with visual impairment include Apple's VoiceOver, Google's TalkBack, and Microsoft's Narrator, which provide auditory feedback that helps students navigate websites, read documents, and complete online tasks independently and with ease (Kirboyun, 2021). These tools are important for students with visual impairment so far as computer technology usage is concerned, as they enable them to interact with computer systems with ease without relying on sight or sighted colleagues. Students with partial vision frequently rely on screen magnifiers to enlarge and clarify on-screen text and images, which helps them fully utilise their residual vision and navigate computer applications more efficiently. Screen magnifiers are either an inbuilt software application or a downloaded software application which enlarges texts and images on the computer screen or desktop, making texts and icons easier to identify, read and navigate (Royal National Institute of Blind People, 2020). These tools also have features that allow users to adjust text size, change contrast and colour settings to suit their preferences, specific needs, and abilities. Screen magnifiers are particularly beneficial for students who have low vision (who do not rely solely on auditory feedback) but need enlargement and enhancements of visual content on the computer to interact effectively with digital content on the computer (Momotaz et al., 2023). Additionally, keyboard shortcuts and voice commands are also major techniques and widely used techniques that facilitate navigation and interaction with computer technology and its related systems. Keyboard shortcuts have been known to assist students irrespective of their abilities, bypassing the need for mouse-driven navigation or solely depending on a computer mouse, enabling them to perform tasks quickly and easily (American Foundation for the Blind, 2021). Voice-controlled software allows students to complete tasks hands-free without the use of a keyboard, further enhancing their independence and reducing reliance on physical interfaces (American Foundation for the Blind, 2021; RNIB, 2020). Using the voice commands and keyboard shortcuts has been known to make it easier for students with visual impairment to interact and engage with their computer technology and access educational content with ease.

Ensuring that students with visual impairment can fully benefit from available computer technology necessitates the implementation of various appropriate support systems. These systems are important in equipping students with the knowledge, tools, skills, training, and resources needed to succeed in the academic space (Sibadela et al., 2025). Technical support as part of support services plays an important role in ensuring that assistive technologies, such as the computer, function perfectly. Access to well-trained IT personnel who can assist with updating, troubleshooting, installation, and maintenance of assistive devices is essential to help students with visual impairment to optimise the use of computer technology to their full potential. Without adequate technical support, students are likely to struggle when using computer technology effectively, limiting their ability to fully participate and engage in their studies (Kisanga, 2020). Training programmes for both students and staff are vital. Students must be trained on how to use computer technology and its related assistive technologies meaningfully to navigate academic platforms and complete assignments and quizzes. Faculty and administrative staff should be educated about the needs of students with visual impairment and the importance of creating accessible learning materials that are inclusive to all individuals irrespective of their abilities. Workshops and training sessions can help raise the awareness level of sighted colleagues and promote inclusivity across the university community (Sibadela et al., 2025).

At the University of Education, Winneba, the institution arguably has the highest number of students with visual impairment compared to other tertiary institutions in Ghana. Students with visual impairment at this institution access support services such as braille embossment through the Resource Centre for Students with Special Needs (RCSSN), which is located at the Faculty of Educational Studies (FES), rooms 102 and 104, respectively, at the north campus. The centre has assistive technologies for students with visual impairment and an ICT lab. These facilities are responsible for assisting students in accessing educational resources such as lecture notes and slides, completing assignments, writing quizzes, and preparing for exams. Despite these resources available for students with visual impairment, informal observations by the researcher at the Resource Centre for students with visual impairment showed that a significant number of students with visual impairment prefer using traditional methods for writing and learning, such as using braille, over the use of computer technology. Observations at the Resource Centre indicate that only a small number of students with visual impairment regularly use computers for learning activities and completing examinations or quizzes. During end-of-semester and mid-semester examinations, many students continue to use braille, often receiving embossed braille versions of examination papers and writing their answers in braille (Rockson, 2025). These responses are subsequently transcribed by resource personnel before being sent to lecturers for grading. While this approach is well established, it raises important questions for investigation regarding the factors that influence students' choice of braille versus computer technology. Understanding these factors is relevant to exploring students' skills in using computer technology, the extent to which they utilise its features, the support systems they require, and any barriers they encounter in academic activities.

During the 2022/2023–2023/2024 academic year, preliminary observations indicated that the ICT laboratory for persons with special needs at the University of Education, Winneba, had inadequately functioning computers. This issue left students with no option but to use their personal computers during exam periods, which is less than ideal given the technological limitations they face and the fact that all their learning materials, such as lecture notes and PowerPoint presentations, are on the same computer they will use to write examinations and quizzes. Some of the students who are computer literate cannot afford to buy their laptops, further intensifying the problem where students are not transitioning to the use of computers (Mudra, 2020). The lack of a fully functional ICT lab places an additional burden on students, especially when considering the important role these technologies play in the academic success of students with disabilities. When students are unable to access up-to-date computers and assistive technologies, they are cut off from the full benefits of digital learning resources as compared to their sighted colleagues in the same classrooms (Kyei, 2023).

The lack of functional computers and a reliable ICT laboratory is not the only issue contributing to the low use of computers at the University of Education, Winneba. One major barrier that prevents students with visual impairment from using computer technology is the limited exposure and training in the use of computer technology and its related assistive (Senjam et al., 2021). Many students, especially those in their first year, are new to university life, come from high schools where braille had been their primary learning tool, and as a result, they may feel more comfortable and confident using braille in their academic activities more than using computer technology. For instance, students who have used braille throughout their schooling may have little motivation to learn how to use computer technology, screen readers or braille displays, especially if they have not been adequately trained in using technologies (Rudinger, 2023). Additionally, inadequate technical support services limit students from using ICT tools.

Using computer technology often comes with challenges for students with visual impairment, for example when using screen reader applications (such as JAWS and NVDA), this can be frustrating to users when navigating the computer technology. The American Printing House (2023) emphasises that JAWS is one of the fundamental tools for blind and low-vision students when using the computer. Without proper training, the majority of the students either fail to use these assistive technologies altogether or make very limited use of them, for instance, to read text files. Not having access to trained professionals who can facilitate students in overcoming the challenges during the use of these assistive technologies and also instruct students on the proper usage of these tools means that the majority of students do not derive maximum benefit from the use of these assistive technologies. Biswalo (2024) explained in their research that educators who instruct learners with visual impairment are required to demonstrate competencies and adequate knowledge in the use of assistive technologies to satisfactorily meet the diverse needs of the learners. The implication of this lack of integration with computer technology is profound. The immediate effect is that students with visual impairment are deprived of access to online educational content in the form of e-books, online journals, and interactive learning websites. That the university relies very much on computer platforms for learning, assignments, and examination timetables means that the students with visual impairment is at a disadvantage. This limitation reduces their academic opportunities and potentially impacts their overall academic performance. Studies have determined that the combination of assistive technology with blind and students with visual impairment has the potential to promote many student outcomes in learning and academics (Ketema Dabi & Negassa Golga, 2024).

While Braille literacy remains imperative for the visually impaired, total dependence on Braille can limit access to the broader digital society. In today's technology-driven world, digital literacy and the ability to operate online systems are fundamental skills in most business and work sectors. The Royal National Institute of Blind People (RNIB) (2020), highlights that age, inaccessibility, and cost are large obstacles that individuals who are blind and partially sighted face when adopting and using technology, and this can influence their feelings of competence and achievement. Besides, Kiambati et al. (2024) indicate the importance of digital accessibility to people with visual impairments because challenges in accessing digital technologies have the potential to hinder their complete inclusion in today's society. Therefore, students with visual impairment who do not acquire proficiency in computer technologies are likely to be disadvantaged when they begin working, where digital literacy is increasingly important.

A series of barriers to utilising assistive technology effectively by learners with visual impairment has been presented in prior work. For instance, Quainoo and Dikmen (2024) noted that older individuals with blindness and younger people with visual impairment face obstacles of limited access to computer technology, limited access to assistive technologies, limited technical exposure, and a shortage of teaching staff to support them. For the same, Ofori-Atta et al. (2023) found that although very few students with visual impairment in the University of Education, Winneba were aware of ICT to some degree, they failed to realise the potential application of such technology because of hurdles emerging out of unavailability, proper training, and supply of appliances. Regardless of the existence of reports, however, the literature did not include any document with particular hurdles impacting the applications by students with visual impairment in UEW. The findings of this study will fill this gap by providing a comprehensive review of the factors influencing the use of computer technology by students with visual impairment at UEW.

From the above, the present study seeks to assess the computer technology usage by students with visual impairment at the University of Education, Winneba, through their knowledge, usage patterns, support required, and barriers they face when using computer technology at the University of Education, Winneba.

1.1 Statements of the Problem

The integration of computer technology into the learning process of students with visual impairment in the University of Education, Winneba (UEW), remains a challenge despite the recognised potential of computers and digital learning materials to enhance learning outcomes of students with visual impairment (Awini et al., 2025). The inadequate computers in the ICT Lab earmarked for the use of students with visual impairment are one of the primary challenges as informally observed by the researcher at the Resource Centre for Students with Special Needs. Throughout the period from 2023 to 2024, this laboratory had inadequate computers. This is apart from the problems that this group of students confronts and further highlights the inadequate infrastructure and support systems to which they are subjected. Thus, students with visual impairment have very limited use of the technology tools required to make them academically successful, especially in those subjects that involve digital resources such as numeracy. The absence of inadequate computer merely compounds the difficulties that these students face, dampening their learning space and limiting their ability to engage productively with course material.

At the University of Education, Winneba, students with visual impairment frequently utilise traditional learning tools, such as braille, alongside, or in some instances in place of, computer technology. This pattern may be attributed, in part, to limited opportunities for the effective use of digital tools, as well as variations in computer literacy and familiarity with assistive technologies. Although computer technology offers potential advantages in terms of accessibility, interactivity, and efficiency, students with visual impairment at UEW may encounter barriers to fully benefiting from these resources, including limited infrastructure, inadequate training, and constraints in available support systems. As a result, their interaction with digital resources may differ from that of their sighted peers, which could have implications for their engagement with academic tasks and assessment activities.

This difference in access to and familiarity with computer technology is distressing because it not only affects the grade of the students in the short term but also limits their career opportunities in the long term. In the modern and future digital world, the absence of exposure to and knowledge of computer technology has serious consequences, as it deprives students with visual impairment of learning the digital competencies needed for success in the workplace. There is thus a need to undertake an immediate exploration of the barriers for such students in using computer technology in learning tasks. By realising where these obstacles come from, we can identify strategies with solutions to these obstacles and construct an even more inclusive learning environment for all.

Earlier studies have attempted to explore some of the dimensions of students with disabilities, that is, the visually impaired, in the use of computer technology, but with the large studies failing to meet the benchmark of revealing a complete picture of the advanced knowledge gaps, approaches, and the underlying structure at UEW. For example, Teye (2019) researched ICT skills and knowledge of students with visual impairment, but the research failed to identify where the students lack or where they need intervention. Cabero-Almenara et al. (2023) researched the digital Competence of university students with disabilities and factors that determine it. Furthermore, Amponsah and Bekele (2023) discussed challenges experienced by students with visual impairment when e-learning materials are in use, but did not discuss the larger issue of how such students use technology as a whole within an academic context. Such loopholes in earlier research call for the necessity of a study based on a wider research approach to examining the hindrances, strategies, experiences, and support systems influencing the usage of computer technology by students with visual impairment at UEW. Therefore, a pressing need arises to assess computer technology usage by students with visual impairment at the University of Education, Winneba.

1.2 Purpose of the Study

The purpose of the study was to assess computer technology usage by Students with Visual Impairment at the University of Education, Winneba.

1.3 Research Objectives

The following research objectives were raised to guide the study:

1. To assess the computer skills proficiency of students with visual impairment at the University of Education, Winneba.
2. To examine how students with visual impairment use the features of computer technology at the University of Education, Winneba.

3. To identify the support services available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba.
4. To identify the barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba.

1.4 Research Questions

The following research questions were raised to guide the study:

1. What is the computer skills proficiency of students with visual impairment at the University of Education, Winneba?
2. How do students with visual impairment use the features of computer technology at the University of Education, Winneba?
3. What support services are available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba?
4. What are the barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba?

1.5 Significance of the Study

Assessing computer technology usage by students with visual impairment at the University of Education, Winneba, is critical for promoting inclusive education and equitable access to digital learning resources. By examining the unique needs and experiences of these students, the study provides insights that can improve institutional support, the design of assistive technologies, and the overall learning environment.

Firstly, the study focuses on assessing computer skills proficiency of students with visual impairment at the University of Education, Winneba. The findings will inform university administrators, policymakers, and educators about the current levels of competence in using computer technology. This information can guide the development of targeted training programmes and interventions, ensuring that students with visual impairment acquire the necessary digital skills to engage effectively in academic activities.

Secondly, the study examines how students with visual impairment use the features of computer technology. Understanding the strategies and techniques employed by these students can inform the design of more accessible digital tools and platforms. Technology developers, educators, and disability advocates can use these insights to improve accessibility and usability, fostering more inclusive digital learning environments.

Thirdly, the study identifies the support systems required to optimise the use of computer technology by students with visual impairment. The findings will assist service providers, teachers, and policymakers in designing specialised support programmes, training, and guidance to enhance students' learning experiences and promote inclusive classroom practices.

Finally, the study explores the barriers faced by students with visual impairment in using computer technology. Insights from this investigation can inform adjustments to teaching methodologies, policy formulation, and the development of assistive technologies. By addressing these barriers, students will have improved access to digital resources, enhancing both academic performance and overall learning experience. In addition, the study provides a foundation for future research on inclusive digital education for students with disabilities. Finally, the results of the study would serve as a guide to other researchers who are willing to conduct a similar study.

1.6 Delimitation of the Study

This research was delimited to students with visual impairment at the University of Education, Winneba, although there are students with visual impairment in other Ghanaian Universities. This is because the University of Education, Winneba, has the largest number of students with visual impairment in Ghana. Also, the study concentrated on computer technology usage. Again, the study was delimited to students with visual impairment who were in level 100, 200, and 300, respectively, and had skills in the use of computer technology. This was because they would mostly use computer technology in the learning activities. The study was delimited to cover the following variables: the skills of students with visual impairment regarding the use of computer technology, how students with visual impairment use the features of computer technology, the support systems needed by students with visual impairment to optimise their use of computer technology, and the barriers faced by students with visual impairment in using computer technology.

1.7 Limitations of the Study

The researcher 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.

1.7 Definition of Terms

Computer Technology encompasses all forms of technology that involve computers, including hardware (like desktops, laptops, and tablets) and software (such as operating systems, applications, and assistive technologies).

Computer skills refer to the practical ability to use, manage, and troubleshoot computer systems and technologies.

Usage refers to how frequently and effectively computer technology is employed by the students.

Students with Visual Impairment are learners who have significant difficulties with vision, which cannot be fully corrected with glasses or contact lenses, including those who are partially sighted or blind.

Assessing refers to the process of systematically examining how students with visual impairment use computer technology.

1.9 Organisation 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 is made up of 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 considering 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 the 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 a related literature on Assessing Computer Technology Usage for Students with Visual Impairment at the University of Education, Winneba. The literature reviewed included research articles, journals, and books. The literature review also included empirical studies and the theoretical framework supporting the main issues addressed in this study. The areas that were discussed are:

1. Theoretical Framework
2. Computer Skills Proficiency of Students with Visual Impairment
3. How Students with Visual Impairment Use the Features of Computer Technology
4. Support Services Available to Students with Visual Impairments to Enhance the Use of Computer Technology
5. Barriers Faced by Students with Visual Impairment in Using Computer Technology
6. Summary of Literature Review

2.1 Theoretical Framework

Venkatesh et al. (2003) established the Unified Theory of Acceptance and Use of Technology (UTAUT), which provides a strong theoretical framework for understanding the factors that drive technology acceptance and use. UTAUT provides a complete approach to analysing user behaviour in terms of technology adoption by combining components from various well-known models, including the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB), and the Innovation Diffusion Theory (IDT). The concept recognises four major constructs—Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions—that collectively influence how consumers adopt and engage with new technology. For the study on *Assessing Computer Technology Usage for Students with Visual Impairment at the University of Education, Winneba (UEW),* these constructs offer valuable insight into the factors that shape students with visual impairment's interactions with and use of computer technology. Each of these constructs corresponds directly with the research questions posed in this study, allowing for a detailed exploration of the barriers and support systems that affect technology use among this student group.

Performance Expectancy

Performance Expectancy is the idea that employing technology would improve an individual's task performance and outcomes (Venkatesh et al., 2003). This construct plays a key role in understanding the perceptions of students with visual impairment regarding the utility of computer technology in their academic pursuits. It addresses the question: *What is the computer skills proficiency of students with visual impairment at the University of Education, Winneba?* Essentially, it reflects how students believe that the use of computers and assistive technologies, such as screen readers and Braille displays, will enhance their academic performance. This construct is critical in establishing whether students are aware of the potential benefits of using technology and see it as a necessary tool for academic success. Performance Expectancy is frequently the strongest predictor of technology adoption (Venkatesh et al., 2003), making it an important aspect to consider when assessing how students with visual impairment approach the usage of computer technologies. A high level of Performance Expectancy among students implies that they understand the value of technology in boosting their learning experiences, whereas a low level may indicate a lack of understanding or confidence in using such tools effectively.

Effort Expectancy

Effort Expectancy is the perceived ease of use of a technology (Venkatesh et al., 2003). This concept is especially important for students with visual impairment when assessing the usability of various assistive technologies, including screen readers, Braille displays, magnification software, and other specialised tools developed to help them use computers. Effort Expectancy is directly related to the research question: *How do students with visual impairment use the features of computer technology at the University of Education, Winneba?* This construct explores how intuitive and user-friendly these technologies are for students with visual impairment. If these technologies are difficult to use or need substantial training, students may be less likely to use them for academic purposes. According to research, the easier a technology is to use, the more likely users are to incorporate it into their daily lives (Schorr, 2023; Venkatesh et al., 2003). Understanding the Effort Expectancy of students with visual impairment can shed insight on how the design and accessibility of assistive technologies influence their willingness and ability to use them successfully. By assessing this construct, the study can determine whether students have difficulty utilising these tools and provide ideas about potential improvements to the design and usability of assistive technology.

Social Influence

Social influence relates to an individual's perception that influential others, such as peers, instructors, and support staff, believe they should use technology (Venkatesh et al., 2003). This concept is critical for understanding the function of external support and encouragement in the technology adoption process, especially for students with visual impairment. It addresses the third research question: *What support services are available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba?* Social Influence investigates how the attitudes and behaviours of peers, professors, and support personnel influence students' decisions to use and accept computer technology. For students with visual impairment, social support might take the form of encouragement from instructors and peers, mentorship programmes, or institutional measures to promote technology use. In an academic setting, students who believe their instructors or peers respect the use of technology are more likely to embrace it themselves. This construct contributes to a better understanding of the social dynamics that influence students' perceptions of technology, revealing whether external encouragement or support systems play a beneficial role in supporting their computer use.

Facilitating Conditions

Facilitating Conditions refer to the availability of organisational and technical support, including infrastructure, resources, and training that enable the effective use of technology (Venkatesh et al., 2003). This construct is highly relevant to the fourth research question: *What are the barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba?* Facilitating Conditions include the availability of accessible computers, software, assistive devices, and technical support services, as well as the presence of training programmes and adequate physical locations for technology use. If the appropriate infrastructure and resources are not available, students with visual impairment may experience substantial challenges in using computer technology for their academics. This concept aids in identifying the systemic and institutional barriers to effective technology use, such as inadequate assistive devices, a lack of training, or insufficient technical assistance. By analysing Facilitating Conditions, the study will determine how well the university's physical and organisational resources fulfil the needs of students with visual impairment and identify any gaps that must be filled to improve accessibility.

Integration of Constructs

The integration of these four constructs into the UTAUT framework gives a thorough knowledge of the different aspects that influence students with visual impairment's usage of computer technology. Each construct focuses on a different component of technology adoption: Performance Expectancy reviews perceived benefits, Effort Expectancy examines ease of use, Social Influence investigates external support, and Facilitating

Conditions examines the infrastructure and resources available. By combining these concepts, the study will provide a comprehensive understanding of how human perspectives, societal dynamics, and institutional support systems contribute to or impede the effective use of technology.

This theoretical framework is particularly well-suited to the study objectives since it provides for a comprehensive examination of the factors influencing technology use among UEW students with visual impairment. By investigating each of these factors, the study can provide useful insights into the skills, access, support, and barriers that students face, informing the development of focused interventions and strategies to promote technology use. The UTAUT model directed data collection and analysis, ensuring that individual (e.g., perceptions and ease of use) and institutional (e.g., resources and support) elements were considered. Finally, this study made recommendations to improve the academic experience of students with visual impairment, ensuring fair access to the resources they require for success.

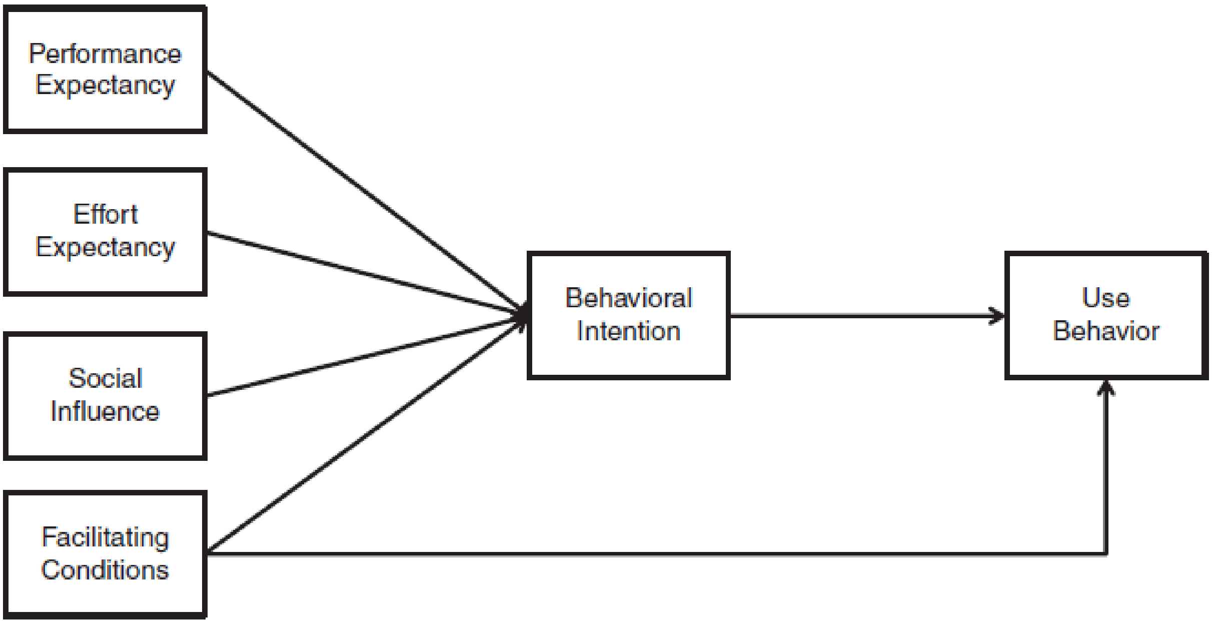

Figure 1: Unified Theory of Acceptance and Use of Technology (UTAUT) Model (Venkatesh et al., 2003)

2.2 Computer Skills Proficiency of Students with Visual Impairment

Today, computer technology has become an integral part of the work of educational institutions as well as the employment sector. For students with visual impairment, learning to use computers is not only an academic necessity, but also a step toward more independence and integration into society. According to Akbar et al. (2024), understanding computer technology in the survival of young pupils in our ever more technologically oriented environment is essential. Computers provide an important resource for expanding educational opportunities for children with visual impairment. Another important aspect of computer technology proficiency is the ability to carry out a few fundamental computer operations. For instance, how to turn a computer on and off is a base but essential skill. Organising and managing digital papers is essential to academic success, and requires creating folders and saving files. In addition, keyboard shortcuts help improve efficiency and productivity, as noted by Álvarez et al. (2025) who found significant inefficiencies in touch-typing and shortcut use amongst students with visual impairment. Recognising and finding desktop icons is also an essential skill. Screen-reader-based applications help visually impaired students to learn their desktop structure and use quickly without having to rely too much on sighted assistance (Nino et al., 2024). This skill is particularly crucial for accessing frequently used programmes and documents quickly. Moreover, although for some students with visual impairment using a mouse precisely is not as easy as the sighted students, screen magnifying software and other input devices like trackballs and touchpads can help. These tools allow to open up graphical user interfaces and put your computer navigation skills to the test (Kanmani, 2023). Along with these, the knowledge of productivity software like word processors and spreadsheets is essential among other activities. These software programmes are essential for writing, editing, and structuring academic papers. Acquah (2023) emphasises the importance of computer literacy, pointing out that competency with these tools can greatly improve academic achievement.

2.2.1 Enhancing Computer Proficiency Among Students with Visual Impairment

Students currently learn related to their communication and problem-solving abilities with modern computer technology. Technology provides students with disabling vision challenges with unlimited access to long-unreachable opportunities. The research of Kyei (2023) validates how computer technology tools enhance student learning of diverse subjects through enhanced communication and expanded information access. Software tools function as equalising instruments which students need to advance their educational progress. Basic computer operations that include booting up and shutting down a computer system and making folders and file storage while utilising the mouse effectively and keyboard mastery and desktop icon identification lead students with visual impairment toward independent information retrieval. The lack of dependence on sighted peers through this independence lets students completely participate in their education. Essential computer operation skills function as essential abilities which enhance the independence of students with visual impairment. Starting and shutting down a computer system remains necessary for basic computer usage. Students gain independence from assistance through this skill which promotes their competence and ability to start learning activities (Kyei, 2023). Academic document management requires users to build folders and store their files because these steps help control their data effectively. Students who properly organise their documents through file management achieve digital workspace order which allows them to locate educational materials more easily (Whittaker et al., 2024). Students who handle multiple assignments with project work need this organisational ability to efficiently locate and store their work.

Students should learn effective keyboard operation to build their level of proficiency. Álvarez et al. (2025) state that students who learn touch typing and shortcut key usage become substantially more productive. Students who need to navigate through activities efficiently can use shortcut keys to perform their work without extensive searching and tedious movements that cause difficulty for people with visual impairment. The system's efficiency becomes essential when dealing with timed tasks or tests since time management is crucial with each passing second. The ability to use a keyboard allows students to utilise screen readers that convert digital text into speech or Braille output according to Okolo et al. (2024). Specific implementation of these technologies with students during their regular activities leads to upgraded academic achievement and stronger self-assurance. The mastery of using a mouse requires greater skill for students who have visual impairments but it stands as a fundamental ability to develop. Trackballs alongside touchpads serve as alternative input tools which improve readability for users (Kanmani, 2023). Students who use screen magnification software will find operating a mouse becomes easier as the software enlarges the visible on-screen objects until they are easy to select and locate (Nino et al., 2024). Some writers support using keyboard shortcuts and screen readers to meet the needs of students with visual impairment since these methods eliminate interaction with visual components that cause them difficulty (Okolo et al., 2024). The need for customised educational approaches becomes evident because these methods should align with students' individual abilities and preference styles.

User competence in computer operations heavily depends on their ability to locate and recognise desktop icons. Youth who are visually impaired can learn about their desktop layout and desktop management through screen reader programmes. The skill enables them to achieve quicker access to programmes and data while simultaneously granting digital environment control (Nino et al., 2024). The use of educational software together with internet resources both mandatory for modern education demands proficient navigation skills from students. Through quick application identification and execution students gain access to various learning opportunities that include research work and interactive simulations. Researchers share the understanding of these capabilities' importance yet maintain different views regarding the most suitable teaching strategies and assistance methods for kids who are visually impaired. Several writers believe that education should prioritise technology through the adoption of contemporary assistive technologies together with early training for software platforms. Phochai et al. (2024) present evidence demonstrating that students with visual impairment can reduce digital literacy gaps by receiving early computer technology training with comprehensive methods. The educational approach establishes robust technological competence which students can build upon at each stage of their academic journey.

Several researchers continued to explain that a strategic approach requires blending traditional tactile educational methods with electronic teaching practises. Hashim and Thomas (2023) prove that excessive technological reliance sometimes causes students to ignore key tactile and spatial skills that affect their comprehensive learning progress as students with visual impairment. A holistic approach uniting traditional and technological teaching methods provides the optimal learning atmosphere according to such educational beliefs. The use of tactile methods enables teachers to build across-the-board student expertise which will benefit their achievements in digital technology and physical spaces. Computer technology enhances the academic journey of students with visual impairment through appropriate tools which help them grasp the entire course material according to Ofori-Atta et al. (2023). The screen reader technologies JAWS and NVDA transform textual information into speech or Braille output to enhance accessibility and learning comprehension according to Okolo et al. (2024). The tools provide students with self-autonomy for assignment completion and research by granting them digital library and database independence. Educational tools that students encounter in their learning environment lead to better academic results and greater classroom participation according to Phochai et al. (2024). Students with visual impairment depend entirely on-screen readers to obtain digital content. Students benefit from using the screen readers NVDA (NonVisual Desktop Access) and JAWS (Job Access with Speech) to convert digital screen text into spoken feedback and text-based Braille for adapting their interactions with educational material (Okolo et al., 2024). The essential character of this accessibility enables users to work with digital versions of textbooks and research articles and, educational resources provided in digital format. Screen readers enable students with disabilities to read complex texts while improving their critical thought capabilities according to Phochai et al. (2024). By giving students access to digital libraries and databases these tools enable students to finish their research-based coursework. Student academic success requires independent research capability so they can explore subjects thoroughly and collect different perspectives to write well-rounded arguments (Nino et al., 2024). Students who use screen readers can gain control of their academic success by obtaining convenient access to diverse information which helps them achieve excellence in their studies despite having visual impairments.

Research has officially documented all the advantages of assistive technologies and screen readers yet multiple studies present different conclusions about their extensive impact. Some researchers claim these necessary technologies are not sufficient to solve every problem. According to Kimogol (2023), technology limitations stem from insufficient training and unfamiliarity with it. Students who lack proper training struggle to maximise their screen reader use which hinders their educational progress. The perspective recommends that students require training in assistive technology usage through extensive programmes to develop their ability to use them effectively. Additionally, there is a debate about the potential over-reliance on technology. Hashim and Thomas (2023) argue that an overemphasis on technological solutions can sometimes lead to the neglect of other important skills, such as tactile learning and spatial awareness. The researchers support an educational model which unites modern technology and conventional methods to develop a whole curriculum. Educators can provide students with visual impairment with the best skills for operating in digital and physical spaces by integrating screen reader systems with hands-on workshops. Online content accessibility represents a crucial factor which affects its utilisation. According to Kanmani (2023), various online platforms do not work with screen reader programmes which creates significant operational challenges for students with visual impairment. Students with access to limited or weak websites face problems in navigation as their academic ability suffers because of information barriers. The issue emphasises the necessity for campaigning about inclusive web design principles together with accessible educational content expansion across all pupil populations.

Computer technology enables better communication patterns among students with visual impairment through educational platforms. Students who use assistive technology such as screen readers can easily access software programmes that include email clients and instant messaging while using social media to communicate with peers and teachers and family members. The ability to communicate effectively represents a fundamental need for both educational teamwork and interpersonal social interactions in schools. Students with visual impairment experience completely different ways to handle their learning environment because of computer technology implementations. Educational email services like clients let students deliver messages to professors and course fellows for assignment completion along with immediate feedback delivery (Nino et al, 2024).

The real-time communication features in instant messaging apps are vital for both project teamwork and school classroom exchanges. Through these collaborative communication tools students can fully participate in team-based learning sessions which in turn increases student-to-student inclusion and group work (Okolo et al., 2024). Students with visual impairment benefit from contemporary social media networks which promote better student communication practises. Students can access Facebook and Twitter and LinkedIn through screen readers to connect with more audience members. The networks enable students to become members of interest communities while engaging in academic discussions as they stay informed about educational programmes and school activities (Phochai et al., 2024). This supports students' educational advancement and enables them to develop vital social relationships which provide mutual assistance and moral support. Various perspectives exist regarding the degree to which computer technology supports students who have visual disabilities. Academics who focus on the advantages of these tools recognise that their success depends substantially on software accessibility together with available training quality. Based on Khalid and Owusu-Boateng (2024), each communication channel presents different accessibility levels which lead students to encounter barriers during their resource utilisation. Screen readers are unable to operate with specific email clients and social media sites resulting in impaired navigation capabilities for visually impaired users when they try to access materials through these platforms.

According to Alsolami (2022), all students need appropriate training about communication technology. Insufficient training about how to utilise these technologies creates major barriers which result in student confusion and dropout from course activities. The necessity of educating students with visual impairment through fully comprehensive training includes teaching them effective strategies for using communication technology and navigating web content. Social isolation worries students both within and outside educational settings. Technology used for communication enables easier contact yet improper utilisation of these systems may increase feelings of being cut off from others. According to Hashim and Thomas (2023), excessive dependence on digital communication leads to reduced real-world interaction that students with visual impairment need for building their social abilities and emotional competency. Students with visual impairment need electronic and face-to-face social interactions which should exist in balance to avoid any gaps in their social development. Furthermore, the level of interaction on social media and its platforms can vary. Even though these platforms offer opportunities for social connection and acquiring knowledge, they can also expose students irrespective of their abilities to negative activities and experiences such as cyberbullying or misinformation (Kanmani, 2023). This turns out to be essential for educators and parents to provide guidance on safe and responsible use of social media, helping students navigate these platforms positively and beneficially to their academic and social life.

2.2.2 Internet Proficiency and Accessibility

The internet now serves as an essential foundation for educational activity and labour force engagement and social activities. Students with visual impairment need to develop competent internet skills. The authors Phochai et al. (2024) stress that online capabilities enable users to find educational materials and professional positions while connecting with their social network. Most online platforms contain visual designs which cause significant accessibility problems. Nino et al. (2024) determine that students with visual impairment find it difficult to use contemporary graphical user interfaces for navigation. Web accessibility challenges become worse because most websites lack disabled user consideration during development. According to Kanmani (2023), people who have visual challenges showed higher levels of satisfaction for web pages that included alternative methods to obtain information. Web developers need to prioritise accessibility in their work because students alongside them need to master proper internet navigation methods.

2.3 Accessing the Features of Computer Technology

New computer technology developments have brought major social changes to human communication methods as well as academic and professional practises. Specialised modifications become essential for students who have visual impairments when they try to use these technological advancements as part of their learning process. The World Health Organisation (WHO) estimates that visual impairment affects 2.2 billion people across the world including individuals who have severe sight loss and people who are fully blind (Marques et al., 2021). Through assistive technologies society now provides essential digital access tools to support complete participation in contemporary life for all individuals.

The combination of computers and assistive technologies leads to better information access opportunities for people who are blind and visually impaired. Assistive technologies access text on the screen through their synthesiser hardware units or screen reader software offerings (Souza et al., 2024). Braille display uses Braille codes while screen reader operates through the common alphabet according to Shokat et al. (2020). The Braille display functions by reading text in single line, while it does not provide screen-captioning for complete pages. The way users who are blind seek serial information undergoes a significant impact because of this method (Shokat et al., 2020).

2.3.1 Keyboard Shortcuts

Computer-based interaction mainly depends on keyboard usage for people with visual impairments. The reason behind this dependence is the inability to utilise graphical user interfaces (GUIs) effectively in the manner they were designed to work. Students who have visual impairments need keyboard shortcuts to achieve appropriate computer accessibility. Programming command sequences as shortcuts help users navigate applications more effectively thus overcoming functional barriers that come from vision challenges. Students who have visual impairments benefit from keyboard shortcuts because they enable simple access to digital content and alteration of it which enhances their educational experiences along with their independence levels. People with visual impairment gain significant value from keyboard navigation because they can access digital material by eliminating the dependence on visual cues. Through this engagement method users gain empowerment because they receive a different approach to handling digital information thus enabling them to perform work independently and quickly. Keyboards provide users the navigational and interactive capabilities that overcome the problems triggered by graphical user interfaces designed specifically for sighted users.

Nicolau and Montague (2019), identify keyboard shortcuts as fundamental features when sighted people work with computers through non-visual means. Visual impairment users benefit from these command shortcuts because they boost their productivity and simplify multiple tasks such as navigation and text management and command procedures. Users achieve rapid and precise control of digital content together with command execution and workflow management through memorised predetermined key combinations that perform tasks without visual feedback. Users find the feature very helpful because it works even when there is no visual feedback available.

Among all navigation shortcuts the Tab key stands out as one of the most popular. The Tab key enables users to proceed through all web elements and application components which can receive focus beginning from the first interactive element on the screen. Users can navigate fragments using the Tab key in the exact sequence they appear on the screen thus benefiting students with visual impairment who depend on screen readers and keyboard access. Aljarallah and Dutta (2024), explain that the Tab key enables users to navigate systematically while emphasising its function in supporting interactive feature use without visual feedback requirements. Users can reverse-focus their way through focusable elements on a page with the Shift + Tab key combination. Users must be able to navigate elements back and forth due to the importance of this two-directional feature for backward and forward access. Nicolau and Montague (2019), explain that the dual direction interface traversal capability enables visually impaired persons to access digital interface regions, which improves their usability control.

Activation of particular interface items requires pressing the Enter key. Using the Enter key can activate different operations, including link launch, form submission or execution of commands (Fan et al., 2023). The activation of this key feature benefits keyboard-only users because it lets them perform their tasks and access content without needing to use a mouse. As Ramesh et al. (2025) mention in their research, users find keyboard shortcuts effective for delivering an accessible and efficient user experience so the Enter key serves this purpose. Students with visual impairment can benefit from text manipulation capabilities, which keyboard shortcuts provide to improve their computer usage efficiency. The keyboard shortcuts help users better handle and modify their text in situations that do not need visual feedback during word processing, data input, and more advanced text work. Both copying and pasting text require users to activate keyboard commands Ctrl + C and Ctrl + V. These specific commands serve to accelerate text manipulation tasks by enabling users to efficiently duplicate and relocate portions of text. Aljarallah and Dutta (2024) state that productivity and accuracy thrive on these shortcuts primarily because they lessen the need for user-initiated manual actions that prove challenging for visually-impaired users. Through keyboard shortcuts, users who have visual impairments eliminate the need to navigate complicated menus or use mouse interaction with context-sensitive items since those processes are challenging without visual cues.

The Ctrl + F shortcut works effectively to search and identify particular text inside documents and webpages. Users gain access through this command to a searching interface that allows text entry for locating selected keywords. The functionality makes text and complex documents more accessible to explore expediently. The quick capability of using keyboard shortcuts to locate specific information reduces both reading times and prevents errors, as found by Aljarallah and Dutta (2024), particularly for users who require screen readers for text-based content access. The implementation of text manipulation shortcuts develops better efficiency alongside an accessible user interface. The process of selecting all text content becomes faster with Ctrl + A and cutting text with Ctrl + X as two fundamental keyboard commands for managing large text bodies. Enable users to select entire blocks of text or eliminate content by using these commands without needing exact cursor movements. According to Fan et al. (2023), these shortcuts deliver efficiency since users finish complex text manipulation tasks rapidly with precision, which enhances their workplace output.

Keyboard shortcuts serve two functions that aid both text formatting processes and editing operations. Users can use commands Ctrl + B to make text bold Ctrl + I to add italics, and Ctrl + U to apply underlining effects. The shortcuts come in handy, particularly during document editing, because well-formatted information matters for proper presentation. Such shortcuts create a streamlined workflow because users can effortlessly implement formatting adjustments without navigating through different menus or dialogues, as described by Nicolau and Montague (2019). The application of keyboard shortcuts has an effect on the mental workload. Users who use standard key combinations need to expend less mental effort for text manipulation tasks when compared to interface navigation through visual means. The arrangement benefits users with visual limitations because it lets them skip visual information interpretation to concentrate on their work instead. User experiences become both more intuitive and mentally restful when keyboard shortcuts are used, according to findings published by Ramesh et al. (2025). Using keyboard shortcuts automatically simplifies command execution for users. The browser operation Ctrl + Tab enables users to change between active browser tabs, while Alt + Tab functions as a programme switching interface. Users benefit from multiple active tasks through these shortcuts, which enable them to handle more programmes simultaneously for better efficiency and productivity levels.

Keyboard shortcuts function as crucial tools because they let users with visual impairment access their computers through simple non-visual methods. Users can use the Ctrl + Tab shortcut to switch between tabs in web browser applications. Users with visual impairments find this method extremely helpful because they need to view numerous online pages both for exploration purposes and research needs. Users who hold down the Ctrl key while clicking the Tab key can easily move between their open tabs without the visual difficulty of manual mouse clicks. Pressing the Tab key allows users to navigate all tabs one by one, while this operation continues between different tabs. This functionality receives additional assistance from screen readers because they announce each tab title when users select it, which provides an audio notification to help users track their browser position. The Alt + Tab shortcut functions as a practical tool when dealing with many active applications. The user can select multiple applications using the Alt key while clicking the Tab key consecutively. This allows for cycling through all active programmes. The combination creates an accessible process for users who are visually impaired to switch tasks on different programmes without needing eyesight to discover each application window.

The notification system of screen readers vocalises application names while highlighting a selection. This communication system helps users track their current position in available applications. The audio feedback system allows users to navigate and handle their computer environment efficiently. These shortcuts provide more benefits than their role as navigational aids. The combination of these shortcuts raises productivity levels by shortening the amount of time necessary for transition between different tasks for people with visual impairments. For instance, a student with visual impairment using computer technology in writing a report or conducting any form of academic research will need to keep switching between a word processor and a web browser to consult online resources. The Alt + Tab key combination allows the user to switch through apps and tabs easily and conveniently between the two programmes without interrupting their work and disturbing them. Smooth switching is crucial in preserving focus and efficiency.

2.3.2 Navigating Through Tabs and Windows

Effective window and tab navigation is essential for students who work with multiple projects since keyboard shortcuts remain crucial for their workplace tasks. Proficiency in these commands helps students improve their work efficiency, combined with an enhanced workflow procedure. Users can navigate tabs and windows, plus applications, through the most frequently utilised keyboard shortcuts according to this section. Your digital workspace organisation depends on regular tab opening and closing operations to stay functional. Web browsers enable users to start new tabs by pressing Ctrl + T while they work on existing processes (Fan et al., 2023). The feature helps students working on online research by allowing them to view multiple forms of information simultaneously. Students who need to research for a paper can activate this shortcut for multiple scholarly articles which will simplify their study and boost the research effectiveness. Ctrl + W provides the ability to close an active browser tab, which deduces browser clutter, making the browser easier to maintain order (Aljarallah & Dutta, 2024). Users must focus on efficient tab management since an excessive number of open tabs leads to distractions, reducing their concentration. Students benefit greatly from this keyboard shortcut to close tabs they do not need before moving on to their relevant content. Swift tab collapsing creates a better user experience through the generation of cleaner and easier-to-control browsing conditions.

The Ctrl + Shift + T serves as an essential operation to help restore tabs that were shut by mistake. The Ctrl + Shift + T command helps users instantly retrieve their earlier closed tab, thus preserving important web page content (Keddisseh et al., 2021). The tab restoration tool saves crucial information that students usually unintentionally mark for deletion from their view. Uninterrupted work recovery ability provides essential protection for productivity while helping avoid resource wastage in the work environment. The successful management of digital workplaces depends heavily on an efficient method to switch between tabs. The Ctrl + Tab command organises active tab navigation through sequential movement according to Ramesh et al. (2025). Digital workplace management provides a beneficial shortcut that helps students manage their multiple responsibilities between research tasks, virtual classes, and social media activities. This feature generates a quick tab switching capability that students can use to maintain control over their activities and handle their time effectively.

Users can easily access their last visited tab with the Ctrl + Shift + Tab command to maintain their productivity flow (Fan et al., 2023). Students experience an efficient total browser navigation due to the combination of Ctrl + Tab and Ctrl + Shift + Tab commands, which allow seamless browser tab switching. Prime among workplace productivity tools are these tab navigation features because they maintain user focus when people work on tasks that demand repeated transitions between information sources. Digital navigation requires an effective method to manage multiple windows. Users can end their open window at the current moment using Alt + F4 series, which operates across web browsers and additional programmes (Aljarallah & Dutta, 2024). Students can use Alt + F4 to quickly terminate their word processing applications and email clients, along with their additional programmes, after finishing their tasks. The command serves to tidy up the desktop and thus enables both increased productivity and enhanced organisational focus. Students can maintain their focus on important work by closing unwanted windows effectively. Students need to master keyboard shortcuts because these tools speed up their digital workplace navigation and management tasks. Students benefit from work-related applications which help them manage their studies while learning and performing multiple tasks, and recover from errors as well as organise their workplace. Students may perform in-depth research using several tags for different sources of information, and good tab organisation makes sure the precise information is accessible to you. With simple tab switching, students can work on multiple projects, conduct online research, check their personal things, etc., at once, which leads to a much faster, less mentally taxing way of studying.

Also, the feature of reopening closed tabs allows reducing distraction from accidental closure, which means that no valuable information is lost. This is particularly useful in academia when access to physical resources may be limited, therefore hindering progress. Having the ability to close useless tabs and windows also helps pupils in maintaining a clear and tidy virtual desktop, thus lowering cognitive load and making concentrating easier. Students adapting to the electronic age need keyboard shortcuts for toggling between tabs and windows to maximise their productivity and efficiency. Some good examples of this are keyboard shortcuts such as Ctrl + T, Ctrl + W, Ctrl + Shift + T, Ctrl + Tab, Ctrl + Shift + Tab, and Alt + F4 that can help you into learning how to control browser tabs and windows. These shortcuts can be used by students to streamline their workflow, increase multitasking capacity, and keep their digital space uncluttered, thus resulting in seamless and enjoyable learning (Aljarallah & Dutta, 2024; Fan et al., 2023; Ramesh et al., 2025).

2.3.3 Virtual Cursors

Screen readers utilise virtual cursors as their main accessibility tool which helps visually impaired users efficiently read both online pages and documents. Through these cursors, users can utilise exact keyboard commands which lead them to different website items, enhancing their content interaction abilities. People who depend on auditory information find digital content more accessible through this vital feature. The complete functionality of virtual cursors, along with their operational commands, becomes clear through the following explanation. The virtual cursor command H functions as a popular tool for moving the screen pointer to different webpages and document headings according to Aljarallah and Dutta (2024). Users find the built-in function significantly useful because it enables fast page exploration for locating target areas of interest. Users can increase the speed of their web browsing and document reading because headings function as easy-to-find markers alongside the option to move directly to them. A screen reader user can use the H key to rapidly shift among headings in an online article, thus bypassing unneeded sections and finding essential content.

Using Shift + H in the same fashion enables users to move backwards from one heading to the prior one, as noted by Ramesh et al. (2025). Users who want to review previously missed crucial information should utilise this essential tool. Screen readers give users complete direction techniques to browse content quickly through forward and backward movement that work using headings. Users can operate through the website or document buttons using essential commands as one of the key capabilities. The B key allows users to navigate through buttons forward, but the Shift + B keystroke moves the pointer toward the preceding button (Fan et al., 2023). Interactive elements such as navigation buttons and submit buttons are essential for users to operate with the help of commands. A user who completes an online form can use the B command to locate the submit button quickly, thus creating an efficient form processing experience. Users can easily browse tables with commands provided by screen readers. The T key enables users to bypass to the following table and provides quick access to tabular information without needing manual search through other content (Yesilada & Harper, 2019). The functionality proves especially helpful in academic research where researchers need to analyse tables, which frequently occur in data presentations. A textual search using the T command allows students reviewing research data to immediately reach essential tables, which helps them conduct their data review faster.

The command combination Shift + T moves the user cursors to the previous table structure in a document that users can navigate in reverse order (Nicolau & Montague, 2019). The requirement for backward navigation helps users who need to examine former data tables or assess multiple data sets. Users gain improved control of tabular data through screen readers since these tools offer commands to move both forward and backwards between tables. Virtual cursors enhance document and page exploration because they implement additional commands that guide navigation of links, forms, and regional contents. The screen reader software includes commands that guide users between links, form fields and regions, thus improving users' abilities to handle complex online pages (Ramesh et al., 2025). The commands create a robust system to browse multiple information formats, thus enabling users to rapidly access and control the essential elements. Virtual cursors and key commands play a great role in increasing the usability and accessibility of digital information for the visually impaired. H, Shift + H, B, Shift + B, T, and Shift + T commands guide the users to navigate from headings, buttons, and tables (Aljarallah & Dutta, 2024; Ramesh et al., 2025; Nicolau & Montague, 2019). These instructions allow users to easily manage their navigation and interaction with digital content, giving a more streamlined and effective user experience. Screen readers use virtual pointers to allow visually impaired users to utilise and interact with digital content independently, promoting broader digital access and inclusion.

2.3.4 Form Navigation

Students with visual impairment need to be familiar with form navigation features since these components enable effective screen reader form completion. Screen reader programmes provide specific instructions that let users connect with form components after entering simple commands. The screen reader programme provides streamlined navigation features that let users seamlessly complete form fields such as text boxes, checkboxes, and dropdown menus, thus improving ultimate form completion speed. This section offers a detailed breakdown showing the main instructions that allow users to move through forms by precise application. The F key functions as a fundamental navigation order that progresses through each control element throughout all types of forms (Ramesh et al., 2025).

Users benefit considerably from this essential command because it enables them to bypass form fields and immediately access the subsequent input field. The F key enables users to move automatically between fields on a registration form, starting from name and proceeding to email and then to password, without page navigation. The streamlined navigation system enables users to achieve their task efficiency by concentrating on form completion accuracy. Users can navigate to the preceding form field by pressing Shift + F so they can browse backwards to review entered information (Aljarallah & Dutta, 2024).

Users can benefit from this command to alter or correct mistakes they made in preceding form fields. The capabilities of screen readers help users accomplish fast form entry and assessment using forward and backward field navigation. Form navigation requires special attention to deal with checkboxes as an essential component. Users can easily modify checkbox statuses by pressing the Spacebar key according to Fan et al. (2023). A user operating a survey can select or dismiss options through the Spacebar when setting agreement for terms or signing up for newsletters. Through this command, users obtain quick capability to handle their options while successfully finishing the form. Consumer interaction with dropdown menus has become a common form feature that users frequently need to traverse through.

Users can select their preferred choice in dropdown menus with the help of the Arrow Keys, which enable scrolling through all available options (Yesilada & Harper, 2019). The command serves customers who need to choose various options from predetermined form selections, such as states or countries. Using the Arrow Keys enables users to search dropdown choices effectively and select their desired option without visual guidance. Users can benefit from additional capabilities included by screen readers, which enhance the form navigation process. Screen readers possess a set of built-in navigation commands that allow users to instantly reach form fields first and cycle between different form elements such as radio buttons and text spaces (Nicolau & Montague, 2019). The instructions create a strong basis for users to handle complex forms, which enables them to work through forms efficiently regardless of their situation. Users who depend on screen readers to complete online forms require form navigation commands as essential operational tools to navigate and use the forms. The combination of keys F, Shift + F, and Spacebar and Arrow Keys enables users to complete form navigation efficiently (Aljarallah & Dutta, 2024; Ramesh et al., 2025; Nicolau & Montague, 2019). These commands make form completion easier and more accessible, allowing users to interact with various form elements and features accurately and efficiently. Screen readers use these form navigation directions to allow students with visual impairment to complete and fill out online forms independently, enabling more digital inclusion and accessibility.

2.3.5 Custom Scripts and Macros

Advanced scripts together with macros serve as crucial tools for students with visual impairment, enabling them to streamline repeated tasks, thus achieving better efficiency across their academic settings and personal zones. Users create these scripts to personalise their needs for improving screen readers and other assistive technologies functions. Students benefit from utilising personalised tools that automate productivity tasks in various software interfaces to minimise cognitive strain and speed up their work. Scripts developed as part of the digital learning system automation make it easy for students to access lecture materials as well as assignments and discussion forums. The method becomes valuable for instances where users encounter platforms that have default interfaces difficult to access or navigate (Perera, 2024). Using standard shortcuts Ctrl + Tab and Alt + Left Arrow, students can navigate the web better and, through custom scripts, achieve multi-step functionality with a simple keystroke.

Microsoft software macros enable users to simplify complex tasks within both Excel and Word applications. Users can create custom macros through two shortcuts: Ctrl + Shift + T formats tables, while Alt + F8 executes pre-defined macros. The technological improvements provide students with visual impairment with efficient tools to analyse data and produce long documents through reduced keystroke operations (Abidi et al., 2024). Custom scripts can serve adaptive learning requirements due to their adaptable nature. Users can access script features through integrated screen reader commands that let VoiceOver users activate page reading after pressing Ctrl + Option + A or JAWS users show all links after pressing Insert + F7. According to Isaeva et al. (2025), students easily use learning platforms and software programmes because of customised solutions, regardless of platform upgrades.

The production process of these scripts becomes collaborative when students join with students and educators with IT specialists to create an atmosphere of inclusivity in education. Institutions backing custom scripts implement practises for accessible personalised learning that boost the empowerment of students with visual impairment (Botelho, 2021). The customised features in these scripts enhance academic results while boosting independence and self-confidence, thus enabling students to utilise shortcuts like Ctrl + Home and Ctrl + End to reach document beginnings and ends (Fan et al., 2023). Custom scripts serve multiple functions in professional realms that deliver automated benefits to people with visual impairments. A user-defined key combination of Ctrl + Alt + M enables users to start a menu or execute complicated data entry operations in specific programmes. Workplace inclusivity increases through script development since it enhances task performance (Ntoa, 2022). Affected students with visual impairment can enhance their digital resource accessibility through customisable scripts and macro commands, which present a flexible solution for efficiency improvement. Assistive technologies provide effective navigation through academic journeys through automatic process automation and optimised user interface design, which emphasise the need for personalised features (Bern & Liljeström, 2021).

2.3.6 Screen Readers

Screen reader applications support visually impaired people through various functions that enhance keyboard navigation. Through software applications named screen readers, users can convert both textual content and screen-based visual elements to speech or braille output for digital material interaction. Text-to-speech technology within screen readers enables users to have content read aloud from the screen while the system provides auditory navigation alerts for user engagement, according to Abdelaal (2022). Users who depend on keyboard shortcuts need audio feedback for navigation since it shows their current screen position along with their device operations. Navigation and interaction through keyboard shortcuts are offered by screen readers to help users navigate systems. Thorough navigation to website or document elements is possible through the use of keyboard shortcuts, which activate specific destination points like headings and links or form fields and other on-screen sections. Users can bypass enormous quantities through these shortcut keys that let them skip straight to different areas without needing to review every section. Users gain better access to dynamic content together with enhanced usability because Aljarallah and Dutta (2024) found screen readers' web mode works via the DOM structure instead of visual layout.

Students with visual impairment benefit most from keyboard inputs when they use braille displays. Users gain text accessibility through textured feedback provided by Braille displays, which convert characters into Braille code for reading purposes and interaction. Alam et al. (2024) consider braille displays to be crucial reading tools in spite of their recognised character count restriction per line. Braille display implementation, along with keyboard shortcut usage, provides maximum control and efficient performance to people facing vision difficulties. Screen magnification software used together with keyboard-based navigation functions as professional tools for individuals with limited vision abilities. A research report by Yesilada and Harper (2019) shows that text and tool enlarging through magnification decreases the functional visual load directed at the user. The drawback of using magnification tools for users stems from enlarged items because it reduces complete interface visibility, which leads users to interact with items one-by-one. The combination of keyboard shortcuts along with screen magnification functions as an effective method that benefits low-vision users by enabling smooth usage of digital information. Each screen reader programme includes a set of specialised commands and keys that improve users' ability to access various components and functionalities on their screens efficiently. These commands are intended to make the process of interacting with a computer and its content, allowing users to do tasks that might otherwise be difficult without visual input.

2.3.6.1 Narrator

Microsoft Windows includes the screen reader instrument Narrator to grant accessibility and better user experiences for people who have difficulty seeing. The application enables users to operate and navigate digital content through an exclusive system of keyboard commands. The set of Narrator commands exists to handle different user requirements for both basic movement operations and complex content manipulation tasks. Microsoft (2022) explains that the commands function as an auditory alternative to visual indicators that sighted users normally use. The commands function through three different sets, which include basic navigation commands, text interaction commands, and advanced feature commands. The Windows built-in screen reader Narrator, provides numerous activation choices which suit different user requirements. The most expedient way to turn on Narrator depends on keyboard shortcuts. Users can enable Narrator through the Windows Key + Ctrl + Enter shortcut according to Microsoft (2023). Users find this activation method beneficial when they want to use screen-reading functions instantly without traversing menus.

Windows Settings offers an alternative path to enable Narrator through its app. Users can start by pressing Windows Key + I to reach Settings, where they should select the “Accessibility” section, followed by picking “Narrator” from “Vision” in the list. The switch for enabling Narrator should be turned to the “On” position through Microsoft (2023). Users who prefer graphical system configuration methods can use this method, which presents Narrator functions through a visual interface. Users can start Narrator through the menu available from the Start screen. Users need to enter “Narrator” in the

Start menu search field before selecting the Narrator application from available results. Screen Reader activation is possible for users through their selection of the "Start Narrator" button located in the programme's user interface (Microsoft, 2023). You will find the Narrator application directly accessible from this basic platform. Users can activate Narrator by pressing Windows Key + X in the Power User menu according to Microsoft (2023). The procedure to enable Narrator is described in detail under the Windows Settings method. People who know the Power User menu will find this activation method effective. Cortana serves as a hands-free option to enable Narrator through voice commands. Users who have difficulty accessing standard input mechanisms can activate the screen reader through vocal commands, which state "Hey Cortana, turn on Narrator," according to Microsoft (2023).

Users need basic navigation commands from the narrator to succeed at navigating their way through the material effectively. With Caps Lock + M, users can hear the active item displayed as an audio output, which provides immediate feedback about their present focused section (Microsoft, 2022). Confirmation of user placement becomes easier because of this function when working in apps together with documents. Users benefit from text and information navigation with the Caps Lock + Arrow Keys command because it enables precise movement by characters and lines (Södergård, 2024).

Users can easily move from one focusable element to another with Caps Lock + Tab, but Caps Lock + Shift + Tab leads them backwards to the previous element. Sequential webpage or application progression depends on these commands because they help users who do not depend on visual feedback (Nicolau & Montague, 2019). The manipulation of text requires proper instructions from the narrator system. Users who do not use mice can easily handle their texts through standard shortcuts, including Caps Lock + C for copying and Caps Lock + X for cutting (Aljarallah & Dutta, 2024). These commands are also essential for jobs like word processing and data entry that require fast and accurate text manipulation. For example, Caps Lock + O replaces the comma with a period symbol, Caps Lock + V pastes copied text and Caps Lock + F opens the Find dialogue to search in the documents or Web pages (Nicolau & Montague, 2019). This is essential to quickly retrieve data and perform text-based operations, which in turn improves user productivity and efficiency. You can find the instructions for element navigation in the Narrator settings, which allows users to communicate with various components of digital interfaces. For instance, I think a lot of people go to links on a page just one by one, so you can actually press Caps Lock + F7, and it would give you a full list of every link on that page (Fan et al., 2023), which is helpful for delete users who have trouble actually going through the hyperlink on the Content visually.

And Caps Lock + U reads through all heads on the page, allowing users to jump to and navigate structured text more efficiently. By the Caps Lock + B command, users can see a list of all buttons and thus easily determine the interactive elements to interact with their browser (Yesilada & Harper, 2019). Narrator has commands like Caps Lock + R that read the whole document or page and will give you a comprehensive overview of the content in the document. This is useful for people who want to understand the whole context of a document or a web page without scrolling through the page (Microsoft, 2022). Users can also adjust the verbosity level of spoken feedback to their preferences, using commands like Caps Lock + Shift + F (Nicolau and Montague, 2019).

Caps Lock + Alt + Arrow Keys moves users between screen regions, such as navigation panes and sidebars. It enables users to collate and interact more effectively with multiple areas of a webpage or application. Additionally, the Caps Lock + D command reads the desktop content, allowing for a quick overview of the icons and objects on the desktop (Microsoft, 2022). There are many different ways to disable Narrator in Windows, each one more suited to some users' preferences and requirements. The easiest option available is a keyboard command, Windows Key + Ctrl + Enter, which toggles the Narrator on/off, enabling users to quickly stop using the screen reader when it is not needed anymore (Microsoft, 2023).

Users can deactivate Narrator through the Windows Settings app, which can be accessed by hitting Windows Key + I before navigating to Accessibility and selecting Narrator under Vision to turn off the Narrator feature. By searching for "Narrator" on the Start menu and opening the app users find the "Exit Narrator" option to disable Narrator within the interface (Microsoft, 2023). Computer users with visual impairment can access the Power User menu by pressing Windows Key + X then selecting "Settings" to access Accessibility and turn off Narrator. Users with limited mobility can use voice commands with Cortana to turn off Narrator by saying "Hey Cortana, turn off Narrator" which offers a convenient hands-free option which most consider to be an easy and simple option. A range of methods can help computer users turn off the screen reader with ease according to their specific requirements and preferences which can lead to enhanced accessibility and user satisfaction for students with visual impairment. The Narrator instructions help people with visual impairments access the necessary tools to navigate and interact with their devices. Södergård (2024) demonstrates that keyboard-based interactions play a crucial role for users who depend on audio signals to manage their digital surroundings. Through their ability to serve simple as well as complex requirements Narrator commands prove beneficial by enabling effective and full-scale use of computers. Narrator offers extensive capabilities but users might still encounter problems. Users who need to perform complex tasks might require additional training and practice to use Caps Lock + M and Caps Lock + Arrow Keys for basic navigation (Aljarallah & Dutta, 2024). Users might find that specific command combinations like Caps Lock + R for reading full texts need a good understanding of the command system to operate correctly (Nicolau & Montague, 2019).

2.3.6.2 JAWS Commands and Usage for Users with Visual Impairment

The screen reader JAWS (Job Access With Speech) has many different instructions to enhance accessibility and user engagement. Using JAWS users can access all webpage hyperlinks by pressing Insert + F7 according to Nicolau & Montague (2019). JAWS displays connection information in a single list to help users find thoughts quickly thus enhancing web browser performance and minimising time usage. Through its command structure JAWS enables users to stay informed about their position in the interface using the Insert + T command (Yesilada & Harper, 2019). JAWS provides users with commands to monitor their position and monitor their advancement within different digital interface areas. The utility key combined with the Down arrow provides continuous reading from the cursor's current position allowing users to read documents as well as webpages smoothly.

Users can start JAWS through the desktop or start menu or by accessing its preconfigured keyboard shortcut. Upon starting the application JAWS begins speaking everything that appears on screen through the active focus point. The JAWS application menu or the Insert + F4 keyboard shortcut allows users to deactivate JAWS by using the exit function (Freedom Scientific, 2023). The JAWS software finds regular use for positions that need computer navigation skills along with interactive abilities. Word processing software users can access the beginning of their document through Ctrl + Home and reach the document conclusion with Ctrl + End. The Insert + Up Arrow command enables users to read the current line yet Insert + Left Arrow or Insert + Right Arrow provides character-level reading of the previous or upcoming character as described by Freedom Scientific (2023). Browser users can navigate between document sections with the H key because it jumps between headings. The Insert + F6 command shows a list of page headings similar to a link list which enhances both user speed and satisfaction (Freedom Scientific, 2023). Web browser navigation and information retrieval speed up considerably when accessing complex websites using these tools. Text editing and management operations within JAWS require users to implement a set of commands for controlling functionality. Users can operate between text copying and pasting functions with Ctrl + C for copying and Ctrl + V for pasting and Ctrl + X for cutting selection. Pressing the Insert + Spacebar and then the S key enables temporary disabling of screen reader voices without a full shutdown through the S key. The platform gives users control to adjust their interaction methods in accordance with their current requirements (Fan et al., 2023).

JAWS embraces braille displays as a function to enable users to read text by feeling tactile feedback generated through the system. Users who are blind can activate braille document summaries by using the Insert + B command according to Aljarallah and Dutta (2024). The Braille reading feature of this function serves as an important option for users who choose not to use audio feedback. The web accessibility features are integrated into JAWS. Users can access the latest information on the current page through the Insert + Ctrl + R command in Microsoft Word. Web form navigation becomes easier through the Insert + F5 command which shows a complete list of all page fields. Web form users often find these characteristics highly useful for their daily interactions (Abdelaal, 2022). JAWS commands as a complete set provide visually impaired people with independence for digital content reading and navigation. Visually impaired individuals benefit from this capability by gaining enhanced digital accessibility that matches their sighted peers' ways of using digital sources. The assistive technology industry maintains JAWS as a fundamental tool for global users who need help with their visual impairments according to Freedom Scientific (2023) and Fan et al. (2023).

2.3.6.3 NVDA Commands (NonVisual Desktop Access)

The NVDA (NonVisual Desktop Access) system functions as a widely popular screen reader which enables visually impaired users to control their digital content through multiple commands. The set of commands allows users to build individualised screen experiences and develop easy access methods to control all screen elements. In NVDA the command NVDA + N represents one of the essential functions to display the NVDA menu (Aljarallah & Dutta, 2024). The NVDA menu presents critical capabilities because it enables users to view multiple control options through its interface. The NVDA menu presents a set of options through which users can alter voice parameters while customising braille display features and various other fundamental capabilities to modify screen reader behaviour. Users can make their NVDA more usable through customisation which results in NVDA working as needed for each user. Users can obtain an interactive item list on the screen using the NVDA + F7 command (Ramesh et al., 2025). Users benefit greatly from this command because it enables fast targeting and usage of specific items without requiring them to perform manual screen navigation. NVDA achieves efficient navigation by showing users all available interactive elements thus they can quickly find specific items to activate. The NVDA software allows you to enable its functionality through multiple mechanisms to suit your personal needs and screening conditions.

Clicking the NVDA icon in the desktop or Start menu stands as one common practice for running NVDA. An alternative option to activate NVDA is through designated keyboard shortcuts such as Ctrl + Alt + N if this feature is enabled by the user. During active mode NVDA immediately generates audio readings from all focused screen elements including texts which provides essential acoustic feedback for users to conduct digital operations promptly. Both NVDA on and off functions are easy to execute. Users can shut down the NVDA application by clicking its Exit NVDA command in the application menu. Programme closure can be initiated by using Insert + Q to open a confirmation dialogue according to NV Access (2023). The available methods provide NVDA users with simple procedures to disable the screen reader instantly in situations where it becomes unnecessary.

The NVDA software serves multiple occupations throughout computer navigation situations. Word processing applications enable users to select NVDA + Down Arrow which delivers continuous reading starting at the cursor point that results in a flowingly controlled interaction. The command sequence Ctrl + End provides document subscribers with a tool to find the document conclusion which enhances their document handling speed (Fan et al., 2023). The web browser version of NVDA brings several commands to assist users during online navigation. Users can use the H key to surf headings thus assisting them in navigating between various areas within a webpage. The command NVDA + F6 provides users with a visible list of page headings which helps them find specific parts of content more easily by navigating through the page effectively. Through its command system NVDA provides users with options to manage and edit web-based texts. Using NVDA + Spacebar followed by selecting S enables users to manage the voice mode between being on or off the screen reader while keeping it active. Users can benefit from the flexible features of NVDA when focusing intensely on tasks because they can suspend auditory notifications (Aljarallah & Dutta, 2024).

The NVDA software system enables braille display utilisation in addition to its speech output functionality for text reading through touch feedback. Users can request NVDA + B to receive tactile braille summaries of their documents according to Yesilada and Harper, (2019). This fundamental feature serves users who use braille Better than audio feedback because it enhances their digital content interaction capabilities. The importance of the screen reader NVDA must be highlighted when understanding digital accessibility improvements. Digital content interaction methods for people with visual impairment are transformed due to the devices described by Nicolau and Montague (2019). NVDA functions as an equality-enabling tool by giving users the capacity to navigate and modify text and execute commands which lets users with visual impairments match capabilities with those of their sighted colleagues. People who use NVDA can navigate between web pages and documents and programmes efficiently and precisely therefore their capabilities improve as well as their self-confidence. Continuous developments and updates to screen reader technology, such as those seen with NVDA, guarantee that users have access to the most recent features and functionalities that can assist them with their daily tasks (NV Access, 2023). In a quickly changing digital landscape, continuous improvement is critical for screen readers to remain relevant and successful for users.

2.3.6.4 VoiceOver Commands

VoiceOver, a screen reader application built into macOS and iOS, depends on a collection of commands and procedures to enable individuals who are blind to access and engage with information effectively. Amongst the easiest to use commands is VoiceOver + Arrow Keys, whereby users utilise the VoiceOver modifier key in order to make use of the arrow keys navigating towards objects that appear on screen, and may include buttons, links, and text fields (Fan et al., 2023). The process is one that is clear and rational as a method of navigation, and thus makes provision for the access of information logically and in a very efficient manner. Besides simple commanding, additional user experience improvements are also provided through the application of commands in the application. For example, the Control + Option + U command opens the rotor, allowing users to navigate by headings or content type (Nicolau & Montague, 2019).

The rotor is helpful while reading complex documents or web pages since the user can easily go to any sections, page or items within the document or webpage and does not need to scroll the whole text. VoiceOver can be enabled and disabled in various ways based on the computer hardware that students with visual impairment use and according to their preferences. On macOS for instance, VoiceOver is activated using Command + F5. Either of these, however, you can activate VoiceOver command through the System Preferences menu by selecting Accessibility and then VoiceOver. VoiceOver on iOS devices, however, is activated by going to Settings, then Accessibility, then VoiceOver. Another iOS option is to activate Siri and speak, “Turn on VoiceOver.” All of them have the accessibility and ease with which VoiceOver can be switched on using one's preferred procedure (Bern & Liljeström, 2021).

VoiceOver can also be turned off equally easily. For macOS, VoiceOver can be turned off by pressing Command + F5 bottons again. One way is the user can navigate to System Preferences option, click on Accessibility, and click on turn off VoiceOver. VoiceOver can also be turned off on iOS devices by going to the Accessibility settings within the Settings app or simply instructing Siri orally to “turn off VoiceOver.” Having the ability to turn VoiceOver off and on as one wishes is convenient to students with visual impairment so that they might toggle and toggle rapidly with ease between the employment of the screen reader and employing their device in whatever mode they desire. VoiceOver is predominantly utilised for browsing and talking to actions of digital content (Abidi et al., 2024; Botelho, 2021). VoiceOver in a web browser assists you in browsing a web page by using the rotor to iterate through headings, links, etc.

Control + Option + H, for instance, will guide you through headings, and Control + Option + L will guide you through links. As Isaeva et al. (2025) explains, the feature enhances the speed of navigation by visually impaired shoppers on websites through instantaneous discovery and use of desired information. Besides web surfing, VoiceOver also assists you in editing and managing documents. Control + Option + Shift + Down Arrow assists one in working with a text field and entering and changing text. Control + Option + A is able to read the entire document, which is beneficial in reading text. These commands assist users in carrying out word processing operations easily without vision input (Perera, 2024). VoiceOver also provides extra support for a series of touch gestures on iOS, which improves the user experience. A three-finger left or right swipe, say, navigates through pages but a double tap single-finger will show the intended item. Such gestures enable customers to interact with their devices through touch inputs, providing ample and more convenient access to digital content (Ntoa, 2022). VoiceOver possesses one of its greatest strengths to provide its users in the sense that it can be personalised based on the user's requirements as it enables the users to set up the screen reader in a way that it serves their individual requirements. One of the benefits of VoiceOver is that there are potentialities of customisation, and thus people are able to personalise the screen reader according to their personal tastes. The user can set speech rate, voice, and verbosity options at will. VoiceOver also includes braille displays, which provide an opportunity to people to read text in terms of touch feedback. This assistance is important for readers who prefer or need to read braille and helps their way of accessing digital materials (Abidi et al., 2024; Bern & Liljeström, 2021). Being in the Apple ecosystem, VoiceOver integrates flawlessly on both macOS and iOS.

Such consolidation provides an effortless user experience since visually impaired users can transition smoothly from Mac to iPhone or iPad using the same screen reader commands and functionality. VoiceOver commands are important in assisting visually impaired users to access and use digital content efficiently. VoiceOver allows users to have productive and efficient interactions with their virtual environment through the introduction of powerful tools for navigating, editing text, and issuing commands. Smooth movement between web pages, documents, and applications quickly and accurately boosts productivity as well as gives users confidence and a feeling of autonomy. VoiceOver's ongoing updates and enhancements make it an important asset for digital accessibility, closing the gap between visual impairments and digital access (Botelho, 2021).

2.3.7 General Screen Reader Commands

Screen readers are an extremely significant tool for the visually impaired as they present several commands that can assist them in navigating and accessing digital information efficiently. Ctrl + Alt + Arrow Keys and Ctrl + F are two of the most utilised commands to enhance user experience. Most screen readers have the Ctrl + Alt + Arrow Keys, which is useful when switching from one area of the screen to another. With this feature, one can shift between various components of a web page or mobile app, such as navigation, content areas, and sidebars (Yesilada & Harper, 2019). This is a very convenient way of continuing with navigating when dealing with multi-sectional interfaces that hold information distributed across various sections of the screen. As an example, on a complicated web page, the users can use this command to quickly move the focus from the primary content area to a navigation menu, and then to a sidebar with extra information or links. Navigation based on regions is required for individuals who have to travel and keep up with complicated layouts. It makes it possible to maintain an organised flow of information so that users can access and interact with all applicable sections with ease without getting lost or disoriented. The Ctrl + Alt + Arrow Keys shortcut optimises digital interface accessibility and usability for persons with visual impairment by making navigation between various places seamless (Fan et al., 2023; Perera, 2024). Another helpful function is Ctrl + F, which finds text specified in websites or documents.

This shortcut provides access to a facility for searching, and the user can enter a word or words that they seek. The screen reader reads through the document or web page and speaks out all instances of the search term such that the users can skip immediately to the relevant sections (Fan et al., 2023). The use of Ctrl + F actually increases the effectiveness in the acquisition of information. As it relates to the use of screen readers, it prevents users from having to progressively search through large volumes of text in hopes of identifying certain information. Rather, users can locate and navigate to the relevant material at high speeds, saving time and reducing cognitive load. For example, if a consumer is reading a long article or report, he or she can type Ctrl + F to search for certain portions or words, thereby making the job of extracting information much easier (Abidi et al., 2024). The use of Ctrl + Alt + Arrow Keys and Ctrl + F commands is a powerful blend of assistance to the visually impaired while navigating digital content. The two commands act on two key aspects of screen reader navigation: region-based navigation and retrieval of focused information. Region-based navigation is of assistance in reality in navigating a rich website, using software programmes consisting of many panes, or handling documents possessing disjointed structures like headers, footers, and body (Botelho, 2021).

It is practical to use an email programme containing disjoined areas such as inbox, sent, and drafts, making the Ctrl + Alt + Arrow Keys handy in switching among them. Ctrl + F, however, is a valuable text search feature utilised in activities with large text, like reading books, web research, or reading long reports. The function allows one to easily narrow down particular information, which is paramount in professions that involve precise data collection or when time is a priority (Zhang & Li, 2025). The capability to find and navigate quickly with these instructions enhances visually impaired users' productivity and independence. It allows one to accomplish things that, otherwise, would need a lot of help, to be able to live with a heightened sense of independence. Further, the increased effectiveness through the use of these guidelines aids users in their interactions better with school material, technical texts, and regular digital content (Ntoa, 2022). Universal screen reader commands like Ctrl + Alt + Arrow Keys are unavoidable for users who are blind, providing robust functionality in terms of navigation and interaction with digital information. They take the accessibility of complex interfaces to the maximum level and allow for information extraction, making the process very efficient and intuitive. Users who are blind can be made more productive and independent by using these commands as part of their daily routines, highlighting the role of screen reader technology in digital accessibility (Bern & Liljeström, 2021).

2.3.8 Accessibility Settings

Both the operating systems and the software have accessibility features, which enable individuals who are blind to enjoy digital content more comprehensively. They contain a set of functionalities whose function is to enhance visibility, navigability, and the user interface overall. One of them is high contrast mode, where the text and background items is enhanced so that they can be more easily distinguished. This is especially helpful for low vision users since it simplifies the reading of text on screen by increasing the contrast between blocks. On Windows, Left Alt + Left Shift + Print Screen is typed to activate high contrast mode (Aljarallah & Dutta, 2024). This foundation-level accessibility allows users to turn high contrast mode on and off and adjust their screen to various levels of brightness and personal preference. High contrast mode enhances text readability and interface object recognisability, significantly enhancing the use of digital content by visually impaired individuals. The zoom feature makes screen areas large enough that small print and intricate images are more accessible.

It is actually very useful for low vision users who need to zoom in on certain areas of the screen and maintain context. Windows Key + Plus (+) zooms in and Windows Key + Minus (-) zooms out (Fan et al., 2023). The magnifier supports a full-screen, lens, and docked mode where you can choose how the content to be magnified is displayed. The feature makes one have the ability to acquire and work with the right information and thus they are well-placed to utilise digital content positively. Sticky Keys is an inclusive feature that gives one an opportunity to utilise keyboard shortcuts single key at a time rather than successive clicking on multiple keys simultaneously. This comes in handy to a physically disabled user or when they are not able to press down more than one key at a time if they are unable to do that physically. Windows Sticky Keys can be activated through repeated rapid clicking on the Shift button five times (Ramesh et al., 2025). Inactive Sticky Keys provide visual and auditory feedback indicating to users that modifier keys (i.e., Shift, Alt, and Ctrl) are being pressed so that keyboard shortcuts can be activated through the sequential activation of keys. The feature allows for complicated commands and facilitates keyboard accessibility for the blind and mobility-disabled community. Filter Keys is a feature that will ignore repeated typing or faster typing, thus enabling people with tremor or other mobility impairment to type accurately.

In Windows, you will enable this by holding and pressing the Right Shift key for eight seconds (Yesilada & Harper, 2019). Filter Keys slow down the speed at which you can type errors and make typing easier. This is extremely helpful for individuals with a tendency to press keys accidentally or find it difficult to keep their fingers flowing smoothly. Filter Keys enhance keyboard use for individuals with motor and visual disabilities by enabling them to type more accurately. Besides these specialised features, operating systems typically have one place where accessibility features can be set up. Under the Windows operating system users can access the Ease of Access Centre by pressing Windows Key + U (Nicolau & Montague, 2019). Users of the accessibility centre can customise their display settings and keyboard behaviour along with multiple other accessibility feature options. With macOS users can access System Preferences through Command + Space to start Spotlight Search then enter “Accessibility” as per Fan et al. (2023). The options allow users to customise their computer environment specifically according to their personal needs which leads to enhanced digital information interaction. The accessibility features Magnifier along with High contrast mode complement Sticky Keys and Philtre Keys to create a set of useful methods for visually impaired users who want to access digital content. Users can modify their operating system settings by using quick keyboard commands to access high contrast mode through Left Alt + Left Shift + Print Screen along with magnifier activation through Windows Key + Plus (+) in combination with five Shift key presses to activate Sticky Keys and right Shift key presses for eight seconds to activate Philtre Keys (Aljarallah & Dutta, 2024; Ramesh et al., 2025; Nicolau & Montag, 2019). Better access to content along with improved usability results from these configurations which allows visually impaired people to handle digital materials better on their own.

2.4 Support Services Available to Students with Visual Impairments to Enhance the Use of Computer Technology

Computer technology is a fundamental component of the computer age learning with abundant possibilities for growth and learning. Students with visual impairment, however, encounter unique challenges in accessing and making the best use of these technology resources. Full support services must be introduced to level the playing field and facilitate students with visual impairment to derive maximum advantage from technological advancements. Among the services are numerous strategies and tools that operate to maximise the utilisation of computer technology, thereby maximising learning processes and experiences. Institutions and teachers can assist students with visual impairment to utilise the digital world confidently and independently by offering e-training, accessible materials, technical support, as well as establishing a facilitation environment. This introduction considers the many support services that exist and can impact the student's educational experience if they are a visually impaired person, and highlights the need for an integrated approach to technology availability and use.

2.4.1 Assistive Technology Training

The learning of assistive technology stands as an important factor in improving computer technology usage among students dealing with visual disabilities. The programme provides educational instruction through specialised courses for students who learn to operate assistive technology tools which include screen readers and Braille displays together with magnification software and speech recognition systems. Akbar et al. (2024) argue that such technologies enhance the accessibility of digital content, enabling students to access their learning materials and learning environments more fully. Screen readers, including JAWS (Job Access With Speech) and NVDA (NonVisual Desktop Access), are a significant component of the visual impairment student population since they read text and other screen content in speech or braille output. Training in the use of screen readers equips students to work with documents, website, and software packages effectively. Aljarallah and Dutta, (2024) discovered that acquiring the skills of navigating with keyboard shortcuts and screen reader commands will enable you to navigate and interact with digital information more effectively. Students learn about reading operations as well as setting configuration and profile creation through specialised training programmes.

Users receive textured feedback from Braille displays that enable them to read digital text written in Braille format. Successful Braille display training also involves teaching students how to have the device installed on computers, utilise the special commands of the device, and correct common breakdowns. As Nicolau and Montague (2019) aver, understanding these technologies enhances students' capability to independently access and evaluate digital information. The training introduces proper use of Braille displays with various software platforms and their applications for text reading and web browsing along with document writing environments. The visual impairment assistance software ZoomText performs screen text enlargement as well as graphical element magnification in order to help students read digital content. The software training includes adjustable features to meet personal needs which allow users to optimise magnification degrees and contrast levels and cursor visibility (Fan et al., 2023). The training includes step-by-step advice about how to enhance magnification software performance by showing students convenient keyboard commands and techniques for dealing with large-format content. Users can operate speech recognition software called Dragon NaturallySpeaking by both providing voice commands and writing with their spoken voice. The technology can significantly benefit students who have difficulty using the default input method. Ramesh et al. (2025) suggest offering voice command syntax instruction, dictation practices, and techniques in order to support accuracy during training to increase maximum usability for speech recognition systems. Training is usually done through practice exercises to make the students used to speaking clearly and in a uniform manner, and correcting general speech recognition accuracy problems. Constant updates and seminars are essential in informing students about recent technological breakthroughs and software versions. Continuous training makes the students alert to which technologies are current at any point and ready to switch to newer tools and functionality when they arise. With evolving technology, it is imperative to remain current in a way that will help provide accessibility and maximise the application of assistive technology (Yesilada & Harper, 2019). The seminars also assist in developing platforms upon which students will exchange experiences and learn from each other, and through this, there will be a learners' community that will provide peer guidance and counselling. Training in assistive technology is tailored to endow students with visual impairment with the ability to effectively utilise computer technology. Schools can condition such students to become more independent and achieve academic success by providing extensive and continuous training. A focus on both initial training and regular professional development enables students with the ability to remain current with the rapidly evolving assistive technology universe while at the same time being able to enjoy the advantages of innovations and breakthroughs in accessibility aids.

2.4.2 Technical Support and Maintenance

Technical maintenance and support are required for maintaining students with visual impairment accessibility through assistive tools and software. Special needs technical support staff and frequent updates and upgrades are necessary to maintain these technologies efficiently and functionally. The support system facilitates fewer technical issues and maintains the compatibility of assistive tools with other education technology, thus providing students with visual impairment with effortless learning. Technical support staff trained in assistive technology is required to assist students with visual impairment with the installation, debugging, and maintenance of assistive hardware and software. Technical support staff are required to make technology function as it should and be easily incorporated into learning environments for students. Technical support plays an important role in assisting students in overcoming initial difficulties in the use of assistive technology as shown by a study conducted by Daskalakes et al. (2024). Such problems can vary from the difficulty of customising programme settings, running required updates, and troubleshooting hardware problems.

Having qualified technical support staff can also provide students and instructors with a sense of comfort in knowing that qualified support is within reach should issues occur. Lirong and Ghani (2025) noted that technical assistance is needed in the long term to address the dynamic and changing nature of assistive technology, hence devices and software remain operable over a period of time. Such support groups are refreshed from time to time in assistive technology and are aware of the particular needs of the visually impaired users, which is necessary in order to offer focused and effective assistance.

Assistive technology training requires technical support personnel to teach appropriate use of assistive technology to both students and teachers. User training consists of both new user orientation known as onboarding and continuous maintenance that addresses technological problems users face. The objective targets user independence through proper technology training so students can achieve better learning results. Regular updates and upgrades of assistive devices are necessary for assistive technology to be functional and keep up with new developments. Upgrades typically involve adding programme functionality, security fixes, and changes to allow the technology to integrate easily into other educational digital tools and platforms. Without updates, assistive software and hardware become outdated, causing compatibility issues and decreased functionality. Lourenço et al. (2025) emphasise the need to upgrade assistive technology in a manner that it will not become obsolete and can add new features that provide a better user experience. For example, screen reader updates can add support for new web technologies or additional languages, and they can potentially enhance user accessibility significantly. A stream of frequent updates can provide new features that enrich the learning process for students with visual impairment. For instance, improvements in machine learning and artificial intelligence are being incorporated into screen readers and other assistive programmes to make the interactions more responsive and intuitive. These improvements can enable students to engage more meaningfully with their learning material and finish activities quickly (Olawade et al., 2025). Regular updates are another critical component of maintaining assistive technologies securely. Assistive technologies as software like any other are susceptible to security issues, which must be dealt with by regular updating. In order to safeguard students with visual impairment data and privacy, technical support staff must update all the hardware and software using the newest security patches.

2.4.3 Customised Learning Environments

Dedicated learning environments are central to improving computer technology utilisation by students with visual impairment. The learning environments are specifically designed to meet the particular needs of visually impaired learners to facilitate access to facilities and resources through which they are helped to attain continuation of study. The implementation of adapted learning environments requires the creation of technology stations for all students and secluded areas for technology use which eliminate disruptive elements when using the device. Adapted classroom layouts are made up of accessible technology stations, which include PCs and assistive software. For instance, the classrooms can be equipped with screen readers, magnification software, Braille displays, and voice systems, all of which are aimed at assisting the students with visual impairment to read more effectively. Following Ketema Dabi and Negassa Golga (2024), accessible technology touchpoints in the classroom make students' access to digital content easier, involve them in interactive learning experiences, and complete assignments autonomously. The arrangement not only ensures academic success but also reinforces autonomy and confidence among the visually impaired. The access to these tools within classrooms removes student dependency on external help so that learning processes become unified and superior. Alshahrani (2020) emphasises that classrooms should embrace assistive technology because it improves the educational results for students with disabilities. The development of technology stations designed for visual impairment needs allows educational institutions to provide equal access and class involvement along with academic achievement opportunities for this student group.

Students need both specially developed classes and one of the following options: quiet spaces that provide access to technology free from disruptions. Quiet rooms provide the best environment for concentrated studying and unbroken utilisation of assistive devices. Quiet rooms are more effective for tasks that require concentration, like reading lengthy texts, working on assignments, or online testing. Gadiraju et al. (2021) found that selected study spaces enhanced academic performance for students with disabilities. Their research discovered that access to quiet, which are less noisy and disturbance-free spaces significantly enhanced students' concentration, learning and completion of tasks. Students with visual impairment who use computer technology can benefit more from screen readers, braille displays, and other assistive technology to access materials and read digital content without being distracted. That silent rooms are also provided speaks to a determination to offer an inclusive learning experience that meets every student's diverse needs. Such special rooms enable schools to help ensure that students with visual impairment are provided with the accommodations they need in order to excel academically. This practice is consistent with Universal Design for Learning principles that demand flexible learning spaces that are able to meet particular learning differences (Bray et al., 2024).

2.4.4 Teacher and Staff Training

A mandatory training programme should be implemented to ready teachers and staff members for developing environments that welcome students with visual challenges alongside assistive technological implementations. The professional development activities focus on helping teachers understand student requirements better while teaching them the methods to operate assistive technology devices alongside accessible instructional techniques. Quality training integrates students into an inclusive learning system that equally enables them all to achieve success. Professional development training enables support staff along with teachers to develop skills needed to provide exceptional services for students with visual impairment in standard classrooms. The courses provide educators with extensive information about students with visual impairment while teaching methods for creating accessible learning spaces. These courses are typically holistic in order to raise awareness and skills. Professional development courses for learning about the various needs of students with disabilities assist in developing a more inclusive learning environment, writes Viner et al. (2022). The programme includes intensive special classes and workshops and seminars which teach students the specific training they need to serve individuals with visual limitations. Educational workshops would teach teachers braille literacy alongside orientation and mobility training as well as adaptive technology use which enables them to include these features in their educational activities.

Examples and practice-oriented methods form the core understanding in these courses to promote student accommodation for visually impaired individuals. Educators learn how to modify their strategies of teaching as well as classroom settings to cater to the varied needs of the students. This may involve rearranging the class, offering materials in tactile or audio format, and making use of technology to support instruction. Attending these courses allows teachers to gain a better grasp of the issues that students with visual impairment encounter and how to integrate effective strategies to overcome them, thereby improving the learning process for all the students (Viner et al., 2022). Training in assistive technology is also an essential component of teachers' professional development. Alshahrani's (2020) study highlights the importance of training teachers on assistive technologies in enhancing students with visual impairment learning experience. Successful training not only familiarises teachers with different assistive devices, but also enables them to use them in their classroom teaching. Teachers, for instance, can be taught how to install and correct screen readers so that they function properly and meet the needs of their students. Also, training usually consists of educating on how to include assistive technologies in lesson planning and assessment so that instructors can modify their instruction to incorporate students using such devices. Apart from that, ongoing training is necessary to empower teachers with technical innovations and assistive technology advancements. Such professional training enables teachers to keep pace with emerging technologies and methods to ensure that they are able to offer maximum support to students with visual impairment (Alshahrani, 2020).

2.4.5 Accessible Teaching Methods

Accessible instructional techniques are critical in facilitating an inclusive classroom. Among these are adapting instructional materials and the instructional process to support students who have visual impairments. Professional development workshops should include training for different accessible instructional techniques so that teachers are able to respond appropriately to the needs of different learners. Based on a study conducted by Bray et al. (2024), the significance of accessible instructional techniques in fostering inclusive education is highlighted. Trained instructors who use such approaches can plan inclusive learning opportunities that work well for all learners, including the blind. For instance, digitising textbooks and handouts in classes and providing them with audio description and tactile graphics can improve access and learning facilitation among blind students. Accessible instructional practices also involve the modification of instructional approaches to allow all students to engage in the programmes. This includes providing a verbal description of visual materials, providing alternative ways of showing an understanding of something, and providing adaptive instruction styles. Integration of these processes with the teaching process by instructors can provide an inclusive classroom setting that caters to the learning differences of the students according to their visual impairment (Bray et al., 2024).

2.4.6 Academic and Peer Mentoring Programmes

Academic and emotional support delivery to visually impaired children requires the implementation of mentorship programmes. Most mentorship programmes provide two main mentoring approaches which are academic mentoring and peer mentoring. Academic mentors at an age above the student or with veteran professional experience assist students with visual impairment to master software programmes and screen readers and voice recognition systems and Braille translation applications (Manirajee et al., 2024). Mentors grant personalised tutoring based on individual student needs and speed which reduces their time to learn new technology skills. Apart from academic assistance, peer mentoring also generates a feeling of community and belonging. Peer mentors, who are usually students within the same learning environment, provide informal advice, disclose personal experiences and guide students with visual impairment through social and academic issues. Through this, not only do students become more confident in the use of assistive devices, but they also become socially more connected and less likely to suffer from loneliness, as stated by Kimaro (2023). Peer mentors are likely to serve as role models, modeling effective strategies in coping with typical educational problems (Thompson et al., 2020). Mentorship programmes have also been established to play a fundamental role in building self-efficacy and confidence in students with visual impairment to a great extent. Students that are confident in the use of assistive technology are likely to engage more in learning activities and be owners of their own learning (Lirong & Ghani, 2025). In addition, peer mentorship facilitates emotional wellness through the availability of a support system in which the students can share advice and encouragement (Beals et al., 2021). Literature highlights the importance of formal mentoring programmes that integrate intellectual and social support. In addition, successful mentoring programmes incorporate learning sessions where mentors and mentees learn together through technology. Not only do these sessions impart technical competency, but also teamwork and problem-solving, both of which are essential for academic success (Klegeris, 2021). Mentors also work outside the classroom to help students build resilience and adaptability in the event of failure, readying them for future workplaces.

2.4.7 Accessible Online Resources

Students with visual impairment need easy access to online learning sites as well as platforms where they can conveniently use their online learning materials. Online platforms and websites must follow web accessibility guidelines as a requirement for offering equal online learning possibilities to students. Adhering to W3C's Web Content Accessibility Guidelines (WCAG) 2.1 requires digital content to be accessible with alternative formats while also being easy to use and understandable and reliable for individuals with disabilities (Paul, 2023). All websites should implement functions enabling assistive technology while permitting users to navigate using keyboard commands and allowing access to content through screen reading software. There are some of the most significant aspects of accessible web design. Websites, for instance, must include text descriptions of non-text content, including images and graphics, to enable users who are blind to access information through screen readers (Sánchez et al., 2020). In addition, website navigation needs to be made simple and all the interactive elements like buttons and links need to be accessible by using keyboard shortcuts (Daskalakes et al., 2024). By following these guidelines religiously, online education websites can make sure there is an accessible learning environment that supports students with visual impairment. In addition to making websites accessible, web content like videos and interactive modules also needs the application of audio descriptions and transcripts. Audio descriptions are verbal explanations of video images that allow students with visual impairment to perceive visual information that is not accessible to them (Zabrocka, 2021). The feature is particularly needed for tutorial videos that contain graphic diagrams, animations, or other visual elements that support learning. Transcripts are also available as they include written versions of audio content in film and interactive material (Jayaraman & Aane, 2024). Transcripts help students to access the content through reading and listening to screen readers in a manner that they may gain access to the information. This gives every student with or without vision an equal opportunity, to access and utilise teaching resources. Video recordings of tutorials, say, enable students to listen to the content when it suits them and not miss key details (Levenberg & Reesh, 2023).

2.4.8 Funding and Resource Allocation

Financing has a vital role in the availability of necessary assistive technology and learning accommodations to students with visual impairment. Assistive technology such as screen readers, Braille display, and zoom software can be extremely costly for schools and institutions (Alshahrani, 2020). Appropriate financing in purchasing and operating such equipment, and the aspect that students need to utilise newer and more advanced technology, must be considered. Literature indicates that many funding bodies, including government grants, education foundations, and personal donations, are required in order to fulfil these conditions (Huda, 2024). For instance, student grants and government funding programmes for the disabled can access the funds required to acquire new assistive technologies (Harpur et al., 2025). Investment in such technology allows learning institutions to effectively change the learning experience of visually impaired and blind students to the extent that they gain competence in obtaining academic success.

Apart from investing in assistive technologies, money must be invested in ongoing development and use of accessibility programmes. It is not just a case of upgrading and keeping current technologies running, but R&D to create innovations to cope with higher demands (Fan et al., 2023). Ongoing development must take place to maintain pace with new technologies and maintain accessibility programmes running efficiently and effectively. Continuing funding is used to plan for accessibility, training initiatives, and continued monitoring to verify the effectiveness of interventions being rolled out (Alshahrani, 2020). Funding, for instance, can be used to train teachers and staff in assistive technology use and provision of accessible educational resources and online content (Mishra et al., 2024). Effective resource management guarantees that access initiatives are put in place, maintained, and constructed to support students with changing visual impairment needs. It is challenging to establish and maintain accessibility conditions, such as guaranteeing long-term funding and attaining resource efficiency. Schools must build inclusive finance models with stakeholders in an attempt to overcome such obstacles (Ramesh et al., 2025). Best practice encompasses the presence of dedicated budgets for accessibility, joining technology vendor deals, and the composition of grants for topping-up funds for assistive technologies. In addition, involving stakeholders during planning and implementation, i.e., teachers, students, and interest groups, can assist in ensuring resources are properly allocated and visually-impaired students receive their needed provisions (Daskalakes et al., 2024). If schools embrace the collective effort principle and address the issue on the basis of a sustainable long-term basis, then they can hopefully make the best of their investment and budget in financing to enable constant expansion of accessibility.

2.5 Barriers Faced by Students with Visual Impairment in Accessing Computer Technology

Students with Visual Impairment encounter various challenges in the use of computer technology, reducing the potential benefit to learning. These are technological, social, and institutional obstacles that restrict utilisation and access. Knowledge of these obstacles is needed towards bridging gaps and provide equitable access to computer technology, which will eventually improve learning outcomes among blind students.

2.5.1 High Costs and Financial Constraints

Students with visual impairment face major obstacles in accessing and making use of assistive technology due to a lack of economic resources. A Delhi, India study supported that the main obstacle was financial constraint with 20% of the students reporting inability to purchase necessary assistive devices due to financial reasons (PARVEEN, 2022). Similarly, in the UK, while services such as the Disabled Students' Allowance (DSA) do try to make provision for assistive technology, the cost of devices such as screen readers and Braille outputs may still prove prohibitive to most students (Hewett, 2020). Apart from this, the provision of funding itself is not guaranteed to provide access since bureaucracy and the policy of eligibility may hinder students from accessing the equipment that they need (Pius & Kamugisha, 2023). The expense not only limits the purchase of technology but also maintenance and upgrading materials, thus widening the gap between individuals who are able to purchase such equipment and those who are not (Szymkowiak et al., 2021).

2.5.2 Inadequate Support and Training

There are major barriers to the implementation and effective use of assistive technology in the form of inadequate competent support systems and a lack of training. The majority of teachers lack the necessary skills to assist visually impaired learners, and this disables the capacity to create an inclusive learning environment (Belay & Yihun, 2020). These technologies are not maximised when teachers with insufficient knowledge of teaching methods and assistive technologies find them difficult to apply in class (Oyedokun, 2025). Furthermore, a systematic review indicated that children with visual impairment are likely to encounter a range of barriers, a shortage of skilled teachers and an inadequate degree of curriculum modification that restrict their chances to adapt successfully to inclusive school environments (Zen et al., 2023).

Such unawareness can make students who are blind receive a poor impression about what they can actually do, shrinking their prospects as well as their opportunity for participation (Nsabayezu et al., 2022). More importantly, technology is increasing day by day and so instructors ought to also keep improving their professional expertise in order to meet the arising trends and approaches. Nevertheless, insufficient professional growth limits the potential of the majority of instructors to offer the support needed and, therefore, undermines effective incorporation of assistive technology in education (Alsolami, 2022). Other than these setbacks, limited access of students to technical support represents a crucial obstacle. A lack of knowledgeable people to identify problems could make the technology obsolete should equipment fail or need modifications. This support gap stresses the need for a comprehensive training curriculum combining pedagogical tools and technical capabilities for optimal help of assistive technologies for pupils with visual impairment (Mishra et al., 2024).

2.5.3 Technological Limitations

Although assistive technology like screen readers and magnifiers is necessary for students with visual impairment, they are typically greatly hindered in usability and functionality. A primary problem is that occasionally screen readers only reveal very small amounts of text or content at a time. This short-term thinking can restrict consumers from moving through websites or documents effectively, particularly when they need to comprehend the context of information between parts. For instance, moving through lengthy paragraphs, headings, or complicated instructions can be tedious because the screen reader can fail to give proper context or need extensive interaction to obtain the overall impression (Oyedokun, 2025). In addition, assistive devices generally have difficulty with complex designs and large data structures. Screen readers, for instance, have a problem reading complex tables, images, and charts, leading to the wrong or incomplete transmission of visual information (Zong et al., 2022). In the face of such arrangements, screen readers also read linearly and this is bound to frustrate and make users bogged up with massive quantities of non-correlative data that can't connect to the original document layout. Low navigation speeds coupled with a lack of user-control for modifying their experience of the technology have also tended to lead to frustration and abandonment (Yadav et al., 2025).

Apart from that, the structure and operation of the majority of assistive technologies are not necessarily compatible with the diversified needs of students. There are some devices or systems which are either too rigid to suit varying levels of visual impairment. Magnifying glasses, for instance, have a limited capacity for expansion so that text is easily magnified but difficult for students with low vision to read comfortably. Likewise, certain screen readers are unable to interpret non-conventional fonts or emerging media components, including dynamic web pages or interactive multimedia objects, diminishing students' ability to undertake whole-digital based learning experiences (Sharif et al., 2021).

These technical limitations coupled with periodic software updates can hinder the ability of learners to remain conversant with digital technology, minimising their learning possibilities.

2.5.4 Social and Psychological Barriers

Besides technological limitations, social and psychological factors affect the use and acceptance of aid devices by blind and partially sighted students. Students might refuse to use aid assistance because they are afraid of being stigmatised or socially isolated, or simply so they are not different from their fellow students. Most blind and partially sighted students are highly sensitive to their differences from fellow students with sight. This consciousness can create psychological barriers since students might feel that the use of assistive technologies, i.e., screen readers, labels them or reveals their disability (Pinjatela, 2024). Therefore, students might resist or not utilise these resources, even when provided, so that they do not stand out.

Partially sighted students who are usually able to use digital information without assistive technology may be more inclined to avoid using screen readers or magnifiers in a bid to keep things normal in their social circles (Pinjatela, 2024). They may fear that the use of assistive technologies will indicate a worse vision issue, which will lead to prejudice or unwanted attention. Blind students, nonetheless, may not have much choice but to use assistive devices in order to be able to access digital content, even though they face the same social stigma. This status may give rise to a feeling of exclusion because blind students are socially isolated from their other students who do not face similar issues.

Psychologically, the impacts of such isolation are noteworthy. The research opines that excessive protection or isolation of students with visual impairment based on their reliance on assistive devices can be negative to their self-esteem and confidence. In addition, low teacher or peer expectations perpetuate such negative attitudes and create a setting where visually impaired children are not likely to take an active part in their learning (Nsabayezu et al., 2022). In order to overcome such challenges, schools and universities need to create an inclusive setting that not only offers access to assistive technology but also ensures its utilisation without stigma, thus ensuring social inclusion and psychological well-being. Social determinants of peer relations and social acceptance impact the willingness of students with visual impairment to use assistive technology. Assistive devices will make students feel excluded, so they are discouraged from using them even when these aids would maximise their learning. Providing a secure and supportive learning environment that is focused on the advantages of assistive technology will ward off some of these concerns, allowing the student to feel comfortable enough to employ the provided resources without fear of isolation or judgment (Nsabayezu et al., 2022). The convergence of technological and social barriers underscores the need to undertake a number of different strategies for enhancing accessibility and use of assistive devices. Supplying instruments alone is inadequate; teachers, support staff, and policymakers need to collaborate in offering students with visual impairment technological and social support throughout their academic lifetime. This involves giving students and instructors intense training packages, and instituting a school culture that enables the normalisation of assistive technologies as an established norm.

2.5.5 Accessibility and Technical Challenges

Screen readers and other assistive technology, in playing a very significant role in assisting students with visual impairment, often face extreme technological problems that restrict their usability. Language and cultural barriers of most screen readers, manufactured in foreign locations as they most frequently are, pose a big challenge. For instance, screen readers using foreign accents or tones of speech could hinder users from comprehending the text, particularly when it involves uncommon words or technical vocabulary. It is particularly challenging for students whose local accent or language does not match that used by the screen reader, such that digital text becomes hard to comprehend (van Niekerk et al., 2023). Moreover, navigational constraints using assistive technologies make their usage cumbersome. Most screen readers and magnifiers lack effective features in navigating complex web hierarchies or interactive multimedia content, for example, dynamic pages or inlined media (Nino et al, 2024). Students might thus experience significant challenges accessing online course content, submitting homework, or cooperating with digital resources. For instance, screen readers will be unable to browse long forms, perform tasks, or read online multimedia in different forms (van Niekerk et al., 2023). These technological problems tend to annoy and can discourage students from effectively utilising assistive devices, thus hindering their learning development and social integration.

2.5.6 Lack of Adequate Training Resources

Insufficient training resources are one of the major barriers to the effective use of assistive technologies. As discussed by Nino et al. (2024), limited experienced trainers and prohibitive training expenses are enormous barriers to extensive use of assistive technologies. Students with visual impairment might have access to technology but not the appropriate training required to utilise these devices effectively. This is worsened by the reality that there are no study materials or other avenues for acquiring these skills. The consequence of this is that students are unable to maximise the potential of these devices, and this is reflected in the poor academic records and social relationships (Nino et al, 2024). The training for educators and teachers sometimes fails to develop their skills needed to integrate assistive technologies properly within their educational approaches. The lack of training for teachers creates insufficient support when they integrate assistive technologies into classroom education because they do not receive proper training for special needs education of students with visual impairment. This training deficit for students and teachers fuels the underuse of assistive devices, diminishing their overall effect on the academic and social lives of students. Limited training resources also lead to lengthy adjustment times for students who must learn assistive technologies independently without adequate support and guidance (Pinjatela, 2024).

2.5.7 Cultural and Symbolic Barriers

Symbolic and cultural barriers actively delay student adoption of assistive technology devices intended for use by students with visual impairment. The use of stigmatising tactics discourages students with visual impairment from using these devices because they notice their different characteristics or disability status. Pinjatela (2024) found that blind children, especially in the adolescent and teenage age groups, would reject assistive devices in a bid not to be different from the rest of the class. If these tools are perceived as markers of difference, students will reject them in a bid to blend in with social norms and attain normalcy.

Partially sighted learners who can, without the help of assistive technologies, still engage with digital information are more likely to avoid such technologies since they may fear exclusion or being seen as more disabled than they are. Blind students, for their part, are more likely to use assistive devices for educational purposes; nevertheless, they, too, can suffer from social stigma in their academic and even in their social environments. In case the symbolic value of assistive technology is negative, then it can create a psychological boundary that dissuades students from using these tools, despite them being necessary for educational achievements (Pinjatela, 2024). This cultural stance underscores the necessity for greater effort in establishing a more accepting learning culture in which the utilisation of assistive technologies is the norm and not stigmatised or marginalised. Establishing regulatory policy and capacity-development programmes that are conducive to the value of assistive technologies and promote use without invoking negative cultural judgment is foremost in eliminating these barriers. Additionally, the development of an inclusive school culture valuing diversity and the integration of assistive technologies within schools has the capacity to enhance social relations and psychological functioning in students with visual impairment (Nsabayezu et al., 2022).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter details the methodology and procedures adopted to assess the usage of computer technology among students with visual impairment at the University of Education, Winneba. It covers the research approach, research design, the study population, data collection instruments, and the strategies used to ensure the trustworthiness of the study, including transferability, dependability, confirmability, and credibility. Furthermore, the chapter outlines the procedures for data collection and analysis, as well as the ethical considerations that guided the research process.

3.1 Philosophical Position

This study took an interpretivist stance, focusing on understanding individual experiences and viewpoints within specific contexts. Interpretivism, as described by Pervin and Mokhtar (2022), emphasises that reality is not fixed in objectivity but is shaped by people's individual experiences with the meanings they attach. Likewise, Pervin & Mokhtar (2022) notes that interpretivism is uniquely suited to qualitative research, since it seeks to explore details of human experiences within a naturalistic setting.

The researcher seeks to explore the ways students with visual impairment at the University of Education, Winneba, use computer technology to support their learning. This approach is very relevant, for it sought to offer an understanding, quite in depth, of the knowledge held by students with visual impairment about computer technology, also how they then access its various features, and their perceptions of all the support systems available to optimise computer technology for their learning.

Interpretivism values personal stories as well as understanding of participants (Alharahsheh & Pius, 2020), unlike the positivist approach, which focuses on measurable data. Each student could have varying experiences with computer technology with a dependence on factors such as their degree of impairment, availability of computer technology, previous knowledge, existing resources and individual learning strategies, highlighting the subjective nature of reality in social contexts (Davids & Waghid, 2021). The study adopts this philosophical stance. It aims to capture the richness and diversity of these experiences through methods like interviews and observations. As Luijk (2023) noted, interpretivism lets investigators delve into the meanings people give to their activities and relationships within a given social context. This allows the researcher to compile thorough, firsthand descriptions of how students with visual impairment interact with computer technology including their successes, limitations, and ideas for improvement. Under the interpretivist viewpoint, the research investigates the emotional, social and educational influence on the lives of the students as well as the technical features of computer usage. Such a strategy fits with the idea of respecting lived events to advance social justice and inclusiveness in universities (Davids & Waghid, 2021).

3.2 Research Approach

This study adopted a qualitative research approach. Qualitative research approach which is particularly effective for understanding the meaning of a phenomenon from the perspectives of the participants (Hennink et al., 2020). Given that this study focuses on students with visual impairment regarding their use of computer technology, it is well-suited to explore how these students engage with technology, their skills regarding their use of computer technology, it is well-positioned to explore how these students interact with various technological features, the barriers they face, and the strategies they employ to enhance their learning experiences. Additionally, this study seeks to examine how students use the features of computer technology at the University of Education, Winneba, while identifying the support systems necessary to optimise their use of computer technology in their learning process.

Qualitative research provides insights into the social and cultural contexts in which the participants experience computer technology (Islam & Aldaihani, 2022). It emphasises direct interaction with participants in their natural environment, allowing data collection from the field where the phenomenon takes place at the University of Education, Winneba, in this case. This method enables a deeper understanding of how students with visual impairment use of computer technology to support their studies and highlights the support systems needed for them to fully benefit from these technologies (Potthoff et al., 2023). Again, Pregoner (2024) highlighted that, in the 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 which was the resource centre for students with special needs (UEW).

In one-on-one meetings, the researcher collected opinions of students providing insightful and thorough responses on evaluating computer technology use among students with visual impairment at the University of Education, Winneba. This qualitative approach sought to reflect the skills of subjects and thus illuminate their interactions with computer technology (Mattimoe et al., 2021). It also lets the researcher look into fundamental problems and experiences in a way that quantitative approaches cannot, therefore giving a thorough knowledge of the subject under study.

3.3 Research Design

The design that drove this study was a case study research design. Yin (2018) argues that a case study approach is best suited to a thorough investigation of a particular problem or phenomenon in actual daily life. In qualitative research, a case study is a design that can serve either as an aim of study or as a result of an investigative product. The focus of this study is in this situation how University of Education, Winneba students with visual impairment assess and use computer technology in their studies. The design was chosen so that the relationships of the participants with computer technology could be better understood in depth.

This allowed the researcher to concentrate on a particular group of students with visual impairment, and provide a thorough investigation of their use of computer technology. The main data collection technique was semi-structured interviews, which allowed participants to freely share their knowledge. Interviews delved into things like their level of digital competence, their approaches to including technology into academic activities, their resources of support, and the barriers they face. Furthermore, people were asked to offer ideas on how to enhance their interactions with computer technology. The researcher additionally used complementary techniques such as observation, which are frequently used in case study inquiry (Morgan, 2024), to build a balanced view of the phenomenon. Observations let me document how students with visual impairment use computers in natural surroundings.

This case study design emphasised the experiences and voices of the student respondents. The research revealed the difficulties the subjects face as well as the accomplishments they make using computer technology for their studies by concentrating on their lived experiences. The results were meant to offer pragmatic ideas on enhancing the academic experiences of students with visual impairment as well as guaranteeing their particular needs are met throughout the utilisation of computer technology in the education path.

3.4 Population

The population for the study was made up of fifty-one (51) participants, consisting of 50 students with visual impairment from levels 100, 200, and 300 across seven departments which were: Special Education, Social Studies, Political Science, History, French, English, and Counselling Psychology, and one staff member who is responsible for supporting students with visual impairment in computer technology usage. These departments were used because they had a significant enrollment of students with visual impairment.

Level 100 students were included in the study because some of them had prior knowledge, experience and exposure using computer technology before gaining admission into the university. This provided detailed insight into how their previous exposure to computers influences their recent engagement with computer technology in the university setting. Including this group allowed the study to explore their early adaptation and adjustment to the computer technology and support systems available to them.

Level 400 students were not included in the study because they were mostly off-campus on an internship during data collection. This may render it difficult to contact them and solicit their participation, as well as lead to their limited presence on campus potentially affecting the study's goals to assess computer technology usage among students with visual impairment in the university environment. By focusing on level 100 students, 200 students, and 300 students, the research gave a wider view of the interaction between students with visual impairment and computer technology at different levels, as well as insight into assistance systems at different levels.

3.5 Sample Size

The sample for the study was twenty-one (21) participants. It was made up of 20 students with visual impairment, from various departments and one university staff member responsible for supporting students with visual impairment in their use of computer technology. The student sample consisted of fifteen (15) participants from the Department of Special Education, three (3) from the Department of Political Science, one (1) from the Communication and Media Studies, and one (1) from the Department of History.

A sample of this size is appropriate for a qualitative case study because the aim of qualitative research is not to achieve statistical generalisation but to generate in-depth understanding of a specific context (Mthuli et al., 2022). Qualitative studies typically involve smaller, purposive samples that allow the researcher to explore participants' lived experiences, perceptions, and meanings in rich detail (Subedi, 2021). According to Sarfo et al. (2021), qualitative sample sizes often range from 5 to 25 participants when the focus is on obtaining comprehensive insights within a bounded case.

In this study, the inclusion of 20 students with visual impairment ensured representation across different academic disciplines, while the inclusion of a key staff member provided additional institutional perspective. This sample size was considered adequate to capture diverse experiences and to support a thorough examination of computer technology usage among students with visual impairment at the University of Education, Winneba. The distribution of students by department is presented in Table 1 below.

Table 1

Departments of Students with Visual Impairment

Category	**Department**	**Number of Participants**
Students with visual impairment	Special Education	15
	Political Science	3
	Communication and Media Studies	1
	History	1
Total		20

Source: (Field Data, 2024)

3.6 Sampling Technique

Sampling technique can be defined as the method or procedure used by a researcher to select a group of individuals from a larger population to participate in a study (Douglas, 2022). For this study on assessing computer technology usage among students with visual impairment at the University of Education, Winneba (UEW), heterogeneous purposive sampling was used to select participants for the study. This method was selected because it enabled the researcher to focus on participants who are most important to the research objectives, specifically those who actively use computer technology in their academic activities (Nyimbili & Nyimbili, 2024). As explained by Akinlar (2024), purposive sampling relies on the researcher's judgment to select participants who possess the characteristics, knowledge and experiences necessary to provide relevant data for the study.

Selection of participants to carry out this research was done on various criteria in order to choose the participants to make sure they are a representation of the target group and have the required knowledge needed to provide information on the area of study focus. First, the researcher chose students enrolled on under the Resource Centre for Students with Special Needs to take part in the research. This ensured that the study was focused on students, particularly those who use computer technology in academic activities. Participants needed to be actively engaged in the use of computers as part of their studies, such as using it to conduct research, assignments, access course material, and write examinations. To verify this, the researcher checked files at the Resource Centre for Students with Special Needs and made follow-up phone calls to ensure that the chosen students were using computers for these educational activities.

Second, level 200 and 300 students were selected to participate in the study. The reason for selecting this level is that these students had been in the university longer and therefore had more experience in using computers for their studies. By this time, they had completed foundation courses, sat exams, and were more likely to be familiar with the application of computers in various academic activities, including research work, assignments, and exam preparations. Their longer exposure to the academic environment provided a fertile understanding of how computer technology has been adopted in their learning and everyday learning experiences.

Participants who were actively engaged in their academic programmes and available during the data collection period were selected for the study. This approach is consistent with purposive sampling, which prioritises the inclusion of participants capable of providing relevant and information-rich insights into the phenomenon being investigated. Students who were still on holiday or otherwise unavailable throughout the study were not included. Participants were selected to ensure the data reflected current experiences with computer technology in academic activities. Importantly, the study did not limit participation to students who were proficient or frequent users of computer technology. Students with varying levels of experience, including those with limited use or difficulties, were included to capture a comprehensive understanding of skills, usage patterns, support needs, and barriers. In addition, the study attempted to obtain a range of opinions by selecting students from a range of academic departments. This way, the study was able to discover how computer technology is utilised in different fields of study, as students from departments such as special education, social sciences, among others, mentioned previously in the sample size, were included in the sample. The difference in the academic disciplines was necessary to understand how the usage and availability of computers may vary depending on the specific needs and nature of the courses.

Finally, students were selected to include those who were visually impaired at different stages of life. Some of the students may have acquired the condition from birth, while others may have become visually impaired later in life. The spectrum enabled an investigation into how the duration and stage in life where visual impairment took place affected students' adaptation to and use of computers, particularly within the limits of their studies. Through these selection factors, the researcher managed to gather an assortment of participants who were capable of providing a broad range of perceptions of computer technology usage by students with visual impairment at the University of Education, Winneba. In this manner, the study managed to capture the complexity in which such students use and interact with computers for their studies.

3.7 Instruments for Data Collection

The study adopted three primary data collection instruments to assess computer technology usage among students with visual impairment at University of Education Winneba: a semi interview guide, a focus group discussion, and an observation checklist. The semi-structured interview guide was used to gather detailed responses from students' participants who use computer technology and one university staff member on their knowledge, accessibility and available support systems for using computer technology. The focus group interview guide facilitated the carrying out of a group discussion among the students, which allowed them to share common problems, experiences, and suggestions. An observation checklist was employed to systematically record how students interacted with computer technology, with particular attention to their skills, accessibility issues, and coping mechanisms. These instruments were designed according to the study objectives to obtain a comprehensive description of the problems researched.

3.7.1 Semi-Structured Interview Guide

Data for this study were collected from participants using a semi-structured interview guide. A Semi-structured interview guide ensured that participant responses remained focused on assessing computer technology usage among students with visual impairment at the University of Education, Winneba to prevent participants from deviating from the study's focus (Flick, 2024). Semi-structured interviews also provided participants with the opportunity to share their personal experiences while offering flexibility for the researcher to probe deeper into specific areas of interest (Roberts, 2020). An individual interview was conducted with one IT assistant instructor to gain insights into the institutional support provided for the maximum use of computer technology by students with visual impairment. Semi-structured interviews are particularly valuable for capturing detailed accounts of participants lived experiences (Karatsareas, 2022).

The interview plan was centered around the support measures available for the visually impaired pupils to access computer technology at the University of Education, Winneba. It contained questions which were directed to gathering detailed information about the assistance provided to pupils, the application and role of assistive technology such as screen readers, and the steps needed to ensure the use of these technologies. Besides, the guide went into how students utilise computers on campus, the way computer technology is integrated into their coursework, and the way methods are utilised to help students access online material and coursework. The guide also briefly mentioned more generic support mechanisms, such as between the faculty and other departments to facilitate the use of computer technology and how feedback is collected from students about the support they are getting. The guide asked participants to suggest how the support mechanisms can be made better and whether these mechanisms are significantly contributing to the academic performance of students with visual impairment.

Although semi-structured interviews provide the versatility to explore participants' experiences comprehensively, they risk meandering away from the core theme. To prevent this, a structured interview guide was created that could guarantee talks stayed within the study's goals and followed important areas of interest. The interview guide was carefully constructed based on previous research in accessibility, use frequencies, and successful adoption of computer technology by visually impaired individuals (Bhalla et al., 2023).

3.7.2 Focus Group Interview

As Khan et al. (2025) suggest, focus group interviews are structured group discussions that aim to determine the views, sentiments and experiences of participants about a specified research topic. The discussions encourage collaborative feedback and brainstorming, leading to the collection of diverse and comprehensive data (Bolin et al., 2023). In this study, focus group discussions were conducted with students with visual impairment at the University of Education, Winneba (UEW). For effective discussion, the participants were grouped by degree of visual impairment. Such groupings enabled the participants to link closely with each other's conditions as well as create high intensities of discussion interaction.

Each focus group consisted of five participants making groups of four in total. The choice of using five participants per group was informed by both practical considerations and methodological guidance from the other studies. Although several authors recommend that focus groups should typically consist of six to twelve participants, other studies have emphasised that smaller groups are often more effective in certain contexts, particularly when dealing with sensitive topics or participants who may require more time to communicate their experiences.

According to Longhurst and Johnston (2023), smaller focus groups of three to five participants are preferable when participants are likely to have much to say or when the topic is complex and requires more individual contributions. Similarly, the OERU Research Methods module (2023) notes that a focus group of three to five members allows each participant enough opportunity to express their views in detail, making it ideal for in-depth qualitative inquiry. Given that students with visual impairment often have unique, detailed, and personal experiences regarding computer technology and accessibility, smaller group sizes ensure that each participant can share their experiences comprehensively (Tsindos, 2023).

Empirical studies also demonstrate that focus groups of five participants are both methodologically sound and effective. For instance, an ERIC-archived qualitative study used focus groups of five stakeholders to gain deeper insights into participants' experiences, highlighting that smaller groups enhance interaction and allow for a more manageable discussion environment. These examples show that using five participants is not only acceptable but also supported by recent qualitative research practice.

Smaller focus groups have several advantages in this study context. First, they promote depth over breadth each participant has ample time to discuss personal experiences with assistive technologies such as JAWS and NVDA, or challenges related to accessibility, training, and institutional support. Second, with participants who use assistive devices, smaller groups reduce interruptions and logistical challenges, allowing the moderator to better manage participation and ensure inclusivity. Third, students with visual impairment at the University of Education, Winneba, represent a relatively small population, which makes it more practical to organise smaller, well-managed focus groups rather than attempt to convene larger sessions.

Additionally, previous research conducted at the University of Education, Winneba by Kyei (2023) on students with visual impairment used seven focus groups comprising 36 participants, averaging roughly five per group. This precedent supports the methodological soundness of using five participants per group in a similar population and context. As Kyei's study demonstrated, smaller groups facilitated meaningful interaction and produced rich data reflecting the lived experiences of students with visual impairment.

While larger groups may offer a wider range of perspectives, they can also hinder full participation, particularly when participants differ in communication speed or confidence. Smaller groups, by contrast, allow for a more intimate, comfortable setting where individuals feel valued and heard. For a topic as personal and experiential as computer technology usage among students with visual impairment, five participants per group strike a balance between ensuring diversity of opinion and allowing for in-depth, detailed exploration (de Souza et al. 2024).

Geampana and Perrotta (2025) and Mwilongo (2025) point to the danger of bias in focus group interviews if the conversation is not properly managed. In an attempt to mitigate this, the researcher used semi-structured interviews in the focus groups, which were a middle ground between being structured and allowing participants to talk freely. Focus groups were used because they encourage active participation and bring about sharing of contrasting viewpoints. This approach facilitated the building of a common understanding of computer technology use possibilities and challenges for students with visual impairment (Guest et al., 2023; Kamalı-Arslantaş et al., 2023).

To help establish that every participant did have a free chance to add their point, the researcher utilised high-strength mediation as well as facilitation to contain the chances for dominant persons to overrunning the debate of the majority (Guest et al., 2023). According to Tisdell et al. (2025), using a clearly conceptualised focus group interview guide gives rise to more face-to-face interaction as part of it includes participants voicing their personal standpoint and story individually. The researcher guided the conversations to ensure that the issues stayed on course and that all members' voices were heard and honoured.

The focus group interview guide was organised into four general sections covering the research questions of the study (see Appendix C). The first question asked the participants about what they knew of computer technology. It asked them about their familiarity with various tools, software, and applications that would help them with their academic tasks. The second question asked about how students with visual impairment made use of the potential of computer technology that existed at the university. The third section dealt with the support facilities provided by the university to facilitate the use of computer technology by students with visual impairment. Concerns involved accessibility of assistive devices, technical support, and training schemes. Finally, the fourth section examined the obstacles faced by the students in the use of computer technology. Each question began with the overall question under one of the research questions and then subsidiary questions to find even more in-depth responses. During the discussion, the researcher used probes and prompts to further expand and make sure participants' responses were made lucid for continuing the conversation to keep it directed and fruitful (Robinson, 2023). In comparison of the guide for focus group interview to research questions, it ensured the gathered data was exhaustive and replied accordingly for research purposes.

3.7.3 Observation

Observation is another qualitative data collection method that involves systematically watching and recording behaviours, events or interactions as they naturally occur in their context (Al-Hendawi, 2025; Uwamusi & Ajisebiyawo, 2023). This method was utilised to complement the data collected through interviews and focus group discussions in order to provide additional context and validation for the research findings (Hurst, 2023). The researcher used overt-active participant observation, where the researcher actively participated in the students' activities while they were aware of the observation's purpose. This approach enables me to immerse myself in the participants' environment, documenting details of their interactions and activities (Barries, 2024). The aim was to gain deeper insights into how students with visual impairment engage with computer technology during their academic activities. An observation checklist, adapted from resources used by the Perkins School for the Blind, was employed to assess the skills of students with visual impairment on computer technology and how students with visual impairment use the features of the computer technology. The checklist helped ensure systematic data collection, focusing on how students interacted with computer features, navigated through different software, and utilised the technology for their learning tasks (Qaddo, 2019). This method offered a practical perspective on the use of computer technology, revealing both the strengths and limitations in students' interactions with digital tools. Additionally, it provided valuable insights into the support systems required to optimise their learning experience.

3.8 Trustworthiness

Trustworthiness is a key concept in qualitative research, and it refers to the rigour and quality of study methods and study findings. Credibility, transferability, dependability, and confirmability are the four key criteria that are used to evaluate trustworthiness (Kakar et al., 2023).

3.8.1 Credibility

Credibility is the confidence that can be placed in the validity of the research result. It ensures that the findings reflect the participants' experiences and opinions, rather than being influenced by the researcher's assumptions (Bang, 2024). To achieve credibility, several strategies were used, including prolonged interaction with participants, member checking, peer debriefing and triangulation. In this study, the researcher ensured credibility by taking the participants through a process of member checking, where the findings and interpretations were read out to them to make sure that the data indeed represented their experiences that they shared. The researcher also returned the emerging themes to the professionals working in the field of computer technology use and visual impairment to test them for validity. Audio recordings were used during the focus group discussions to strengthen the credibility of the data. This approach enabled precise documentation of participants' contributions, facilitated verbatim transcription, and supported a rigorous analysis of the collected data. The researcher also utilised observation alongside interviewing to cross-validate information and reinforce the validity of the findings, a technique called triangulation (Shufutinsky, 2020).

3.8.2 Transferability

Transferability is the extent to which findings from a study can be applied in other contexts or settings. In other words, transferability has to do with applicability. To maximise transferability, the researcher provided a detailed description of the study context, participants, and procedures (termed "thick description") to allow readers to judge the applicability of the findings to their own contexts (Bang, 2024). In this study, the reesearcher provided a comprehensive description of the participants, who were all students with visual impairment at Winneba University of Education, was provided. The study also gave the inclusion and exclusion criteria for participant enrollment and gave a comprehensive description of the study environment, the data collection procedure (e.g., interviews, focus groups, and observation), and how the data were analysed. This approach enhanced the transferability of the findings by providing detailed and contextually embedded descriptions that allow readers to determine the applicability of the results to other settings (Cloutier & Ravasi, 2021).

3.8.3 Dependability

Dependability targets the reliability and consistency of the research process and outcomes. Dependability involves ensuring that the research process is systematic, well-documented, and replicable (Kakar et al., 2023). Dependability in this study was achieved by careful design and execution of the research process. The case study design allowed the participants to detail their own lived experiences of accessing computer technology at the University of Education, Winneba. Literature related to the research questions provided the foundation for the interview questions, and these were designed so that they are relevant to the purposes of the study. These were piloted and refined before conducting interviews. Careful documentation of the research design and procedures was maintained, and monitoring of each step of the process of gathering the data was conducted to prevent duplication and obscurity (Bang, 2024).

3.8.4 Confirmability

Confirmability refers to the objectivity of the study and ensures that the findings are determined by the participants' experiences rather than the researcher's preconceptions or biases. Confirmability in this research was achieved by defining the researcher's intention and role clearly throughout the data collection process (Shufutinsky, 2020). Confirmability was ensured by maintaining reflexive practices throughout the study. The researcher continuously examined and documented personal assumptions and prior experiences to reduce their potential influence on data collection and interpretation. Furthermore, the analysis was grounded in participants' verbatim responses, supported by field notes and audio recordings. An audit trail of methodological and analytic decisions was maintained to enhance transparency and demonstrate that the findings emerged from the data rather than researcher predispositions (Cloutier & Ravasi, 2021).

3.9 Procedure for Data Collection

Permission and Communication: The researcher sought permission from the Coordinator of the Resource Centre for Students with Special Needs, University of Education, Winneba (UEW) before conducting the study. The researcher also had permission from the students with visual impairment who participated in the study. Respect for the research setting was ensured by obtaining the necessary permissions before accessing the study setting. A letter of referral from UEW Head of Department of Special Education was used to assist access to the area (see Appendix C). Following the acquisition of institutional approvals, prospective participants were contacted via phone. The researcher provided a detailed explanation of the study's purpose, procedures, and participation requirements, after which students were invited to take part voluntarily. This process occurred during the first semester break of the 2023/2024 academic year, approximately one week prior to the start of the second semester. Although several students confirmed their availability, some could not be reached, partly due to delayed return to campus.

Informed consent was obtained from all participants before data collection. Participants were informed of their right to decline or withdraw from the study at any point without consequence. Confidentiality was strictly maintained through the use of pseudonyms and secure data management procedures. All collected data were stored safely and used exclusively for academic purposes. Data collection was undertaken over a two-week period, with interview sessions arranged at times convenient for participants, predominantly after scheduled lectures.

Interview Schedule and Group Formation: Focus group interviews were conducted in the Resource ICT Laboratory, a location familiar to the participants and considered appropriate for the discussions. Participants were divided into four focus groups according to academic level and type of visual impairment to promote shared experiences within groups. One group consisted of students with low vision, and three groups comprised students who were blind. Each group included five participants, consistent with recommended focus group sizes for qualitative inquiry.

Focus Group Interview Process: The focus group interviews were conducted during the students' free time, which was normally after their lectures. Participants received Braille and large-print copies of the interview consent form (Appendix D) before each session, and these were read through with them. Thumbprints and signatures were then obtained once they had confirmed they had read the consent form. The interviews lasted approximately 35 minutes each. Each group was asked for consent to record the discussion on a mobile phone, with an audio recorder as back-up.

The interview schedule was carefully designed to address the four research objectives of the study. The first section focused on assessing the skills of students with visual impairment regarding the use of computer technology, exploring participants' familiarity with various computer tools, software applications, and accessibility features, as well as their confidence in using these technologies for academic purposes. The second section examined how students utilise the features of computer technology, including assistive tools such as screen readers, magnifiers, and Braille displays, and how they navigate these tools effectively in their learning activities. The third section sought to identify the support systems needed to optimise the use of computer technology, exploring the availability of technical support, training programmes, and peer assistance, and highlighting areas where additional support could enhance learning outcomes. Finally, the fourth section focused on identifying barriers faced by students in using computer technology, including technical, infrastructural, and institutional challenges that may limit their effective engagement with digital resources. This structured approach ensured that the interviews captured comprehensive and relevant information aligned with each research objective, providing rich qualitative data for analysis.

There were sub-questions for all the topics under each of the main questions in order to examine them in-depth. Prompts and probes had been used to elicit elaboration answers and to assist in maintaining the conversation on research questions. That technique facilitated gaining rich insights regarding students' experiences and insights regarding the use of computer technology in academics.

One-on-One Interview Process: The process of interviewing one staff member was used to determine the support systems available for students with visual impairment. The staff member was initially contacted by telephone, where the purpose of the study was explained and their consent to participate was obtained. The interview was supposed to be held face-to-face at his office which is the ICT lab for students with visual impairment.

The interview lasted for about 10 minutes. With the participant's permission, the interview was done using a mobile phone to capture the conversation precisely to gather data. The staff member shared their experiences in helping students with visual impairment, specifically how computer technology is applied in their learning process. They provided constructive criticism on the challenges of students and the effectiveness of the support systems implemented. Moreover, the staff member also put forward pragmatic measures for the enhancement of the students' learning experience, including training and assistive technologies. The process of data collection was realised within the targeted two-week time frame despite the occurrence of some minor logistical challenges.

Observation Data Collection: In order to enhance the validity of the research, an observation was conducted using a checklist (see Appendix B) derived from an assessment tool developed by the Perkins School for the Blind. The observation was conducted to assess the computer literacy skills of students with visual impairment, especially those who reported that they used personal computers for educational purposes. All twenty (20) students with visual impairment who participated in the study were included in the observation exercise, which was scheduled on a separate date from the interviews. Students who possessed personal computers brought them to the observation sessions.

The study employed overt-active participant observation, in which the researcher actively engaged in the students' activities while ensuring that participants were fully aware they were being observed. This approach was selected to provide a deeper understanding of how students with visual impairment interact with computer technology in authentic academic settings. The overt nature of the observation ensured transparency and adhered to ethical research principles, as participants were informed about the purpose of the observation and voluntarily consented to participate. Active participation enabled the researcher to experience the tasks alongside the students, allowing for the identification of strategies, adaptations, and challenges that might not have been fully articulated during interviews. This approach also facilitated the documentation of students' engagement with assistive technologies and digital tools in real-time. Observation specifically focused on students' skills, access to technological features, and practical use of computer technology, thereby generating rich, contextually grounded data to support a comprehensive understanding of their interactions with digital learning resources.

3.10 Ethical Considerations

Research ethics oversees and directs researchers to uphold high standards during the study (Goodwin, 2020).

Informed Consent: All the participants, both staff and students with visual impairment, provided informed consent in the form of a consent form (see Appendix D) offered in Braille and large print. The participants were well informed about the purpose of the study, the level of their involvement, and their rights. The researcher further requested permission to tape record the interviews with the participants. Ensuring informed consent is crucial in qualitative research to protect participants' rights and autonomy (Arellano et al., 2023).

Confidentiality and Anonymity: Confidentiality and anonymity were maintained at all times throughout the study. All identifying information, names and addresses, were replaced with pseudonyms or codes. The researcher took every precaution to maintain the privacy of the participants. The data collected through recording, the data collection tools, and the research results were stored securely, ensuring no identifiable information was linked to the participants. Only the research team had access to the data, and proper measures were taken to maintain the confidentiality of information (Ruggiano & Perry, 2019).

Voluntary Participation: Participation in the study was entirely voluntary, and the participants were free to withdraw at any time without facing any adverse effects. The researcher was keen on making sure that participants felt comfortable and relaxed, so they were not forced to remain in the study but could leave or remain as they wished. Ethical qualitative research requires that participants' autonomy is maintained, for instance, their right to withdraw without any repercussions (Nii Laryeafio & Ogbewe, 2023).

Data Protection and Storage: All the interview audio recordings were securely kept on a recorder and later transferred to a private Google Drive account, which only the researcher could access. All measures were made to prevent unauthorised access, loss, or unauthorised disclosure of the data. Data was maintained in confidence and in a secure manner throughout the research. Protection of data is a major component of moral research techniques, and data belonging to participants are adequately secured (Goodwin, 2020).

3.11 Data Analysis

The data for this study were interpreted using deductive thematic analysis, a method that involves the identification and scrutiny of recurring themes or patterns in qualitative data, guided by pre-established research questions and objectives (Braun & Clarke, 2023). This approach provided a way in which the data was to be investigated against the research questions while guided by particular ideas that were specific to computer technology usage for students with visual impairment. It began with much reading and acclimatising oneself to the qualitative data like the interview transcriptions, notes during the field visits, and records from observation which comprised the baseline analysis. Using the research objectives and questions as the pre-defined themes, the researcher systematically assigned codes to sections of the data about a given theme. This coding was applied by highlighting or underlining text segments, such as paragraphs, sentences, or phrases, relating to pre-defined themes (Squires, 2023). The coded bits of information were then sorted and categorised based on the themes that had been established before analysis, to have a clear summary of similarities, patterns, and differences for every theme. This helped in the highlighting of key issues concerning the understanding of students with visual impairment about computer technology, the access facilities of its functions, and its support systems to optimise its use in their learning process (Cole, 2024).

After the data was structured, the researcher examined and refined the preconceived themes by considering the data for every theme. This ensured the themes captured the content and expressed the meaning of the data and provided insight into how students with visual impairment utilise and engage with computer technology in the University of Education, Winneba (Braun & Clarke, 2023). This systematic data analysis allowed for a complete understanding of the research objectives of the study, providing a foundation for creating sound inferences and recommendations using the experiences of the participants.

Data Analysis Procedure for Observation

The observational data collected from all twenty (20) students were analysed using a qualitative thematic approach, guided by the research objectives. Field notes and structured observation checklists were first reviewed to organise the data according to key areas, including computer usage at school and home, type of device, operating system, and accessibility and use of assistive technologies such as screen readers and magnification tools (Adler, 2022).

Analysis involved identifying patterns, behaviours, and strategies in students' engagement with computer technology. The researcher examined how students navigated devices and software, how they adapted to challenges, and the types of assistive tools they relied upon to accomplish learning tasks. These behaviours were then coded into meaningful themes aligned with the study's objectives, such as skills in using computer technology, utilisation of features, access to assistive tools, and challenges encountered (Palsola et al., 2020).

Although qualitative in nature, the analysis also recorded descriptive counts (e.g., number of students using computers at home versus school, types of devices used) to provide contextual understanding of observed behaviours (Fife, 2020). This information helped illustrate variations in experiences without reducing the data to purely quantitative terms.

To enhance the trustworthiness of the findings, the observational data were triangulated with interview data, ensuring that the behaviours recorded during observation corresponded with participants' reported experiences (Chand, 2025). This combination of thematic analysis and contextual description allowed for a rich, in-depth understanding of how students with visual impairment interact with computer technology in both school and home environments.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF FINDINGS

4.0 Introduction

This chapter presents the results and analysis of data from the study. The analysis reflected on the themes that emerged from the interview data collected from the students with visual impairment at the I.C.T lab for students with visual impairment presented in line with research questions.

4.1 Demographic Information of Respondents

The study was carried out at the University of Education, Winneba, main campus, resource centre ICT lab for students with visual impairment with a sample size of 21. One (1) staff member and twenty (20) students with visual impairment who use computer technology.

Table 2

Class Level of Students with Visual Impairment

Levels	Frequency	Percentage
300	7	35.0%
200	13	65.0%
Total	**20**	**100%**

(Source: Field Data, 2024)

Table 2 presents the distribution of students with visual impairment by class level. The study had 13 respondents from level 200 students, which is 65.0% of the sample size, and 7 level 300 students, which is 35.0% of the research sample size. This indicates that, there was a higher percentage of students with visual impairment in level 200 compared to level 300 in this study.

4.1.2 Level of Visual Impairment

The study also collected data on the levels of visual impairment among the student participants. The findings indicated that the majority of respondents (12 students, representing 60%) had low vision, while the remaining eight 8 (representing 40%) were blind. Students with low vision included those with moderate to severe visual impairment who could still make partial use of their sight in other words who perceive some amount of light, while those classified as blind had no light perception. These findings suggest that although most participants had some level of residual vision, they still required significant accommodations and assistive technologies to make use of computer technology for the academic journey.

Table 3

Students' Level of Visual Impairment

Level of Visual Impairment	**Frequency**	**Percentage**
Low Vision	12	60%
Blind	8	40%
Total	**20**	**100%**

(Source: Field Data, 2024)

4.1.3 Time of Onset of Visual Impairment

The study also examined whether students lost their visual impairment at birth or later. They lost vision later in life in most cases (13 students, 65%), while the remaining seven students (35%) were blind since birth (congenital visual impairment). These matters because students who are congenitally blind may have developed varying coping strategies from those who became blind later in life. For example, students who lost their sight later in life may have had to relearn how to use computers with assistive technology, whereas those born blind may have been using these technologies from an earlier stage in their school life.

Table 4:

Time of Onset of Visual Impairment

Time of Onset	Frequency	Percentage
Adventitious (After Birth)	13	65%
Congenital (From Birth)	7	35%
Total	**20**	**100%**

(Source: Field Data, 2024)

4.1.4 Staff Support for Students with Visual Impairment

Apart from the student respondents, the study had a single university personnel member who is a resource person (ICT support) helping students with visual impairment in the use of computer technology. The personnel served for five years in the position, training and helping students on the usage of computer technology and other electronic gadgets that students use in learning.

Table 5

University Staff Support for Students with Visual Impairment

Staff	Years of Service
Staff 1	5 years

(Source: Field Data, 2024)

The high level of experience of the staff member highlights the necessity of institutional assistance in facilitating students with visual impairment to integrate technology into their studies. The study, however, also aimed to determine if the assistance was sufficient to address the technological problems that students encountered whenever they used computer technology.

RQ 1: What is the Computer Skills Proficiency of Students with Visual Impairment at the University of Education, Winneba?

Five major themes were derived from the analysis of research question one. These themes reveal the understanding of computer technology by the students, their learning experiences, and the challenges encountered in gaining computer skills. The themes are: Understanding of Computer Technology, First Learning and Skill Acquisition, Knowledge Development at UEW, Utilisation of Computer Skills in Academics and Daily Activities and Challenges, and the Desire for Further Training.

Competence in Computer Technology

Students with visual impairment conceptualise and understand computer technology in terms of its use and functionality for them. Their definitions emphasised computers as tools for storing information and doing tasks easily. The majority of them described computer technology as essential devices that facilitate work, facilitate learning, and enhance academic independence. Some students emphasise specific use of computer technology, such as Word document processing, assistive technology, and using the internet, while others emphasise the role played by computers in accessibility and management of information.

One student explained that a computer is a tool used for storing data and accessing online resources, highlighting its relevance in both academic activities and general life tasks:

> "*A computer is an electronic system that carries information or helps us to keep documents safe in terms of need. It also helps us to browse and get access to the internet.*" (**Student from Group One**)

Another student offered a broader definition, emphasising the diverse functions a computer can perform. This response indicates an understanding that computers are not confined to a single function but instead support various activities, from simple and easy tasks to complex tasks and operations:

"*A computer is an electronic device that helps us to perform multiple tasks.*" (**Student from Group Two**)

For some students, accessibility is a key component of their understanding of computer technology. One student, for instance, pointed out that computer technology provides opportunities for individuals with visual impairments to work independently and complete various tasks efficiently without depending on a sighted individual:

"*A computer is a device that helps us to perform easy functions... it helps persons with visual impairments also get access to perform work easily.*" (**Student from Group Three**)

Another student views computers primarily as tools for information management, highlighting their efficiency in organising and retrieving data. This perspective suggests an awareness of computers as powerful tools for handling large amounts of information quickly and effectively:

"*A computer helps in keeping information and data. It is the fastest device or machine that assists in individuals with visual impairments in accessing and getting information.*" (**Student from Group Four**)

The response indicates that students with visual impairment conceptualise computers as indispensable tools that support academic activities, professional activities, and personal activities. Their definitions highlight a strong awareness of how technology enhances accessibility and efficiency, particularly in an education setting.

Initial Learning and Skill Development

Students' exposure to computers varies, with some learning informally through peers, while others receive formal training from institutions they attended. Many of them emphasise the challenge of keyboard navigation as a critical initial hurdle they encountered in the beginning.

One student recounts his structured learning process, explaining how he started from the basics before advancing to more complex tasks with the computer:

> "*Well, I learned how to use a computer by starting from the basic level. Knowing and locating the keys, how to get the keys, knowing where the position of the keys are. Then I started typing.*" **(Student from Group One)**

Another student shares how his first encounter with computer training occurred at an organisation that provides support for individuals with visual impairments, highlighting the role of specialised institutions in enhancing accessibility:

> "*I first learned how to use a computer when I went to Ghana Blind Union. They helped me to be able to access my computer using screen readers.*" **(Student from Group Two)**

Some students find learning to navigate the keyboard particularly challenging, describing the initial learning phase as stressful:

> "*It was very, I mean, stressful, especially the keyboard. How to locate some of the keys is very stressful for the first day, even within the first week or first two weeks.*" **(Student from Group Three)**

One student explains his transition from using mobile phones to fully engaging with a laptop after losing his sight, demonstrating the gradual adaptation and transitional process:

> "*I didn't start learning computer skills. I started learning through the use of mobile phones. But when I lost my sight and I felt I should be serious, using a laptop and other stuff.*" **(Student from Group Four)**

The responses reveal that students with visual impairment acquire computer skills through a combination of formal, structured training and informal, self-directed learning. Those who have undergone structured training, such as through the Ghana Blind Union, tend to demonstrate higher competence with essential assistive technologies, particularly screen readers, which are critical for independent academic work. In contrast, students relying primarily on informal learning often encounter significant difficulties, most notably with keyboard navigation, a foundational skill for effective computer use. This pattern suggests a disparity in skill acquisition linked to access to formal training, indicating that structured learning environments provide targeted opportunities to develop competencies that informal learning alone may not fully address. Furthermore, the gradual transition observed among some students from mobile phone usage to computer technology highlights an adaptive process in skill development, reflecting both prior exposure to accessible technology and individual persistence. However, the reliance on informal learning for many students may limit their ability to fully exploit computer functionalities, potentially restricting their engagement with academic tasks that demand higher-order digital literacy

Variations in Computer Skills Proficiency

Data gathered from students with visual impairment at the University of Education, Winneba reveal noticeable differences in their levels of computer skills proficiency. While some students perceive a significant improvement in their competence, others report little or no progress in their skills since enrolling at the university.

One student expressed dissatisfaction with his current level of proficiency, indicating that his skills have remained unchanged:

> "*Not necessarily. Because I feel like the* skills *I had before coming, that's the same thing I have currently. I have not improved upon it, so I don't think I have.*" **(Student from Group One)**

However, another student believes his skills have advanced, particularly due to the availability of different assistive tools that make navigation easier:

> "*I have developed the use of computers in UEW to the system or the standard that I find is very easy and accessible. Because it also helps with the use of the NVDA or the JAWS.*" **(Student from Group Two)**

Some students confirm that they have gained more skills over time, indicating a positive learning experience based on the frequent use of computer technology:

> "*I must say yes. Since coming to the university, I have noticed an improvement in my computer skills. I am now more comfortable using different applications for my academic work, and I can complete tasks more independently than before*". **(Student from Group Three)**

One student confidently affirms his progress, suggesting that he has significantly improved his computer proficiency:

> "*Please, that one is for sure. My computer skills have improved significantly since I enrolled here. I can now use assistive software more effectively, navigate the system with greater ease, and handle my assignments without much difficulty*" **(Student from Group Four)**

The data reveal a clear variation in computer skills proficiency among students with visual impairment at the University of Education, Winneba. While some students reported that their skills have stagnated, often due to limited access to structured training or advanced computer programs, others indicated significant improvements in their competence. For instance, some participants described noticeable growth in their ability to use computer applications independently and to navigate academic tasks more effectively, particularly when supported by assistive technologies such as NVDA and JAWS.

This contrast highlights that students' proficiency levels are shaped by a combination of factors, including exposure to training, frequency of computer use, and access to technological resources. The experiences of students who report improvement demonstrate that consistent practice, coupled with appropriate assistive tools, can substantially enhance confidence and competence in computer use. Conversely, the stagnation reported by other students underscores the need for targeted and structured skill development programs to ensure all students, regardless of their prior experience, can achieve essential digital competencies. Overall, the findings emphasize the pivotal role of accessibility tools and deliberate training interventions in bridging skill gaps, enabling students with visual impairment to engage more effectively with learning materials, complete academic tasks independently, and build self-assurance in their computer abilities.

Application of Computer Skills in Academics and Daily Tasks/Academic workflow and information literacy

There are many students using computers for studies, including writing tests, research, and document storage. Major assistive tools to make computers accessible are screen readers such as NVDA and JAWS.

One student highlights the significance of Microsoft Word in his academic life, particularly for typing and writing examinations and quizzes:

> "*Microsoft Word, it helps me to type or to open a word document, a blank sheet to type a letter or when we are to write our exams. I use it to write exams.*" **(Student from Group One)**

Another student describes how computers assist in research and organising academic materials:

> "*I use it for research and for keeping my books.*" **(Student from Group Two)**

One student emphasises the efficiency of computers in comparison to traditional Braille-based methods, noting that digital tools enhance his speed and accuracy during exams since he can spell check among other options:

> "*I have developed it in terms of my exams because it helps me a lot to be fast more than using Braille.*" **(Student from Group Three)**

The responses reveal that computers play a central role in the academic activities of students with visual impairment, particularly in tasks such as typing examinations and conducting independent research. The use of software tools, including Microsoft Word and screen readers, not only enhances accessibility but also facilitates more efficient navigation of digital content, allowing students to interact with learning materials with greater speed and accuracy. The observed shift from traditional tools, such as Braille, to digital technologies illustrates how computers provide expanded options and flexibility, enabling students to manage academic tasks more independently. This pattern indicates that access to and familiarity with digital tools directly influence the effectiveness of students' engagement with learning materials. It also underscores the importance of integrating assistive technologies into academic processes, as they can bridge gaps in efficiency and productivity that may exist when relying solely on traditional methods.

Issues Highlighting the Need for Continued Professional Development

Despite their progress, students emphasise the need for more structured and frequent training in computer skills and computer technology. Some feel that one semester of training in ICT as a course is not enough and recommend an extended period of instruction and development of other programmes to enhance their full use of computer technology. One student suggests increasing the duration of training, arguing that the current timeframe is inadequate:

> "*The computer training needs to be much more... One semester, in ICT course is not enough. I think it cannot help. Maybe one year, two semesters. I think it will do a bit.*" **(Student from Group One)**

Another student demonstrates a self-reliant approach, using online resources to overcome difficulties he faces while using the computer technology:

> "*If I get to a place 'me y3 aka' meaning finding it difficult, I'll go straight to the internet. I'll go and research on how to do this there, do this or do that.*" **(Student from Group Two)**

One student describes how he independently discovered and learned to use NVDA, highlighting the importance of self-initiative in overcoming accessibility challenges:

> "*For me to just survive in this technological world, that's why I was doing that… I learned there was an NVDA. I was searching for something online ... they installed it on the computer. When they started talking, I was like, no, they should leave it for me.*" **(Student from Group Three)**

Students recognise the need for extensive and systematic training in computer skills as one semester is not sufficient to acquire it. While some rely on formal training, others adopt self-independent learning methods, using the internet and screen readers, to specialise in their field. Independence to access technology by themselves is essential for students with visual impairment, but structured training would make their learning process much smoother and allow them to be scholastically and professionally adapted through skill acquisition.

Analysis and Interpretation of Data from the Observation of Basic Computer Skills and Accessibility Assessment

The observation checklist was used to assess the accessibility and basic computer skills of 20 students with visual impairment. The results provide insights into their computer usage patterns, access to assistive technology, and proficiency in performing fundamental tasks.

Computer Usage and Accessibility

School vs. Home Usage: All 20 student respondents (100%) stated that they actively use a computer in school. However, 15 students (75%) also used a computer at home, while 5 students (25%) said they do not have access to a computer at home. This suggests that a quarter of the students do not use a computer whenever they are home.

Type of Computer Used: Out of the fifteen (15) students who used computers at home, 7 (46.7%) reported using desktop computers as their primary device, while 8 (53.3%) reported using their personal laptops as the primary device. At school, all 20 (100%) students used laptops, indicating that laptops are the standard and most convenient devices for academic work within the university setting.

Operating Systems: Students identified that the most commonly used Windows OS was, with 11 students (55%) using Windows 10 operating system and 9 students (45%) claiming to use Windows 11 operating system. With the Mac OS operating system being used by only a small number of the students, with 2 students (10%) mentioned versions from 2016 and 2019.

Assistive Technology: 10 students (50%) had a screen reader on their home computers, while 5 students (25%) lacked the availability of this critical tool at home. In the school environment, all 20 students (100%) were accessible to a screen reader, hence making it accessible. Screen magnification software was seldom utilised, with only 1 student (5%) claiming its installation at home, while none in school (0%). This would mean that students with visual impairment may have access to screen readers instead of magnification software.

Basic Computer Skills

Computer Operation: All 20 students (100%) tested for skill proficiency could turn on a computer and monitor, log on, and control the system volume. 5 students (25%) struggled to turn on/off accessibility software, an area that requires more training.

System Navigation and Adjustments: 12 students (80%) were able to perform system volume and mute/unmute sound adjustments, whereas 3 students (20%) were unable to do so. This may be because of problems with locating volume controls or the screen reader's use of keyboard shortcuts.

The findings indicate that access to computers and assistive technology is uneven between the school and home environments, reflecting differences in resource availability and socioeconomic factors among students. While all students have access to computers at school, the fact that 25% do not have a computer at home may limit opportunities for independent practice, restricting the development of mastery in digital skills. Similarly, only half of the students have a screen reader at home, showing that essential assistive technology is not consistently available, which may affect skill acquisition and confidence in using computers independently.

Although students are generally familiar with basic computer functions, many face difficulties in using assistive software, particularly in enabling and navigating screen readers. This suggests that informal learning or prior experience may not fully compensate for structured training in accessibility tools. These findings indicate that the academic success and independence of students with visual impairment are closely linked to both access to appropriate technology and structured support for its effective use. Limited access to computers and assistive tools at home may hinder ongoing practice, reduce confidence, and constrain students' ability to engage fully with digital learning activities.

R.Q 2 How do Students with Visual Impairment use the Features of Computer Technology at the University of Education, Winneba?

This research question sought to explore how students with visual impairment use the features of computer technology at the University of Education, Winneba (UEW). Four themes emerged from the data gathered: Use of Technology for Academic Work, Integration of Assistive Technologies and Online Platforms, Navigation and Interaction with Software, and Verification of Online Information**.**

Auditory Output and Screen Reading Methods

Screen readers such as JAWS and NVDA are central to how students access digital content. One student emphasized the importance of these tools in facilitating independent use of applications:

> "*With the help of our screen readers like JAWS and NVDA, we are able to use it. So, I feel like it's okay. Because I have skills about how to go about it, I'm able to use these apps very well.*" **(Student from Group Three)**

This response indicates that the student does not merely use the software but has developed a skillful approach to navigating applications and interpreting auditory feedback. Similarly, students reported using screen readers to navigate Microsoft Word in a precise, letter-by-letter or line-by-line manner:

> "*With Microsoft Word, whenever I type, I will just go to the Word and then enter on it. Then a blank sheet will come. Then I'll start typing. So, if I want to read letter by letter, I use the right and left arrows. If you start using the right arrow, then it will continue reading the letters from the left to the right. If you use the left arrow, it will read it from the right to the left.*" (**Student from Group Two)**

This demonstrates that auditory output is not passive; rather, it is actively integrated into their workflow, allowing students to check, correct, and produce accurate academic work. The ability to control the pace of auditory feedback shows a sophisticated understanding of the software's features and a high degree of independence.

Tactile Input and Keyboard Navigation

Students' responses highlight advanced keyboard navigation skills, which enable them to interact with computers efficiently without relying on visual cues. One student emphasized mastery of the keyboard through ten-finger typing:

> "*When we are to type, sometimes even our sighted colleagues use only one finger. But we use all the ten fingers... we are familiar with the keys also very well.*" **(Student from Group Four)**

This demonstrates a systematic approach to tactile interaction that allows for faster typing and more effective use of computer software. Coupled with screen readers, keyboard navigation enables students to move through documents, input text, and execute commands independently.

Another student described using Microsoft Word to create documents for assignments and exams:

> "*Microsoft Word helps me to type or to open a blank sheet to type a letter or when we are to write our exams. I use it to write exams.*"
> **(Student from Group One)**

In addition to typing, students highlighted the strategic use of specific keys to navigate software efficiently. Many rely heavily on the Tab key to move between fields, menus, or form elements, and the Alt key to access menu options or switch between windows. The Esc key is commonly used to exit dialogs or cancel commands quickly. One student explained:

> "*I mostly use the Tab key to jump between sections in Word or on websites. The Alt key helps me switch between menus and programs, and the Esc key is very useful when I want to stop something or go*

> *back. These keys make it easier to move around without seeing the screen.*" **(Student from Group One)**

Other commonly used keys mentioned include Arrow keys for reading text line by line or letter by letter, Enter for starting new lines or confirming actions, and Ctrl combinations (like Ctrl+C, Ctrl+V, Ctrl+S) to execute commands efficiently. Another student added:

> "*When I am typing or reading, I use the arrow keys to go through the text, Tab to jump between options, and Alt with other keys to open menus quickly. It helps me finish my work faster and without mistakes.*" **(Student from Group Two)**

These responses indicate that students are not just familiar with basic typing; they have developed systematic strategies for navigating digital environments. Their mastery of keyboard shortcuts and specific keys reflects proficiency, independence, and adaptability, allowing them to complete complex academic tasks efficiently.

Furthermore, repeated practice strengthens their tactile memory of key positions and functions, which complements auditory feedback from screen readers. One student noted:

> "*I have practiced using the keyboard every day, so now I know where all the keys are. Tab, Alt, Esc, and the arrows, I use them without thinking, and it makes my work faster and easier.*" **(Student from Group Three)**

The data suggest that students with visual impairment have developed strategic and efficient methods for interacting with computer technology. Reliance on Microsoft Word, combined with screen readers, enables effective auditory processing of text, while keyboard navigation and tactile mastery facilitate independent document management and task completion. These practices reflect advanced digital literacy, demonstrating how assistive technology and tactile strategies are integrated to overcome visual barriers. However, reported challenges with programs like Excel and PowerPoint indicate uneven skill development, highlighting areas for targeted training to enhance overall competence and academic independence.

Mobile-Computer Synergy and OCR Methods

Students complement computer-based work with mobile devices to conduct research, verify lecture content, and access online resources. The integration of mobile phones with computers reflects adaptive problem-solving and multi-platform usage:

> "*Yes, for that one, you can go to Google. Okay. You can use even a phone. I normally use a phone to get that. I use a laptop.*" **(Student from Group Two)**
>
> "*Whenever they teach, I always use my phone to go to Google to research to see if it matches with what the lecturer taught in the class.*" **(Student from Group Three)**

Some students also incorporate artificial intelligence tools to enhance efficiency, obtaining information in audio format for quicker comprehension:

> "*I search for information online through the use of accessibility or the talk back... sometimes, I also use artificial intelligence as well... it will just respond with the answers in audio form.*" **(Student from Group Four)**

This combination of tools demonstrates strategic integration, allowing students to maximize accessibility and maintain continuity in learning even when one platform or software is limited.

Collaborative Navigation and Peer-Assisted Usage

While many students navigate technology independently, some rely on peer support to overcome software or platform limitations, particularly when websites or university portals are not fully accessible. One student noted the constraints of existing systems:

> "*Actually, in my opinion, I would say it's not all that effective when it comes to persons with disabilities, but for the sighted colleagues, I think they are good to go with that.*" **(Student from Group Three)**

Another limitation highlighted the challenge of conflicting software functions on mobile devices:

> "*Sometimes, when you are using your phone, the software doesn't allow you to do certain things unless you deactivate the speech, but if you deactivate it, there are many things you can't do.*" **(Student from Group One)**

Collectively, these responses illustrate that students with visual impairment actively orchestrate multiple technologies to support academic work. Screen readers provide essential auditory access, while mobile devices and AI tools supplement computer-based tasks, enabling research, verification, and efficient task completion. Peer support serves as an additional adaptive mechanism when software or platforms fail to meet accessibility needs. However, the findings also highlight systemic gaps: software limitations, partially accessible university platforms, and device constraints can hinder fully independent engagement. Students' strategies reflect high digital literacy, adaptability, and problem-solving, but improvements in platform design and assistive technology integration are necessary to optimize their academic participation.

Navigation and Interaction with Software

Students with visual impairment primarily rely on keyboard shortcuts, screen readers and voice applications to navigate their computer devices and interact with academic space. They demonstrate a strong familiarity with Microsoft Office applications, particularly Microsoft Word.

One student explains how they have memorised the keyboard layout, making navigation more efficient:

> "*Because I've learnt about assistive technology in general, we mostly deal with the keyboard. So, Microsoft Word, if I want to type, I have learnt the keyboard, the layout... so it's in my mind.*" **(Student from Group One)**

Another student describes using screen readers for better interaction with software:

> "*With the use of a screen reader… it helps me to know what I need to know. It reads out everything you do on the computer.*" **(Student from Group Two)**

For Microsoft Word, students rely on keyboard commands to perform tasks efficiently:

> "*The navigation, the keyboard helps me to do that with the use of shortcuts, control keys, arrow keys and tabs specifically.*" (**Student from Group Three)**

Students also use multiple assistive features to navigate web pages and applications:

> "*The screen reader or voiceover normally assists us to describe any order. Let me use a voiceover, for example. Let's assume that I have been sent a scanned document of a receipt. It should describe the logo of the bank.*" **(Student from Group Four)**

The students with visual impairment have developed structured strategies to navigate and utilise computer technology effectively. Memorisation of the keyboard layout enables them to work efficiently in Microsoft Word, allowing tasks such as typing and formatting to be performed without constant visual cues. Screen readers, including JAWS and VoiceOver, provide critical auditory feedback, guiding students through both software interfaces and digital content, and allowing them to interpret complex information, such as scanned documents. Additionally, students combine keyboard shortcuts, control keys, and voice tools to streamline their workflow, demonstrating an advanced level of digital literacy and adaptability. However, their limited use of programmes such as Excel suggests gaps in exposure or training, indicating a need for targeted support to broaden their proficiency across different software applications. These practices highlight that students actively leverage available computer features to maximise efficiency and independence.

Online Navigation and Verification of Information

Since students with visual impairment rely on digital tools for research, verifying the reliability of online information is a crucial part of their academic work. They adopt multiple strategies to ensure accuracy.

One student explains their approach to checking multiple sources:

> "*In order to prevent plagiarism, I think you need to reference... I mean, there's a lot of references out there.*" **(Student from Group One)**

Another student relies on AI and search engines for information verification:

> "*If I check it in Gemini and I go to Google ... I would cross-check there to make sure I have similarities ... and merge it into my understanding.*" **(Student from Group Two)**

Students also validate online research by comparing it with lecture materials:

> "*...when you find any information, you have to come back to your memories, think about it well, and then relate it to what you learned in class to see whether you are on the right path.*" **(Student from Group Three)**

The students demonstrate a deliberate and systematic approach to verifying information obtained from online sources, reflecting a high level of critical engagement with academic content. They employ multiple strategies, including cross-checking information across different websites, consulting AI tools such as Gemini, and comparing research findings with lecture materials to ensure consistency and accuracy. This approach indicates that students are not merely passive consumers of digital information but actively evaluate and synthesise content to maintain the credibility of their academic work. Their use of these strategies also reflects an adaptive application of technology to support scholarly rigor, highlighting the intersection of digital literacy and critical thinking skills. These practices suggest that students with visual impairment are capable of managing complex academic tasks independently, while also identifying areas where further training in digital tools could enhance the depth and efficiency of their information verification processes.

Analysis and Interpretation of Data on Basic Computer Navigation from the Observation Checklist

Observation checklist analysis provides an idea of computer literacy potential among students with visual impairment. A sample of 20 students was drawn and assessed for some tasks. Results are presented under different themes, and percentages were calculated with respect to the number of students assessed.

Keyboard Orientation

All 20 students (100%) were able to identify the main keys on the keyboard, including Alt, Control, Shift, Tab, Caps Lock, and Windows. They were also familiar with the location of the "six-pack" keys (Insert, Delete, Home, End, Page Up, and Page Down) and the number pad. All students (100%) were able to identify the function keys, reflecting a strong level of keyboard awareness for navigation and accessibility.

Basic Computer Navigation

All 20 students (100%) did not have any problem in accessing and navigating the desktop, Start Menu, and file folders to find specific documents. They could open and close documents and open and close programmes without any problem. Also, all the students (100%) were able to switch from one open program to another and from one tab or document to another within a programme. It indicates that the students lack the navigation skills required to utilise computers effectively.

Interacting with Text

All 20 students (100%) could perform text by clicking and draging, and keyboard shortcuts of copying (Ctrl + C), pasting (Ctrl + V), and cutting (Ctrl + X) text. 17 students (85%) could perform the text formatting (bold, italic, underline), but 3 students (15%) could not carry out this task. Additionally, 14 students (70%) could change font size and style, and 6 students (30%) could not. In the same way, text alignment (left, right, centre) and paragraph formatting, i.e., line spacing, were achieved by 12 students (60%), while 8 students (40%) could not. From the findings above, it is concluded that most of the students know basic text handling, but there are some students who require training on higher-level formatting commands.

Word Processing

All 20 students (100%) were able to open, save, and close Word documents. 17 students (85%) were able to make bold, italic and underline on a document, whereas 3 students (15%) were not able to do so. Font style, size, and colour changes were successfully performed by 15 students (75%), while 5 students (25%) were unable to do so. The use of bullet points and numbered lists was accomplished by 13 students (65%), with 7 students (35%) unable to perform these functions. More advanced tasks, such as inserting images, tables, and hyperlinks, were carried out by 12 students (60%), whereas 8 students (40%) were not able to do so. Page layout and margin settings were completed by 13 students (65%), while 7 students (35%) were unable to perform these tasks. Spelling checks and use of the thesaurus were performed by 15 students (75%), whereas 5 students (25%) could not use these features effectively. Overall, these results indicate that while the majority of students are proficient with basic word processing functions, advanced document formatting, and more complex features represent areas that require further training and support.

Use of the Internet

17 (85%) of 20 students were able to open and close internet browsers like Chrome and Firefox, while 3 students (15%) failed to perform the simple task. The operation of search engines like Google, Bing, etc. was conducted by 12 students (60%), while 8 students (40%) were not able to do so. 12 students (60%) browsed using websites through hyperlinks, while 8 students (40%) failed. 14 students (70%) were able to download files from the internet, while 6 students (30%) were not. Uploading files onto websites, including online submission of assignments or attachment of files onto emails, was done successfully by 14 students (70%), while 6 students (30%) encountered difficulties. All 20

students (100%), however, were able to navigate browser tabs and windows and complete online forms. These results affirm that while the students know general browser behaviour, more practice needs to be provided in navigation by the use of search engines, downloading, and uploading.

Use of Assistive Technologies

All of the 20 students (100%) used screen reader software such as JAWS and NVDA, which means screen readers are essential for their accessibility. However, 3 students (15%) did utilise screen magnification software (i.e., ZoomText), but 17 students (85%) did not, demonstrating the vast majority utilise auditory feedback rather than visual enlargement capability. 13 students (65%) did utilise speech-to-text software, i.e., Dragon NaturallySpeaking, but 7 students (35%) did not utilise this software. Eye-tracking, and adaptive keyboards were utilised by 15 students (75%), demonstrating there are some specialised input users. 100% of the students utilised braille displays or other assistive devices, which shows that assistive technology based on touch is mainstreamed. These results show that although most students require screen readers and braille displays, speech-to-text software and other input devices can be explored further to offer even more accessibility.

General Technology Access

Only 7 students (35%) were able to use the operating system with the availability tools provided, while 13 students (65%) were not able to use this feature, indicating the necessity to offer additional training in the usage of system-wide accessibility tools. Sixteen students (80%) knew shortcut keys for productivity, while 4 students (20%) lacked these skills. The skills of accessibility options and their activation were demonstrated by 16 students (80%), with 4 students (20%) lacking skills. Enlarging the text size and text contrast on their devices was accomplished by 17 students (85%), with 3 students (15%) unable to do this. Assistive technology setting experience was encountered by 15 students (75%), whereas

5 students (25%) had no experience with assistive technology settings. The result indicates that, although most of the students have skills about shortcut keys and accessibility features, they need to be trained to master the operating system using the built-in accessibility features.

Interpretation

Students with visual impairment at UEW demonstrate strong foundational computer skills, including keyboard orientation and basic navigation, reflecting frequent practice and reliance on assistive technologies such as screen readers. They are proficient in basic text handling and Word processing, but advanced functions like formatting, inserting tables, and managing page layouts are less consistently used, likely due to limited formal training and exposure. Internet navigation is generally competent, though skills in search engines, hyperlinks, and file transfers are less developed, suggesting gaps in independent practice and access to resources. Assistive technology use is dominated by screen readers and braille displays, while tools such as screen magnifiers and speech-to-text software remain underutilised, indicating reliance on familiar methods and limited awareness of alternatives.

Analysis and Interpretation of Screen Reader Observation Checklist

This report determines the capability of 20 students to operate a couple of screen readers like JAWS, NVDA, VoiceOver, Narrator, and ChromeVox and reach accessibility settings and carry out basic screen reader commands. Percentages indicate the number of students tested on each activity.

JAWS (Job Access With Speech) Usage

Out of the 20 students tested for JAWS, 7 students (35%) could successfully turn JAWS on and off, but 13 students (65%) had issues with that operation. But all the students (100%) could read the line and paragraph being read aloud using JAWS commands. When a complete document was being read, 15 students (75%) could do it, but 5 students (25%) had issues.

Navigation commands were easily understood, and 17 students (85%) could navigate between headings using “H” and “Shift + H.” Similarly, all 20 students (100%) could navigate between links using the “Tab” and “Shift + Tab” commands. Also, all students (100%) successfully used the Insert + NumPad 5 shortcut to read an item below the mouse. However, modification of JAWS verbosity settings was successfully performed by 17 students (85%), while 3 students (15%) encountered difficulty. These results affirm high ability at simple navigation in JAWS, but issues do occur within settings adjustment as well as enabling/disabling the screen reader.

NVDA (NonVisual Desktop Access) Usage

16 students (80%) could switch NVDA on/off using the Ctrl + Alt + N key combination, whereas 4 students (20%) struggled with this action. However, all 20 students (100%) succeeded in performing simple reading operations, including reading the current line, paragraph, and document. Headings and link movement were mastered entirely, and every 20 students (100%) utilised “H” and “Shift + H” correctly for moving from head-to-head and “Tab” and “Shift + Tab” correctly for link-to-link. Nevertheless, reading something under the cursor was performed flawlessly by 17 students (85%), and 3 students (15%) couldn't do it at all. Altering verbosity options (speech rate, volume, etc.) proved a great challenge because only 7 students (35%) managed this task, but 13 students (65%) found it hard. This indicates that most of the students are operating using default NVDA settings and need to learn more in terms of customisation.

VoiceOver (Mac OS) Usage

Just 8 students (40%) successfully toggled VoiceOver on and off with Command + F5, whereas 12 students (60%) didn't succeed. Reading assignments were moderately successful with 14 students (70%) successfully reading the current line, paragraph, and entire document, whereas 6 students (30%) found it difficult.

It was also difficult to move between headings, with only 12 students (60%) moving to the next heading and only 2 students (10%) moving to the previous heading. Similarly, moving between links was difficult, as only 2 students (10%) were able to move to the next or previous link. No student (0%) employed the shortcuts to read an item under the mouse or the controls for verbosity. These results show that while some of the students were able to perform simple reading operations, VoiceOver-based navigation was a serious difficulty.

Narrator (Windows) Usage

17 students (85%) were successful in turning Narrator on/off using Windows + Ctrl + Enter, while 3 students (15%) struggled. Reading the current line was successfully done by 17 students (85%), while reading the current paragraph dipped slightly to 13 students (65%). Reading an entire document proved to be difficult, with only 3 students (15%) being successful in doing so.

Navigation to headings and links was also very difficult. Only 3 students (15%) navigated to the next heading, whereas none (0%) navigated to the previous heading, next link, or previous link. Reading an item under the mouse and setting verbosity settings were not performed by any students (0%). These results show that students have working familiarity with Narrator for straightforward reading tasks but struggle to navigate more sophisticated navigation and customisation options.

ChromeVox (Chrome OS) Usage

2 students (10%) were able to turn ChromeVox on/off, read text, browse headings, or toggle between links. The remaining 18 students (90%) were unable to perform these activities. Additionally, no students (0%) could manipulate verbosity options. These results indicate that ChromeVox is the most known screen reader among students, most likely due to limited exposure to Chrome OS devices.

Accessibility Settings and Screen Reader Functionality

When it came to adjusting general accessibility settings, such as font size and contrast, 9 students (45%) were successful, while 11 students (55%) struggled. Similarly, 9 students (45%) were able to enable/disable high-contrast mode, while 11 students (55%) could not. Adjusting screen reader verbosity settings was a major challenge, as only 2 students (10%) could successfully change speech rate or volume, while 18 students (90%) could not. Additionally, no students (0%) were able to adjust magnification settings, indicating a complete lack of familiarity with screen magnification tools.

General Screen Reader Commands

All 20 students (100%) properly performed simple reading commands like reading a complete document and pausing/resuming reading. However, 13 students (65%) correctly navigated headings and landmarks, while 7 students (35%) failed to do so.

Navigating to the next or previous link was not performed by any students (0%), showing a significant weakness in web navigating skills. Once more, no students (0%) enabled/disabled custom scripts or macros, altered macros, or executed a macro, showing no understanding of advanced screen reader customisation.

Form Navigation

All 20 students (100%) moved between form fields successfully using Tab and Shift + Tab commands. In addition, 13 students (65%) were able to read form labels and instructions, while zero students (0%) were able to read form field content using screen reader commands. This is an indication that, while students can navigate forms, they can fail when reading form field information using assistive technology.

Virtual Cursors

None of the students (0%) were able to toggle the virtual cursor on or off in NVDA or JAWS, which refers to enabling or disabling the screen reader's mode that allows linear navigation of on-screen content. This indicates a lack of familiarity with an important feature that gives users greater control over how text and interface elements are read aloud. However, all 20 students (100%) could use the arrow keys to navigate content while the virtual cursor was active. This suggests that, although students can perform basic navigation, they lack knowledge of advanced screen reader functionality, highlighting the need for targeted training to improve efficiency and control during computer use.

Navigating Through Tabs and Windows

A total of 20 students (100%) could alternate between open programmes or windows using Alt + Tab. However, 13 students (65%) could switch between tabs of a web browser, while 7 students (35%) could not. Reading the content of an open window or tab was achieved by 18 students (90%), while 2 students (10%) struggled.

Interpretation

The evaluation indicates that students with visual impairment demonstrate strong proficiency with basic screen reader commands across software applications. However, many experience challenges with more complex navigation tasks, such as moving between links, using virtual cursors, and adjusting verbosity settings. While NVDA and JAWS are the most frequently used screen readers, tools like VoiceOver, Narrator, and ChromeVox reveal usability gaps that affect workflow. Additional difficulties were observed in traversing forms, modifying accessibility settings, and customising screen reader features. These findings highlight the need for targeted training programmes to strengthen students' skills in screen reader navigation, feature customisation, and advanced functionalities, thereby enhancing independent interaction with digital learning environments.

R.Q. 3. What support services are available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba?

This research question sought to identify the specific support systems provided for students with visual impairment to optimise their use of computer technology at UEW. Analysis of participant responses revealed four themes.

Training, and Support

Several students with visual impairment expressed varying levels of confidence in using computers, which they attributed to training and experience. One student emphasised their proficiency in Microsoft Word, which allows them to type documents independently:

> "*Yes, I'm confident with Word. It helps me to type, to write a letter on my own. That someone will not write a letter.*" **(Student from Group One)**

Another student reflected on how learning computer skills transformed their ability to work efficiently. Before acquiring digital skills, they had limited exposure to computers and worked in a studio where manual processes were the norm. Once they became familiar with computers, they realised that these skills allowed them to express themselves better and complete tasks independently:

> "*For me, it's good to me and it's helped me a lot. At the time I was not using a computer, I worked in a studio. So when I got to know computers or to analyse, it helped me to express myself, doing things on my own.*" **(Student from Group Two)**

UEW provides direct assistance through personalised training, workshops, and access to assistive devices. Support staff ensure that students can navigate digital platforms and specialised software effectively.

> "*We provide ed support for students with visual impairment by offering training on how to use assistive technologies. We also organise workshops to improve their digital literacy and help them navigate academic platforms.*" **(Resource Person)**

While many students credited their confidence to formal training, some acknowledged that their familiarity with computers came from external experiences or work-related exposure before entering the university. This highlights the need for universities to provide a balance between theoretical instruction and practical application, incorporating hands-on training sessions, internships, and mentorship programmes.

Access to and Use of Assistive Technology

Assistive technology is a fundamental requirement for students with visual impairment to access digital resources. One student emphasised the indispensable role of screen readers such as JAWS and NVDA:

> "*Yes, we have JAWS or NVDA. Without the JAWS or NVDA, you can't get access to use your computer. So our senior colleagues normally use the NVDA. With the blind, if you didn't download or install the NVDA or the access, it helps us to also speak or use the computer to control it.*" **(Student from Group Three)**

This reliance on older students rather than formal institutional training suggests that universities may not be providing structured programmes to familiarise students with assistive technology. Universities should incorporate mandatory assistive technology training as part of their ICT curriculum and invest in a broader range of assistive devices.

Role of Assistive Technologies and Maintenance of Assistive Technologies

Assistive technologies such as screen readers, magnifiers, and text-to-speech software are crucial for students with visual impairment.

> "*Screen readers like JAWS and NVDA enable students to listen to text and navigate their computers using keyboard shortcuts. For students with low vision, screen magnifiers help enlarge text and images on the screen, making content more accessible.*" **(Resource Person)**

Ensuring that assistive technologies function properly is a priority for the support team.

> "*We conduct routine checks and updates on assistive software and devices to ensure they function properly. When students encounter difficulties, they report to us, and we collaborate with the IT department to resolve the issues.*" **(Resource Person)**

This student went further to explain in detail that assistive technology is not a choice but a compulsory digital accessibility. This student further highlighted the role of older students in introducing newcomers to assistive technology, an indicator of ubiquitous peer support. However, the fact that there is such overdependence on older students rather than institutionalised training indicates that universities lack formal programmes for acclimatising students to assistive technology. The response indicates the level at which students with visual impairment are highly reliant on assistive technology to access computer technology but do not get any institutional support. New students have to be guided by their peers since there is no formal training, resulting in irregular learning performance. This illustrates the necessity of incorporating mandatory assistive technology training within its ICT course. Secondly, the low specification level for other assistive devices (i.e., touch typing, voice commands, or refreshable braille displays) means that students will never be provided with further forms of assistive devices. Colleges and universities ought to spend on diversified and updated assistive technologies such that they are digitally inclusive.

Support for Online Research and Platform Interaction

Many students demonstrated confidence in conducting online research independently. One student noted:

> "*Yes, for that one, you can go to Google. Okay. You can use even a phone. I normally use a phone to get that. I use a laptop.*" **(Student from Group Four)**

Another student cross-checks online information with lecture notes:

> "*For that one, whenever I go to lectures, whenever they teach, I always use my phone to go to Google to research to see if it matches with the one the lecturer taught in the class.*" (**Student from Group One)**

Some students also access their academic progress independently:

> "*Yes, I used to use my student portal to check my results and other things. I do that on my own.*" **(Student from Group One)**

While students effectively utilise technology for research, the heavy reliance on mobile phones suggests that university computers or library resources may not be fully accessible.

Access to Online Course Materials Support

UEW guides navigating academic platforms such as V-Class and the Student Portal.

> "*We assist students in accessing V-Class and the Student Portal by providing training on how to navigate these platforms using assistive technology. Our goal is to ensure that students can independently access academic resources.*" **(Resource Person)**

The responses show that students with visual impairment have managed to access online content and verify information. The evidence that they have conducted research independently is testimony to their adaptability in the utilisation of technology. However, the overreliance on mobile phones is evidence that university computers or library hubs are not easily accessible. This leaves one wondering whether the student portal and other websites are accessibility-friendly. Universities must incorporate accessibility audits assurance that the accessibility of every online learning system falls under WCAG compliance and training programmes for use.

Peer and Institutional Support

Many students with visual impairment rely on peer support when facing challenges. One student mentioned:

> "*I get closer to those I know. They are far ahead of me.*" (**Student from Group Two)**

Regarding institutional accommodations, one respondent stated that lecturers provide flexibility during assessments, allowing students with visual impairment to take exams at the resource centre, where accessible materials are available. One respondent stated:

> "*...whenever we have to write our mid-term or quizzes like this, they give us a chance to go to the resource centre to write it there. Because our materials are there… The time our students use to write their quizzes or exams, we don't use the same time with them… So you are given additional time.*" **(Student from Group Three)**

This answer demonstrates that despite some university concessions like giving additional time to sit for exams and the resource centers being available, institutional support is not forthcoming. That most students must rely on their peers for assistance says a lot about the support mechanism gaps that exist. In an attempt to promote accessibility, the universities are required to create mentorship programmes and support students and scholars with inclusive education models. Furthermore, whereas facilities like extra time are convenient, institutions have a necessity to go beyond just reacting and actually invest in accessibility programmes, such as training workshops with specialisation, sensitisation courses for faculty members, and the provision of assistive technologies.

Faculty Support in Computer Use

Lecturers play a crucial role in supporting students with visual impairment by ensuring their teaching methods and materials are accessible.

> "*We encourage lecturers to adopt inclusive teaching strategies, such as providing lecture notes in accessible formats and allowing extra time for students using assistive technology.*" **(Resource Person)**

Collaboration with Other Departments

Support for students with visual impairment is a collaborative effort involving the IT department, the resource center, and the library.

> "*We work closely with the IT department to maintain assistive technologies, collaborate with the resource center for student accommodations, and assist the library in providing accessible academic materials.*" **(Resource Person)**

Improving Support Systems

While UEW has effective support mechanisms, there is room for improvement in training, resources, and access to assistive devices.

> "*We need more funding to acquire updated assistive technologies and to provide more extensive training* programmes*. Additionally, raising awareness among faculty and students about accessibility issues would enhance the overall learning experience for students with visual impairment.*" **(Resource Person)**

Assessing the Influence of Support Systems

The effectiveness of support systems is measured through student progress and feedback.

"*We assess the impact of our support by tracking students' academic performance and their ability to use assistive technologies effectively. Many students report improved confidence in using computers, which indicates that our support systems are beneficial.*" **(Resource Person)**

These insights illustrate the various support mechanisms available to students with visual impairment at UEW. While significant progress has been made, continuous improvements in resources, training, and collaboration are necessary to further enhance students' academic experiences.

R.Q. 4: What are the Barriers Faced by Students with Visual Impairment in Using Computer Technology at the University?

While assistive technology and institutional support have improved the ability of students with visual impairment to engage with digital tools, significant barriers still exist. Students at the University of Education, Winneba (UEW) face challenges such as unreliable assistive software, inadequate training, technical limitations, financial constraints, and accessibility issues with digital platforms. This section explores these challenges through the voices of the students, categorised into key themes. Each response provides insight into the difficulties they encounter, and at the end of each theme, an analysis and interpretation highlight the broader implications of these issues.

Technical Challenges and Software Issues

One student described the frequent issue of assistive technology malfunctioning, particularly when their screen reader unexpectedly stops working. They emphasised that when the speech output ceases, they struggle to continue using the computer:

"*Whenever I am using the computer, if the speech went off, for that one, I can't use the computer again. Unless I struggle to bring it out or to put it on before using it.*" **(Student from Group One)**

Another student discussed difficulties navigating standard computer functions, such as copying and pasting information from one platform to another. Tasks that are simple for sighted users become complex due to the limitations of screen readers:

> "*Sometimes if you want to get to Google and copy and bring it to your Word or paste it to a different place... it becomes very difficult.*" (**Student from Group Two)**

In addition to software-related issues, students expressed frustration with compatibility problems. One respondent explained that some assistive software fails to recognise and interact properly with certain applications, making specific tasks inaccessible:

> "*Sometimes, some of the software does not recognise this NVDA. So, you can open some menu or some software that NVDA cannot read for you.*" (**Student from Group Three)**

Another student highlighted the issue of university computers crashing due to system incompatibilities and outdated specifications:

> "*It depends on the spec of your computer and the kind of computer you are using... most Windows versions do not meet the specifications of the computer. So, it's normally crashed.*" (**Student from Group Four)**

These responses indicate how technological inefficiencies significantly hinder the independence of students with visual impairment. Crashing of the screen reader can render computers unusable, with students fighting to fix the problem or looking for help from others. Moreover, the inability of some software to interact positively with assistive technologies is that students with visual impairment experience accessibility problems in common academic tasks such as document editing and internet searching. Additionally, hardware obsolescence on university computers makes these challenges more difficult. To address these challenges, the universities must ensure that all institution-provided computers are assistive technology compatible and IT support personnel are properly trained to provide students with visual impairment with updates and troubleshooting.

Inadequate Training and Skill Development

One student raised concerns about the limited duration of computer training for students with visual impairment. They argued that a single semester is insufficient to build strong computer literacy skills, advocating for an extended training period:

"*The computer training needs to be much more... One semester, I think it cannot help. Maybe one year, two semesters. I think it will do a bit.*" **(Student from Group One)**

Another student admitted that their level of training remained basic, emphasising the need for further skill development to navigate computers confidently:

"*My level of training, I feel like I have to improve. I have to improve on what I know because I don't know everything, I just know the basics.*" **(Student from Group Two)**

Some students also highlighted that they primarily learned computer skills through peer support rather than institutional training:

"*I get closer to those I know. They are far ahead of me.*" **(Student from Group Three)**

These responses indicate that many students with visual impairment struggle with limited training opportunities, forcing them to rely on informal peer support rather than structured university programmes. The current one-semester training programmes is insufficient for students to develop proficiency in assistive technology, digital research, and academic-related tasks. Expanding computer training to at least one year would provide students with a more in-depth understanding of essential skills, reducing their dependence on peer assistance. Additionally, universities should implement structured mentorship programmes where advanced students can guide beginners under faculty supervision.

Limited Institutional Resources

One student explained that although university computers are available, their accessibility is severely limited due to non-functional or insufficient devices:

"*Accessibility of computers provided by the university... normally, we don't get much accessibility because we don't have much of them here.*" **(Student from Group One)**

Another student added that the high cost of personal computers forces students to rely on institutional resources, but when these are unavailable, their academic work suffers:

> "*If someone doesn't have a computer and their friend needs to use theirs, it means they have to wait or miss out on their work.*" **(Student from Group Two)**

Students also highlighted the high cost of advanced laptops with suitable specifications. One student noted that lower-end devices struggle to support their academic needs, making it difficult to access essential software:

> "*Let's say 3,500 Ghana cedis. That's a good one I can say... when you give him i3, i5, it's easy.*" **(Student from Group Three)**

These responses bring out the infrastructural and financial challenges that students with visual impairment face while using computers. Universities must invest in accessible and quality computers and ensure that all students have an equal opportunity to access them. Providing subsidised or loaned assistive devices to students who are not able to afford them would significantly improve their learning experience. Institutional computer labs must also be well maintained to ensure that all available resources are in working order.

Internet and Digital Platform Accessibility Issues

Several students reported difficulties accessing the university's Wi-Fi network, forcing them to purchase mobile data for academic research:

> "*...for the past two weeks, I have been buying data for research... now data is more expensive than the meal food we buy. So that is the challenge we are facing.*" **(Student from Group One)**

Others mentioned that online learning platforms were not fully optimised for visually impaired users, making navigation difficult:

> "*Most lecturers normally project an image without describing it... sometimes we have difficulty in describing it and involving us whenever an image has been projected.*" **(Student from Group Two)**

Another student described how screen readers fail to interpret unlabelled buttons on university platforms, forcing them to seek sighted assistance:

> "*...when it comes to us, you have to get the sighted person to read it. And you see one thing... everything there is unlabelled buttons.*"
> **(Student from Group Three)**

Internet access is a fundamental necessity for students with visual impairment, yet patchy campus Wi-Fi requires that they spend large amounts of money on mobile data. This places them at an unfair financial disadvantage and slows them down from performing effective scholarly research. In addition, university online portals must be made accessible. Adhering to WCAG (Web Content Accessibility Guidelines) standards and ensuring that all course materials (pictures and graphs included) are suitably described would make them more accessible to 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 One: What is the Computer Skills Proficiency of Students with Visual Impairment at the University of Education, Winneba?

The study revealed that students with visual impairment at the University of Education, Winneba (UEW) possess varying computer skills proficiency, influenced by access to technology, prior experience, and exposure to assistive devices. Consistent with Bolingo (2019) and Jarbi (2023), the findings show that assistive technologies such as NVDA and JAWS are essential for academic productivity and autonomy. Students largely perceive computers as functional tools for managing information, conducting academic tasks, and supporting personal and professional development. These observations align with Yadav et al. (2025) and Méndez-González & Pérez-Sánchez (2022), who noted that accessible technology enables students with visual impairment to integrate into mainstream education. However, a contrast emerges when comparing this study to Murithi (2022), who found that in Kenyan primary schools, students relied heavily on teacher facilitation for skills acquisition, suggesting that higher education students may demonstrate greater self-directed learning but still encounter gaps in formalised training.

The study also revealed significant variation in skills proficiency among students, depending on the type and extent of training received. Some students had formal instruction through structured programmes, such as those offered by the Ghana Blind Union, whereas others learned informally from peers or through self-directed methods. This mirrors findings by Dabi and Golga (2024) and Miyauchi (2020), who emphasised that keyboard navigation, in particular, is a challenging skill that requires incremental, guided practice. Interestingly, while international literature often highlights early-stage challenges in acquiring keyboard skills (Miyauchi, 2020), UEW students also reported continued difficulties with advanced functions of assistive software, suggesting that formal training duration and depth are critical factors in proficiency development. This contrasts with studies in Spain (Méndez-González & Pérez-Sánchez, 2022), where students had consistent institutional training, resulting in higher overall skills proficiency, indicating that prolonged, structured instruction has a measurable impact on outcomes.

Access to technology outside the university also influenced skills proficiency. While all students had access to computers on campus, 25% lacked personal computers at home, and only half had assistive software installed on their personal devices. These limitations mirror findings by Suleiman et al. (2024), who reported that the absence of home computers hinders reinforcement of skills learned at school. In contrast, studies in more resource-abundant contexts (Al Siyabi et al., 2022) show that students with continuous access to personal devices and software develop advanced competencies more quickly, suggesting that socioeconomic and infrastructural factors play a substantial role in shaping proficiency. The predominance of Windows operating systems over Mac OS at UEW also reflects regional availability and affordability constraints, which further influence students' ability to explore and engage with diverse technological platforms.

The adoption of computers among UEW students has facilitated a transition from Braille systems to digital formats, particularly during examinations. This demonstrates that technology enhances academic productivity and accessibility, consistent with findings by Jarbi (2023) and Méndez-González & Pérez-Sánchez (2022). However, differences in skills proficiency remain evident: some students underutilised screen readers or advanced features, highlighting the persistent need for structured, professional-level training.

Compared to Murithi (2022), who found that younger students in primary schools require constant teacher support, UEW students showed greater initiative in self-directed learning. Yet, as this study demonstrates, reliance on self-study may not guarantee mastery of complex functions, underscoring the importance of systematic, institution-led instruction. The study also identified the need for gradual and guided skill development. While most students could perform basic computer operations such as powering devices, logging in, and adjusting volume, one-third struggled with essential assistive software functions like switching screen readers on or off. This finding aligns with Miyauchi (2020), who highlighted that incremental, hands-on learning improves both confidence and skills proficiency. The challenges observed at UEW suggest that even when access to assistive technologies is available, proficiency is constrained without continuous, focused practice. Furthermore, the differences in individual aptitude mean that training should be personalised and progressive, combining foundational skills with opportunities for advanced mastery.

The students' self-directed learning behaviors indicate both resilience and gaps in formal instruction. While initiative in using online resources and independent study demonstrates adaptability, it also reflects deficiencies in systematic, institutionally supported training. Bolingo (2019) and Senjam et al. (2022) argue that structured, year-long programmes are necessary to ensure students acquire full competence and confidence in using assistive technologies. Compared to contexts where such training is consistently available, the UEW experience reveals that short-term or limited training can lead to underutilisation of digital resources and uneven proficiency levels.

In light of these findings, several actions can strengthen skills proficiency and academic outcomes. Extending formal computer training across the academic year would provide students with adequate time to build both foundational and advanced competencies.

Ensuring access to personal computers and assistive software for all students would reinforce learning beyond the classroom and allow for independent practice. Structured sessions focusing on advanced functionalities of screen readers, keyboard navigation, and other accessibility features would enable students to fully leverage assistive technologies for academic, professional, and personal development.

The study highlights that computers and assistive technologies are integral to the educational and personal growth of students with visual impairment at UEW. While access is necessary, effective use depends on continuous, structured training, resource availability, and guided practice, all of which contribute to higher skills proficiency, autonomy, and productivity. When these elements are in place, students can navigate academic and professional environments more effectively, fostering a more inclusive and equitable learning environment.

5.2 Research Question Two: How do students with visual impairment use the features of computer technology at the University of Education, Winneba?

Assistive technology is a critical determinant of educational access for students with visual impairment, and the experiences of students at the University of Education, Winneba (UEW) demonstrate both its benefits and limitations. The study shows that students rely heavily on core software, such as Microsoft Word, to complete assignments, take notes, and prepare reports efficiently. This aligns with Tuttle and Carter (2022), who noted that assistive technology facilitates autonomous engagement with virtual environments and learning platforms. Similarly, Jarbi (2023) highlighted that accessible technology supports participation in academic and social activities for students with visual impairment. At UEW, screen readers such as JAWS and NVDA allow students to access e-learning platforms, participate in web forums, and conduct academic research, reflecting a global trend toward enabling self-directed learning through technology (Senjam et al., 2022). Compared to primary or secondary contexts, such as the Kenyan study by Murithi (2022), university students demonstrate higher autonomy, yet still encounter barriers when technology requires advanced proficiency or institutional support.

While students at UEW demonstrate competence with basic software and screen readers, the study revealed substantial challenges in using advanced, visually oriented programmes like Microsoft Excel and PowerPoint. Excel's reliance on graphical structures hinders navigation and understanding of data tables, while PowerPoint's multimedia emphasis creates difficulties in creating and editing presentations without high-end assistive software. These findings are consistent with Ketema Dabi and Negassa Golga (2024), who argue that assistive technologies enhance learning only when combined with formalised training. In contrast, studies in Spain (Méndez-González & Pérez-Sánchez, 2022) reported that students with disabilities who had structured institutional training could navigate complex digital tools more proficiently. This contrast highlights that access to technology alone is insufficient; structured guidance is necessary to bridge gaps in digital skills and fluency, particularly for software with visual complexity.

Beyond desktop computing, mobile technology is increasingly integral to UEW students' learning. Screen readers such as TalkBack (Android) and VoiceOver (iOS) allow students to read notes, e-books, and emails, while voice-command apps facilitate note-taking and app navigation. This mobile accessibility aligns with international research highlighting the role of smartphones in extending learning beyond the classroom (Al Siyabi et al., 2022; Tuttle & Carter, 2022). However, institutional barriers remain. Some UEW platforms, including learning management systems and library databases, are not fully optimised for screen readers, limiting timely access to essential materials. Pacheco et al. (2018) similarly note that accessibility gaps in institutional platforms can reduce the benefits of assistive technology, demonstrating a recurring challenge across different educational contexts. Unlike resource-rich institutions where accessibility is fully integrated, UEW students often rely on workarounds, such as keyboard shortcuts, to navigate content, highlighting the interaction between resource constraints and student initiative.

The study also highlights the importance of keyboard proficiency and shortcut usage in promoting independent digital engagement. Students use navigation keys, Word shortcuts, and browsing commands to perform complex tasks without visual guidance, enhancing productivity and self-sufficiency. Yet, the inability to utilise Excel and PowerPoint proficiently underscores the need for formalised training in advanced functionalities. Ketema Dabi and Negassa Golga (2024) emphasise that systematic instruction in assistive technologies, including keyboard commands and accessibility features, empowers students to engage with complex digital interfaces. Comparatively, students in settings with comprehensive training exhibit higher confidence and efficiency in navigating sophisticated software (Méndez-González & Pérez-Sánchez, 2022), suggesting that UEW students' partial proficiency results from gaps in structured training rather than lack of ability or motivation.

An emerging theme is the role of digital literacy in academic rigor and information integrity. Students cross-reference multiple sources, use AI-assisted summarization tools, and navigate academic databases to verify information. This aligns with Tuttle and Carter (2022), who emphasise that students with visual impairment require digital literacy skills including critical thinking and fact-checking to avoid errors in scholarly work. Despite competence in basic navigation, UEW students exhibited gaps in advanced document structuring (e.g., headings, tables, citations), efficient web research, and accessibility settings optimisation. Ketema Dabi and Negassa Golga (2024) argue that training in these areas is crucial for maximising the potential of assistive technology, enabling students to tailor learning environments to their needs. Compared to students in resource-rich contexts, UEW students' digital literacy is partially constrained by limited training and platform accessibility, suggesting a combination of technological and instructional factors shapes outcomes.

The findings demonstrate that while UEW students are proficient in foundational assistive technologies and mobile learning, gaps remain in advanced software use, digital literacy, and institutional accessibility. Structured training in Excel, PowerPoint, advanced screen reader commands, and research methodologies is necessary to enhance digital competencies, while optimising institutional platforms for screen reader compatibility will ensure equitable access. Incorporating AI-assisted tools and voice-command applications can further expand autonomy and learning flexibility. When these elements are integrated, students with visual impairment can participate fully in academic life, achieve higher digital literacy, and engage with complex learning tasks, thereby fostering an inclusive, equitable, and academically enabling environment.

5.3 Research Question Three: What Support Services Available to Students with Visual Impairments to Enhance the Use of Computer Technology at the University of Education, Winneba

The findings of this study highlight the range of support systems provided at the University of Education, Winneba (UEW) to enable students with visual impairment to use computer technology effectively in their learning. Evidence indicates that students' confidence and digital ability are influenced by a combination of prior experience, formal training, and peer guidance. Consistent with Tuttle and Carter (2022), assistive technology training is a key determinant of academic competence and autonomy for students with visual impairment. Without such structured training, instructors may be unable to guide students effectively in using computer resources, potentially resulting in disparities in academic performance. The study revealed that many students acquire preliminary digital skills through extracurricular activities before university admission, aligning with Mahmood et al. (2025), who argue that prior exposure to technology predicts a student's ability to adapt to online learning environments. These pre-university experiences, however, require supplementation by institution-based training to achieve full digital literacy and ensure equitable academic outcomes.

On-campus support at UEW encompasses personalised training, workshop sessions, and provision of assistive equipment, which represent best practices in disability-inclusive education. Pacheco et al. (2018) emphasise that institutional processes such as these are crucial for enhancing students' independence and optimising the use of learning platforms. The study found that students are highly reliant on assistive technologies, particularly screen readers like JAWS and NVDA, to access content, complete academic tasks, and navigate the digital environment. This mirrors Tuttle and Carter (2022), who highlight the critical role of screen readers in enabling students with visual impairment to access instructional content independently. However, the study also revealed that peer support is often substituted for formal institutional training, which may limit proficiency in assistive technologies. Mahmood et al. (2025) similarly stress that while peer mentoring is valuable, structured, system-based training ensures that all students achieve consistent levels of digital competence.

Maintenance and technical support for assistive technologies emerged as an important component of effective support systems. Preventive maintenance and prompt technical intervention such as involving the HRM unit to resolve issues were noted as best practices for sustaining digital inclusion. Pacheco et al. (2018) also underline the importance of ongoing updates and technical support to ensure students with visual impairment can function optimally using computer technology. In addition, access to digital resources, such as search engines and academic databases, was emphasised as foundational to promoting autonomy and self-directed learning, consistent with Tuttle and Carter's (2022) assertion that digital ability is central to academic potential. The study also highlighted extensive reliance on mobile devices, demonstrating that students often compensate for accessibility challenges in computer labs and libraries by using smartphones to continue their studies.

Institutional accessibility and inclusive digital platforms are critical determinants of learning success. The study found that while UEW provides training in accessing the student portal and V-Class e-learning system, gaps remain in accessibility for some websites and digital platforms. Pacheco et al. (2018) advocate for accessibility audits and adherence to Web Content Accessibility Guidelines (WCAG) to ensure that students with visual impairment can navigate university platforms efficiently. The findings show that while students benefit from accommodations such as extended exam time and access to resource centers, systematic institutional interventions such as staff training on accessibility and integration of assistive technology into ICT courses are required to maximise students' academic outcomes. Mahmood et al. (2025) further emphasise the importance of sustained investment, including fundraising and infrastructure support, to maintain assistive technologies and training programmes.

Peer support and mentoring were observed to be integral to the students' learning processes. Senior students often guide newcomers in navigating digital platforms and managing academic tasks. However, while beneficial, the reliance on peers may overstate institutional support gaps and underlines the necessity for structured, institution-driven initiatives to create equitable learning opportunities. This observation aligns with Mahmood et al. (2025), who note that peer mentoring is valuable but cannot replace formal training and systematic interventions. Additionally, coordination among academic staff, IT departments, libraries, and disability support offices were identified as essential for ensuring accessibility, reflecting international best practices in inclusive education (Pacheco et al., 2018; Tuttle & Carter, 2022). Staff sensitisation, along with continued audits of support systems, helps maintain an environment in which students with visual impairment can participate fully and independently in academic life.

The findings demonstrate that UEW provides a range of support systems for students with visual impairment, including assistive technologies, training workshops, peer mentoring, and accessibility accommodations. These systems enhance autonomy, enable digital literacy, and foster academic achievement. However, gaps remain in formalised training, systematic maintenance of assistive technologies, and comprehensive platform accessibility. Consistent with the literature, the study highlights the importance of integrating assistive technology training into ICT curricula, conducting regular accessibility audits, and investing in staff sensitization and infrastructure. Addressing these gaps would strengthen the university's inclusive learning environment, enabling students with visual impairment to realise their full academic potential and engage equitably in the digital learning ecosystem.

5.4 Research Question Four: What are the barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba?

The findings indicate that despite significant advancements in assistive technology and the institutional mandate for inclusion, students with visual impairment at the University of Education, Winneba (UEW) continue to face multiple barriers that limit their ability to fully exploit computer technology for learning. Challenges such as software instability, insufficient training, poor institutional support, and limited accessibility of digital platforms were consistently cited by participants. These barriers reflect broader trends in higher education globally, where technological availability does not automatically translate into equitable access or learning outcomes (Tuttle & Carter, 2022; Mahmood et al., 2025).

A major challenge reported by students is the frequent malfunctioning of assistive technologies, particularly screen readers such as JAWS and NVDA. When these devices fail, students are effectively unable to access digital content, highlighting their high reliance on functional assistive software. This observation aligns with Tuttle and Carter (2022), who emphasise the necessity of regular maintenance and technical updates for assistive technologies, and Pacheco et al. (2018), who argue that technical support is essential to enable students with visual impairment to use digital tools effectively. Similarly, the study identifies poor integration of assistive technologies with university software platforms as a significant barrier. Students reported difficulties accessing learning management systems and performing basic tasks like document editing due to software incompatibilities, reflecting Lirong and Ghani's (2025) findings that mainstream platforms often fail to accommodate students with visual impairment adequately.

Another critical limitation highlighted in the study is the absence of systematic and comprehensive training. While UEW provides some basic digital literacy instruction, the duration and depth of the programmes were deemed insufficient for students to develop full competence in assistive technology use. Mahmood et al. (2025) similarly contend that formal training is essential for students with disabilities to navigate digital environments independently. The reliance on peer mentoring, while beneficial for community support, suggests an institutional gap in providing structured guidance. Akbar et al. (2024) support this perspective, noting that practical, hands-on training sessions significantly enhance assistive technology proficiency compared to passive instruction. The students' recommendation for a minimum of one-year formal training is consistent with best practices in disability services, ensuring continuous skill development and adaptation to evolving digital tools (Pacheco et al., 2018).

Resource constraints were also identified as a significant barrier. Students reported limited access to functional computers on campus and noted that personal computers capable of running assistive technology software are often financially inaccessible. These findings resonate with Fteiha et al. (2024), who emphasise that economic limitations restrict students with visual impairment from fully participating in digital learning. Similarly, Balachandran and Rabbiraj (2025) argue that institutional investment in up-to-date hardware and software is essential to support students with disabilities effectively. Beyond hardware, the study highlights connectivity issues, with students struggling to access reliable internet on campus, forcing them to rely on costly mobile data. Hussain (2024) similarly observes that uninterrupted internet connectivity is a fundamental component of digital inclusion, and institutions have a responsibility to ensure that students with disabilities are adequately connected.

The study further identified digital content accessibility challenges. University platforms and course materials were often not designed to be compatible with screen readers. Unlabeled buttons, graphical data without textual descriptions, and poorly formatted webpages created barriers for students, compelling them to seek assistance from sighted peers. These findings mirror Maerke (2025) and Shaw and Weiler (2024), who argue that accessible content, adherence to Web Content Accessibility Guidelines (WCAG), and inclusive digital design are crucial for enabling students with visual impairment to participate fully in academic activities.

Taken together, the findings suggest that effective support for students with visual impairment must extend beyond mere provision of assistive technology. Institutional strategies including regular maintenance of devices, investment in high-quality accessible digital content, extended and structured training programmes, accessibility audits, and staff sensitisation in inclusive pedagogy are essential. Pacheco et al. (2018) argue that the long-term success of students with visual impairment depends not just on technology availability but also on sustained institutional commitment to inclusive learning environments. Implementing these strategies at UEW would enhance digital inclusion, reduce reliance on peer support, and empower students to navigate digital resources independently, ultimately improving academic performance and equitable access to education.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

6.0 Introduction

This chapter presents a summary of the key findings, conclusions, and recommendations of the study. Additionally, it highlights the study's contribution to existing knowledge on the subject and provides suggestions for further research. The purpose of this study was to assess the usage of computer technology among students with visual impairment at the University of Education, Winneba (UEW). Specifically, the study aimed to:

i. Assess the computer skills proficiency of students with visual impairment at the University of Education, Winneba.
ii. Examine how students with visual impairment use the features of computer technology at the University of Education, Winneba.
iii. Identify the support services available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba.
iv. Identify the barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba.

To achieve these objectives, four research questions were developed to guide data collection. The study was grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003). A qualitative research approach was employed, utilising a phenomenological research design to explore computer technology usage among students with visual impairment at UEW. Data collection methods included semi-structured interviews, focus group discussions, and observations. The collected data was then coded and analysed thematically to identify recurring patterns and insights related to students' experiences with computer technology at UEW.

6.1 Summary of Major Findings

The following were the key findings of the study:

Computer Skills Proficiency of Students with Visual Impairment at the University of Education, Winneba

The study revealed that students with visual impairment at UEW possess foundational computer skills, including keyboard navigation, basic word processing, and the use of screen readers like NVDA and JAWS. These skills are stronger for routine tasks such as typing assignments and navigating documents, while advanced functions (e.g., Excel, PowerPoint, and complex formatting) remain challenging. Limited formal training, inconsistent exposure, and access to personal computers contribute to these gaps. Students suggested extending training duration, offering hands-on workshops, and providing personal computers preloaded with assistive software to enhance proficiency and independence.

How Students with Visual Impairment Use the Features of Computer Technology at the University of Education, Winneba

Students actively use assistive technologies to perform academic tasks, including reading digital content with screen readers, navigating documents with keyboard shortcuts, and verifying information through online resources. Mobile devices with accessibility features supplement their learning, particularly outside formal classroom settings. However, students encounter difficulties with complex software and certain accessibility functions, such as adjusting screen reader settings or navigating forms. These findings indicate that while students have adapted strategies to use essential features effectively, further training is needed to maximise the potential of available tools.

Support Services Available to Students with Visual Impairments to Enhance the use of Computer Technology at the University of Education, Winneba

The study confirmed that institutional support, peer mentoring, and informal guidance are important, but formal and systematic training is limited. Students rely heavily on-screen readers and braille displays, yet technical support, workshops, and structured assistive technology programmes are insufficient. Improving access to digital resources, expanding training opportunities, and integrating assistive technology into the curriculum were identified as key strategies to enhance learning outcomes and digital literacy for students with visual impairment.

Barriers faced by students with visual impairment in using computer technology at the University of Education, Winneba

Several barriers hinder students' effective use of computer technology. These include malfunctioning assistive software, outdated or limited hardware, inconsistent internet access, and inaccessible digital learning platforms. Financial constraints further restrict students' ability to acquire personal computers with preloaded accessibility tools. Instructional materials often lack alternative text descriptions, and staff awareness of inclusive pedagogy is limited. Addressing these challenges requires targeted interventions such as regular maintenance of assistive technologies, extended training in digital literacy, improved access to resources, and institutional policies to ensure accessible learning environments.

6.2 Conclusion

Acquiring computer and digital literacy skills is essential for students with visual impairments to participate fully in academic life at the University of Education, Winneba (UEW). In this study, students demonstrated the ability to use computers with the support of screen readers such as JAWS and NVDA to access learning materials, complete assignments, and conduct research independently.

However, the study revealed that students faced challenges in handling advanced software functionalities, including document structuring, web navigation, and multimedia applications. These challenges were linked to insufficient formal training, inadequate institutional support, and occasional malfunctions of assistive technologies. Many students relied on peer support or self-learning to overcome these limitations, which highlights gaps in systematic skill development and structured ICT programmes. Students also experienced difficulties accessing online learning resources that were not fully compatible with screen readers. These accessibility barriers hindered their ability to make full use of information and learning tools, limiting their academic engagement and digital autonomy. In view of these findings, measures to improve computer technology use for students with visual impairments were identified. These include providing regular and structured training in assistive technology, offering accessible devices for personal and academic use, maintaining functional technology, and sensitising academic staff on inclusive digital practices. Implementing these measures can create a more inclusive learning environment where students with visual impairments are empowered to engage independently, enhance their computer technology usage, digital literacy, and achieve equitable academic outcomes.

6.3 Recommendations

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

1. The University of Education, Winneba (UEW) administration needs to establish an ongoing computer training initiative that will enhance digital skills development for its students with visual impairment. Students encounter difficulties operating screen readers and keyboard navigation while utilising computer systems primarily because of inadequate training and exposure to keyboard-related skills. The management of the University should lengthen its current one-semester ICT course to span the entire academic year, which will provide students with thorough learning opportunities to use assistive software as well as essential computer tools.
2. ICT Departments and resource centres must develop advanced computer training aimed at teaching students Microsoft Excel and PowerPoint in addition to internet navigation excellence. Students who have visual impairment show strong skills in

basic computer operations but struggle intensely with advanced applications that students need for academic achievement and professional progress. Practical interactive sessions should be designed specifically to teach students with visual impairment how to utilise all features of computer technology.

3. UEW management should join forces with IT system administrators to build assistive technology training into regular ICT courses while offering enduring technical help with screen readers and other accessibility tools. Faculty training related to digital accessibility must be mandatory because it ensures educational materials at UEW adhere to accessibility standards. The University needs to schedule periodic digital accessibility audits to verify that all platforms like learning management systems, comply with Web Content Accessibility Guidelines (WCAG) standards to provide students with visual impairment with effective digital resource navigation.
4. The university administration, along with government education authorities, needs to solve the financial and infrastructural challenges students face while attempting to access computers and assistive technology. The University management needs to obtain funding for enhancing computer laboratories with updated computers in addition to stable internet, while maintaining operational screen readers for students with visual impairment. Additional supports put into place will enable students to deeply use computer technology, thus enhancing their academic outcomes and independent digital capacity.

6.4 Suggestion for Further Research

Additional research needs to assess and contrast how well JAWS, NVDA, VoiceOver and other screen readers work for university students who have visual disabilities. The research would establish which assistive software system provides the best support for academic activities. Research must investigate AI-assisted assistive technology along with the practical utilisation of AI-based tools such as voice-driven gadgets and instant text translation services to enhance accessibility options for students with vision problems.

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APPENDIX A

INTERVIEW GUIDE

SEMI-STRUCTURED INTERVIEW GUIDE FOR STUDENTS WITH VISUAL IMPAIRMENT AT THE UNIVERSITY OF EDUCATION, WINNEBA ON THE USE OF COMPUTER TECHNOLOGY

Time:____________________
Venue:____________________
Date:____________________
Duration: ____________________

This interview aims to collect information from students with visual impairment on the topic: *Assessing Computer Technology Usage by Students with Visual Impairment at the University of Education, Winneba*. The questions are designed to address key themes related to the skills, access, and support systems required for the effective use of computer technology in their academic pursuits.

Objective 1: To assess the computer skills proficiency of students with visual impairment at the University of Education, Winneba.

1. How would you define a computer and explain its main functions?
2. Can you describe the first time you interacted with a computer and the support you received?
3. What strategies or resources have you used to improve your computer skills since enrolling at UEW?
4. How do you utilize computers to complete academic tasks such as assignments, projects, or research?
5. Which software programs (e.g., Microsoft Word, Excel, PowerPoint, or assistive software) do you use most frequently, and for what purposes?
6. How do you navigate these software programs effectively considering your visual impairment?
7. How confident are you in performing basic computer operations such as typing, text formatting, file creation, saving, organization, and using software tools for academic tasks?
8. How would you rate your ability to learn new computer programs or features independently?
9. How would you evaluate the adequacy and effectiveness of computer training or instruction provided at UEW?
10. What additional support or resources would improve your computer skills proficiency?

Objective 2: To Examine How Students with Visual Impairment Access the Features of Computer Technology at UEW

8. How do you access the computers provided by the university for your studies?
9. How do you use assistive technologies like screen readers or screen magnifiers while working on a computer?
10. How do you search for information online for academic purposes?
    - How do you ensure that the information you access is reliable?

11. How do you interact with the university's online platforms such as V-Class or the Student Portal?
    - How accessible and user-friendly are these platforms for you?
12. How do you manage challenges you face while navigating computer systems or online platforms?
13. How do the accessibility features on computers or software programmes support your academic work?
14. How would you describe your experience using the internet for your academic needs, such as research or downloading materials?

Objective 3: To identify the support services available to students with visual impairments to enhance the use of computer technology at the University of Education, Winneba.

15. How do lecturers support you in learning and using computer technology?
16. How often do you receive help from peers or university staff when you face difficulties with computer technology?
17. How adequate do you find the support provided by the university in helping you use computers effectively?
18. How do you feel about the availability of assistive devices, such as Braille displays or audio guides, on campus?
19. How do you think the university can improve its support systems for students with visual impairment using computer technology?
20. How can the university enhance your overall experience with computer technology in terms of training or resources?
21. How do you think classroom teaching methods can be improved to better accommodate your needs in learning computer technology?
22. How would providing additional resources or tools, such as specialised software or devices, benefit you?

Objective 4: To Identify the Barriers Faced by Students with Visual Impairment in Using Computer Technology at the University of Education, Winneba

23. What challenges do you face when accessing computers or digital platforms at the university for academic purposes?
24. How reliable and user-friendly are the assistive technologies (e.g., screen readers, Braille displays) available to you at the university?
25. Are there any specific issues related to the design or functionality of assistive devices that affect your ability to complete academic tasks?
26. How would you describe the level of training or support you have received for using computer technology and assistive devices?
27. What technical barriers (e.g., software issues, internet connectivity, maintenance problems) do you encounter when using computer technology?
28. How does the cost of personal assistive devices or software impact your access to computer technology at the university?
29. How comfortable are you seeking help when you face difficulties with computer systems or assistive technologies?

30. What improvements or additional support do you think the university should implement to better support students with visual impairment in using computer technology?

APPENDIX B

INTERVIEW GUIDE FOR STAFF

Topic: Assessing Support Systems for Students with Visual Impairment in Using Computer Technology at UEW

Date: ____________________

Time: ____________________

Duration: ____________________

Introduction

This interview aims to gather information on the support systems for students with visual impairment in using computer technology for their studies. Your responses will help improve the services provided.

Support Systems for Students with Visual Impairment

1. How do you assist students with visual impairment in using computer technology?
2. How do assistive technologies (e.g., screen readers) help students?
3. How do you ensure the assistive technologies are working properly?
4. How do students with visual impairment access computers on campus?
5. How is computer technology used in their courses?
6. How do you support students in learning to use computer technology?
7. How do you help students access online materials and course content?
8. How do faculty support students with visual impairment in using computer technology?
9. How do you work with other departments to support these students?
10. How do you gather feedback from students about the support they receive?
11. How can the support systems for students with visual impairment be improved?
12. How do you know if the support systems are helping students succeed in their studies?

APPENDIX C

OBSERVATION CHECKLIST

Basic Computer Skills and Accessibility Assessment

Category	Item	Yes/No
Use of a PC or Laptop	Student frequently utilises a computer at school	
	Student frequently utilises a computer at home	
	Student frequently utilises a computer at both locations	
	Student does not currently use a computer	
	The computer used at home is a desktop	
	The computer used at home is a laptop	
	The computer at home runs Windows ___ (specify version)	
	The computer at home runs Mac OS ___ (specify version)	
	Monitor size of home computer is known	
	Screen reader installed at home	
	programmes name and version provided for screen reader	
	Screen magnification program installed at home	
	programmes name and version provided for magnification program	
	Additional programmes or notes on computer use at home	
	The computer used at school is a desktop	
	The computer used at school is a laptop	
	The computer at school runs Windows ___ (specify version)	
	The computer at school runs Mac OS ___ (specify version)	
	Monitor size of school computer is known	
	Screen reader installed at school	
	Pogrammes name and version provided for school screen reader	
	Screen magnification programmes installed at school	
	Programme name and version provided for school magnification programme	
	Additional programmes or notes on computer use at school	
Basic Computer Skills	Student can turn on the computer	
	Student can turn on the monitor	
	Student can adjust volume on the monitor (if applicable)	
	Student can log in to the computer (if applicable)	
	Student can turn on/off accessibility software	
	Student can adjust system volume, mute/unmute, etc.	
Keyboard Orientation	Student can locate Alt, Control, Shift, Tab, Caps Lock, and Windows key	

Category	Item	Yes/No
	Student can orient to the "six-pack" (Insert, Delete, Home, End, Page Up, Page Down)	
	Student can orient to the number pad	
	Student can locate function keys	
Basic Computer Navigation	Student can access and navigate the desktop	
	Student can access and navigate the Start Menu	
	Student can access file directories to locate specific documents	
	Student can open and close documents	
	Student can open and close programmes	
	Student can navigate between open programmes	
	Student can navigate between open tabs/documents within a programme	
Category	**Item**	**Yes/No**
Interacting with Text	Student can select text by clicking and dragging	
	Student can copy text using keyboard shortcuts (Ctrl + C)	
	Student can paste text using keyboard shortcuts (Ctrl + V)	
	Student can cut text using keyboard shortcuts (Ctrl + X)	
	Student can highlight text and apply formatting (bold, italics, underline)	
	Student can change font size and style	
	Student can change text alignment (left, right, centre)	
	Student can adjust line spacing and paragraph formatting	
Word Processing	Student can open, save, and close a Word document	
	Student can use bold, italic, and underline in a Word document	
	Student can change font size, style, and colour in Word	
	Student can add bullet points and numbered lists	
	Student can insert images, tables, and hyperlinks in Word	
	Student can adjust margins and page layout in Word	
	Student can spell-check and use thesaurus features in Word	
Use of Internet	Student can open and close web browsers (Chrome, Firefox, etc.)	
	Student can use search engines (Google, Bing, etc.)	
	Student can navigate through websites using hyperlinks	
	Student can download files from the internet	
	Student can upload files to websites (e.g., online assignments, email attachments)	
	Student can manage browser tabs and windows	
	Student can fill out online forms and submit data	

Category	Item	Yes/No
Use of Assistive Technologies	Student uses screen reader software (e.g., JAWS, NVDA)	
	Student uses screen magnification software (e.g., ZoomText)	
	Student uses speech-to-text software (e.g., Dragon NaturallySpeaking)	
	Student uses alternative input devices (e.g., adaptive keyboard, eye-tracking device)	
	Student uses braille displays or other assistive devices	
General Technology Access	Student is able to navigate the operating system using accessibility features	
	Student is familiar with using shortcut keys for efficiency	
	Student is aware of accessibility settings and knows how to activate them	
	Student can adjust text size and contrast on their device	
	Student is familiar with customising settings for assistive technology	

Screen Reader Observation Checklist

Screen Reader	Functionality	Shortcut	Yes/No
JAWS (Job Access With Speech)	Turn JAWS on/off	Insert + F4	
	Read current line	Insert + Down Arrow	
	Read current paragraph	Insert + Up Arrow	
	Read entire document	Insert + Ctrl + Down Arrow	
	Move to next heading	H (capital H for headings)	
	Move to previous heading	Shift + H	
	Move to next link	Tab	
	Move to previous link	Shift + Tab	
	Read item under mouse	Insert + NumPad 5	
	Toggle JAWS verbosity (speech rate, volume, etc.)	Insert + Spacebar (open JAWS menu)	
NVDA (NonVisual Desktop Access)	Turn NVDA on/off	Ctrl + Alt + N	
	Read current line	Down Arrow	
	Read current paragraph	Shift + Up Arrow	
	Read entire document	Ctrl + Alt + Down Arrow	
	Move to next heading	H (capital H for headings)	
	Move to previous heading	Shift + H	
	Move to next link	Tab	
	Move to previous link	Shift + Tab	
	Read item under mouse	Insert + NumPad 5	

Screen Reader	Functionality	Shortcut	Yes/No
	Toggle verbosity settings (speech rate, volume, etc.)	NVDA + Ctrl + V	
VoiceOver (Mac OS)	Turn VoiceOver on/off	Command + F5	
	Read current line	Control + Option + Down Arrow	
	Read current paragraph	Control + Option + Up Arrow	
	Read entire document	Command + F5 (with Arrow keys to navigate)	
	Move to next heading	Control + Option + H	
	Move to previous heading	Control + Option + Shift + H	
	Move to next link	Control + Option + L	
	Move to previous link	Control + Option + Shift + L	
	Read item under mouse	Control + Option + Shift + 8	
	Adjust VoiceOver verbosity (speech rate, pitch, etc.)	Command + F8 (VoiceOver Utility)	
Narrator (Windows)	Turn Narrator on/off	Windows + Ctrl + Enter	
	Read current line	Caps Lock + Down Arrow	
	Read current paragraph	Caps Lock + Up Arrow	
	Read entire document	Caps Lock + Ctrl + Down Arrow	
	Move to next heading	Caps Lock + H	
	Move to previous heading	Caps Lock + Shift + H	
	Move to next link	Caps Lock + K	
	Move to previous link	Caps Lock + Shift + K	
	Read item under mouse	Caps Lock + NumPad 5	
	Adjust Narrator settings (speech rate, volume, etc.)	Caps Lock + Spacebar (open Narrator settings menu)	
ChromeVox (Chrome OS)	Turn ChromeVox on/off	Ctrl + Alt + Z	
	Read current line	Down Arrow	
	Read current paragraph	Shift + Up Arrow	
	Read entire document	Ctrl + Alt + Z	
	Move to next heading	H (capital H for headings)	
	Move to previous heading	Shift + H	
	Move to next link	Tab	
	Move to previous link	Shift + Tab	
	Read item under mouse	Search + Spacebar	

Screen Reader	Functionality	Shortcut	Yes/No
	Adjust ChromeVox verbosity (speech rate, pitch, etc.)	Ctrl + Alt + Shift + V	

Accessibility Settings and Screen Reader Functionality Checklist

Feature	Functionality Description	Shortcut/Action	Yes/No
Accessibility Settings	Adjust general accessibility settings (e.g., font, contrast, etc.)	Navigate to system or screen reader settings (varies by software)	
	Enable/disable high-contrast mode	Windows: Left Alt + Left Shift + Print Screen (system setting)	
	Adjust screen reader verbosity (speech rate, volume, pitch, etc.)	NVDA: Ctrl + Alt + Up Arrow (Increase speech rate) JAWS: Insert + Ctrl + Up Arrow (Increase speech rate)	
	Adjust magnification settings	Windows Magnifier: Win + Plus (Zoom in), Win + Minus (Zoom out)	
General Screen Reader Commands	Read entire document	NVDA: Insert + Down Arrow JAWS: Insert + Down Arrow (Read all content)	
	Start/stop reading	NVDA: Ctrl + Alt + Z JAWS: Ctrl + Alt + Z (Stop reading)	
	Navigate through headings and landmarks	NVDA: H (next heading) JAWS: H (next heading)	
	Move to next/previous link	NVDA: K (next link), Shift + K (previous link) JAWS: Tab (next link), Shift + Tab (previous link)	
Custom Scripts and Macros	Enable/disable custom scripts or macros	NVDA: Insert + F12 (open Script Manager) JAWS: Insert + F12 (open Script Manager)	
	Add new scripts or modify existing macros for specific tasks	NVDA: Script editing menu via Insert + F12 JAWS: Script editor through Insert + F12	
	Execute a macro	JAWS: Insert + F8 (run a macro)	
Form Navigation	Move to next field in a form	Tab (next field) Shift + Tab (previous field)	
	Read form labels and instructions	NVDA: Insert + F (read form fields) JAWS: Insert + F (read form fields)	

Feature	Functionality Description	Shortcut/Action	Yes/No
	Read form field content (text box, checkboxes, etc.)	NVDA: Insert + T (read field content) JAWS: Insert + T (read field content)	
Virtual Cursors	Enable/disable virtual cursor	NVDA: Insert + Z (toggle virtual cursor) JAWS: Insert + Z (toggle virtual cursor)	
	Navigate using virtual cursor (for page elements like links, buttons)	NVDA: Arrow keys (up, down, left, right) JAWS: Arrow keys (up, down, left, right)	
Navigating Through Tabs and Windows	Switch between open applications or windows	Windows: Alt + Tab (Switch apps)	
	Move between tabs in a web browser or application	Ctrl + Tab (next tab) Ctrl + Shift + Tab (previous tab)	
	Read content of an active window or tab	JAWS: Insert + Tab (focus active window/tab)	

APPENDIX D

UNIVERSITY OF EDUCATION, WINNEBA
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sped@uew.edu.gh

18th June, 2024

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION: MR. FARROUK OKYERE

I write to introduce to you, **Mr. Farrouk Okyere** an M.Phil student of the Department of Special Education with index number 8230150018.

He is currently working on his thesis on the topic: **"Assesing Computer Technology usage for Students with Visual Impairment at the University of Education, Winneba."**

He will conduct a semi-structured interview in your Institution.

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

Thank you for the consideration and assistance.

Yours faithfully,

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

www.uew.edu.gh