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Basic Computing Knowledge of Students with Visual Impairments

Ebenezer Ofori-Atta[1], Ephraim Quaynor Teye[2], Adam Awini[3]

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Abstract

This study investigated the computing knowledge of students with visual impairments in a Ghanaian university. Using the case study research design, 103 students were randomly sampled from a population of 118 students with visual impairments. A test instrument was used to collect data for the study. Descriptive statistical methods were used to analyze the data. The results of the study indicated that the participants were knowledgeable in some aspects of basic computer operations, while they were not competent in the use of software. The study concluded that students with visual impairments can gain knowledge and competence in basic computer operations and the use of software and applications if the necessary steps are taken. It was recommended that students with visual impairments should be given access to computers and training by competent ICT professionals who understand the technological needs of students with visual impairments.

Keywords: Covid Basic computing knowledge, Students with disabilities, Visual impairments, Software skills.

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[1] Assistant Lecturer, University of Ghana, Winneba, Ghana. oatta@uew.edu.gh, Orcid ID: 0000-0002-8201-2499

[2] Corresponding Author, Bio Statement Student, University of Education Winneba, Winneba, Ghana. eteye@uew.edu.gh, Orcid ID: 0000-0001-7358-5597

[3] Lecturer, University of Education Winneba, Winneba, Ghana. aawini@uew.edu.gh, Orcid ID: 0000-0003-0979-9173

Introduction

Computing knowledge is vital to the education of all individuals, especially those with special needs such as visual impairments. ICT integration in special education is a 21st-century global phenomenon. Article 9 of the UN Convention on the Rights of People with Disabilities (UNCRPD) requires signatories to: (1) “promote access for persons with disabilities to new ICTs and systems, including the Internet” and (2) “promote the design, development, production, and distribution of accessible ICTs and systems at an early stage, so that these technologies and systems become accessible” (Indongo & Mufune, 2011; UNESCO, 2015).

ICT tools have become the most critical resource for educational, social and economic development for students with disabilities. As noted by Hakkarainena et al. (2006), being able to use ICT tools is a prerequisite for human life quality. Thus, knowledge and competencies in the use of ICT is increasingly required for education and employment, as well as for many activities of daily life. The use of ICT in education has transformed teaching and learning (Rather & Kuraishy, 2015) and is projected to improve educational outcomes, quality, and effectiveness (Jaffer, Ng'ambi, & Czerniewicz, 2007). Elder and Koehn (2009) notes that lack of ICT knowledge and skills might impede learning and raise student’s frustration and dissatisfaction. Therefore, students with visual impairments must possess some basic ICT knowledge to succeed in school. For instance, being able to perform basic computer operations and being able to use appropriate computer software and applications are very important for students with visual impairments if they are to overcome educational barriers and succeed in life (Arslantas & Gul, 2022).

Although all students of the University of Education, Winneba, including students with disabilities are given ICT training as part of their education, it appears that the scope of computing knowledge of students with visual impairments in particular is very limited. This seems to be the cause of the averseness of majority of the students with visual impairments to adopt and use ICT for their academic work instead of relying on the traditional braille system. It is in this light that this study sought to investigate the basic computing knowledge of students with visual impairments.

Subdivide text into unnumbered sections, using short, meaningful sub-headings. Please do not use numbered headings. Please limit heading use to three levels. Please use 12-point bold for first-level headings, 10-point bold for second-level headings, and 10-point italics for third -level headings with an initial capital letter for any proper nouns. Leave one blank line (1.5 times spaced) before and after each heading. (Exception: no blank line between consecutive headings.) Please margin all headings to the left.

Literature Review

ICT knowledge is crucial for students with visual impairments to be successful in the ever-changing world of ICT (Teye, 2014). Computers have become a significant tool for broadening educational possibilities for students with visual impairments. ICT knowledge has changed the way students acquire knowledge, facilitated communication, increased access to information, and supported deeper understanding of issues by developing problem-solving

skills (Balavivekanandhan & Arulchelvan, 2015). Using ICT as a tool can broaden the lives and increase the independence of students with visual impairment. Being able to boot a computer, shut it down, create folders, save files, use the mouse effectively, master the keyboard, identify and locate icons on the desktop, would enable students with visual impairments to not rely on their sighted peers to access information that is not in Braille.

Usually, computer use by students with visual impairments is difficult for several reasons (Ampratwum, Offei, & Ntoaduro, 2016), including insufficient knowledge and skills (Bordbar, 2010; Peralta & Costa, 2007) and inadequate prior experience (Askar & Umay, 2001; Ozcelik & Kurt, 2007). A study by Douglas and Long (2003) on behaviors of persons with visual impairments in copy-typing reported that the participants were inefficient in touch-typing and the use of shortcut keys. Teye (2014) also investigated the computer competency of students with disabilities and found out that only 56.5% of the participants had some level of knowledge about computers. It is critical that students with visual impairments acquaint themselves with ICT knowledge to be able to cope with the rate of ICT integration in education and to grab the spreading of educational opportunities in the era of ICT use in the educational system (Vidhya & Meena-Kumari, 2015).

Students with visual impairments use software to enhance their academic and social life. Mishra, Sharma and Tripathi (2010) noted that the integration of persons with disabilities into the school setting and social life in general, may depend on the use of software such as Window-Eyes, JAWS, and NVDA. Knowledge on these systems is therefore crucial for the education of students with visual impairments. Similarly, knowledge on how to use the internet effectively is very important for students with visual impairments (Hafiar, Subekti, & Nugraha, 2019). This is because use of computers and the World Wide Web is increasingly required for education and employment, as well as for many activities of daily life (Chiang, Cole, Gupta, Kaiser & Starren, 2005).

However, while the advent and growth of the internet has improved society in many respects, they can also hinder the progress of students with visual impairments may have significant difficulty processing the visual cues presented by modern graphical user interfaces which are largely deployed on many websites on the internet (Chiang, et al., 2005). A web accessibility study conducted by Hackett and Parmonto (2006) showed that the persons with visual impairments were more satisfied with transformed website that offered alternative means of accessing contents on the internet. It is imperative therefore that students with visual impairments are knowledgeable in internet use to be able to navigate and retrieve important information that are needed for their educational purposes.

Method

Research Design

The case study design was adopted for this study because the study sought to investigate the basic computing knowledge of students with visual impairments. This design guaranteed that firsthand information was obtained through realistic and flexible engagements with the participants (Dampson & Danso-Mensah, 2012).

Sample Size and Sampling Technique

From a population of 118 students with visual impairments, 103 participants were randomly sampled for this study. The random sampling technique was adopted to ensure that pure chance dictated the selection of each participant and that the cases studied were representative of the larger population of interest (Taylor, Bogdan, & De Vault, 2016).

Instrumentation

A dichotomous test instrument, with two response levels (0 = No Knowledge; 1 = Knowledgeable) was developed for the purpose measuring the participants' knowledge in performing specific ICT tasks. The instrument contained 19 tasks which were grouped under two categories – Basic Computer Operations and Use of Software and Applications which forms part of the skillsets that are vital for any person who is to be considered as ICT literate (Apeanti & Essel, 2015; Uimueka, Altuna, & Ateu, 2010).

Validity and Reliability of the Instrument

To ensure validity, the instrument was developed based on specific criteria for assessing ICT literacy (Apeanti & Essel, 2015; Mat-jizat, 2013). Also, expert opinion was sought on the clarity of statements, appropriateness of language, and clarity of directions of the test items from the Department of ICT Education at the University. Suggestions offered by these experts were incorporated into the revision of the instrument.

Also, in ensuring the reliability of the instrument, a pilot test was conducted with a sample of 15 students with visual impairments who were not sampled to participate in the study. The reliability coefficient was calculated to determine the internal consistency of the items in the instrument. A Cronbach's alpha of .971 was obtained, which is greater than the standard value of .800 accepted for social science research (Field, 2009; Hof, 2012). Therefore, the instrument was deemed to be reliable to be used for this study.

Procedure for Data Collection

Permission was sought from the Resource Centre for Students with Special Needs (RCSSN) at the University of Education, Winneba, for the study to be conducted at the Centre. This is because the RCSSN is the most comfortable place for students with visual impairments in the University, and the researchers wanted to conduct the study at the comfort of the participants. Upon receiving the needed approval, the participants were informed about the intention and purpose of the research. The period and duration for the exercise was also agreed upon, after which participants were assured of the confidentiality and anonymity that will be given to any information gathered from them. Furthermore, the nature of the data collection was discussed and agreed upon between the researchers and the participants. The questionnaires were administered personally by the researchers, to help improve the collection and response rate. The items in the questionnaire were explained to the respondents to ensure that they understood what the items sort to find out. Communication among participants was not allowed,

to ensure that the responses of each participant were not affected by the views of others. The questionnaires were collected from the participants as soon as they were completed.

Data Analysis

The data analysis was done in two phases. In the first phase, the questionnaires were labeled serially for easy identification. This was followed by generating and assigning codes to each response option, after which the data was entered into IBM SPSS Software (version 26) for processing and analysis. A frequency table was generated to check for errors such as outliers and missing values in the dataset. The frequency table showed that the data was clean, hence the second phase of the analysis kicked in.

In the second phase, the demographic information was analyzed using frequencies and percentages, and the data on ICT knowledge was also analyzed using frequency, percentage and mean scores. For each test item, a mean score greater than or equal to 0.5 was interpreted as knowledgeable in performing that specific task, while a mean score less than 0.5 was interpreted as not knowledgeable in performing the task. The data was then presented using appropriate tables.

Results

Demographic Information of Participants

The study collected demographic information from the participants. This information included details on age, gender, and the type of visual impairment. Table 1 shows the breakdown of this information.

Table 1. Demographic Information of the Participants

Variable		Frequency	Percentage
Age	Below 20 years	6	6.3%
	20 – 30 years	81	78.4%
	31 – 40 years	16	15.3%
Gender	Male	65	63.1%
	Female	38	36.9%
Type of visual impairment	Low Vision	41	39.6%
	Blind	62	60.4%
Onset of visual impairment	Congenital	35	34.2%
	Adventitious	68	65.8%
Total		103	100.0%

Out of the 103 participants involved in the study, six (6.3%) were below 20 years, 81 (78.4%) were between 20 and 30 years, and the remaining 16 (15.3%) were between 36 and 40 years. Also, the result shows that there were 65 (63.1%) male and 38 (36.9%) female participants. Again, the results revealed that 41 (39.6%) of the participants

had low vision while 62 (60.4%) were blind. Finally, 35 (34.2%) of the participants had congenital visual impairments, while 68 (65.8%) had adventitious visual impairment. This result revealed that most participants were between 20 and 30 years old, which suggested that the participants were fairly young. It also shows that most of the participants were blind males who became visually impaired after birth.

Findings on Computing Knowledge

To determine the computing knowledge of students with visual impairments, the frequency, percentages, and mean scores of the responses were computed. Two areas of computing knowledge were measured. These are '*Basic Computer Operations'* and '*Use of Software and Applications*. The result for knowledge on Basic Computer Operations is presented in Table 2.

Table 2. Knowledge in Basic Computer Operations

Variable	Responses			
Basic Computer Operations	No Knowledge F (%)	Knowledgeable F (%)	Mean	Interpretation
1. Start or boot a computer	31 (30.3)	72 (69.7)	0.70	Knowledgeable
2. Restart a computer.	50 (48.5)	53 (51.5)	0.52	Knowledgeable
3. Shut down a computer.	44 (42.4)	59 (57.6)	0.58	Knowledgeable
4. Use the keyboard to scroll through a document.	37 (36.4)	66 (63.6)	0.64	Knowledgeable
5. Insert and eject removable drives from USB Ports.	47 (45.5)	56 (54.5)	0.55	Knowledgeable
6. Scan removable drives for viruses.	69 (67.4)	34 (32.6)	0.45	Not Knowledgeable
7. Format a removable drive (pen drive).	78 (75.8)	25 (24.2)	0.24	Not Knowledgeable
8. Determine the storage capacity of a drive.	81 (78.8)	22 (21.2)	0.21	Not Knowledgeable
9. Create and name files and folders.	78 (75.8)	25 (24.2)	0.24	Not Knowledgeable
10. Access files from different storage locations on a computer.	50 (48.5)	53 (51.5)	0.52	Knowledgeable
11. Delete files from a computer.	50 (48.5)	53 (51.5)	0.52	Knowledgeable

From the results in Table 2, 69.7% of the participants were knowledgeable in starting or booting a computer. Also,

with respect to knowledge on restarting a computer, 51.5% of the participants reported that they were knowledgeable. Again, 57.6% of the participants were knowledgeable in shutting down a computer. Also, on the use of the keyboard to scroll through a document, and the ability to insert and eject removable drives from USB ports, it was revealed that 63.6% and 54.5% of the participants were knowledgeable respectively. Again, it emerged that 51.5% of the participants are knowledgeable in accessing files from storage locations and deleting files from computers.

However, the results showed that majority of the participants were not knowledgeable in scanning removable drives for viruses (67.4%), as well as formatting a removable drive (75.8%). Also, 78.8% of the participants indicated that they were not knowledgeable in determining a drive's storage capacity, while 75.8% of participants lacked knowledge in creating and naming files and folders. In summary, the findings from Table 2 suggest that, the majority of participants were knowledgeable in many of the activities that were categorized under Basic Computer Operations. Still further, the result for knowledge in the Use of Software and Applications is presented in Table 3.

Table 3. Knowledge in the Use of Software and Applications

Variable	Responses			
Use of Software and Applications	No Knowledge F (%)	Knowledgeable F (%)	Mean	Interpretation
1. Install new software on a computer.	81 (78.8)	22 (21.2)	0.21	Not Knowledgeable
2. Use software such as JAWS or NVDA on a computer.	50 (48.5)	53 (51.5)	0.52	Knowledgeable
3. Update software to current version.	84 (81.8)	19 (18.2)	0.18	Not Knowledgeable
4. Playing music and video with a computer.	50 (48.5)	53 (51.5)	0.52	Knowledgeable
5. Create backup copies of a document.	66 (63.6)	37 (36.4)	0.36	Not Knowledgeable
6. Open and switch between more than one application at a time.	62 (60.6)	41 (39.4)	0.39	Not Knowledgeable
7. Use a computer software to record audio files.	69 (66.7)	34 (33.3)	0.33	Not Knowledgeable
8. Play audio files after recording.	41 (39.4)	62 (60.6)	0.61	Knowledgeable

Table 3 shows the result of the analysis on knowledge in the use of software and applications. It emerged from the results that majority of the participants were only knowledgeable in three out of the eight activities. These include the use of software such as JAWS or NVDA, where 51.5% of the participants were knowledgeable, compared to 48.5% were not knowledgeable; playing music and video with a computer, also with 51.5% of the participants being knowledgeable, compared to 48.5% who were not knowledgeable; and playing audio files after recording, which had 60.6% of the participants indicating that they were knowledgeable, while the remaining 39.4% indicated that they were not knowledgeable in using software and applications.

On the other hand, the results on the remaining five activities showed that majority of the participants were not knowledgeable in these activities. The results showed that 78.8% of the participants were not knowledgeable about installing new computer software. Also, 81.8% of the participants were not knowledgeable in updating computer software to its current version, while 63.6% of the participants were found not to be knowledgeable in creating backup copies of documents. Again, with respect to opening and switching between more than one application at a time and using computer software to record audio files, the results indicated that the majority of the participants (60.6% and 66.7%, respectively) were not knowledgeable.

Discussion

Knowledge in Basic Computer Operations

The results on Basic Computer Operations point to the fact that most participants are knowledgeable in tasks such as booting, restarting, and shutting down computers, using the keyboard for scrolling, and inserting and ejecting USB drives from ports. Also, most of the participants were knowledgeable in accessing files from different storage locations and deleting files from a computer.

The results agree with the viewpoint of Simsek, Altun and Ates (2010) who noted that students with visual impairments had no difficulty booting and shutting down computers and opening a specified folder. It also affirms De Wit, Heerwegh, and Verhoeven's (2012) position that in order for students with visual impairments to survive in higher education, they must seriously acquire the basic competencies of being able to operate computers, including ability to boot and shut down computers, and master the keyboard. It is therefore necessary for teachers of students with visual impairments to concentrate on the basic skills that are needed to boost computer use among students with visual impairments. This targeted concentration on required skills is critical for the envisaged growth in computer adoption and use by students with visual impairments. Also, an ICT curriculum must be developed for students with visual impairments, with specific arrangements made for ICT teacher training programs that will equip them to effectively teach these skills.

Overall, the findings corroborate the results of Hozmi's (2008) study which found that students with various disabilities, including deaf-blindness, visual impairments and hearing impairments had some knowledge in some specific areas of ICT, whiles they lack knowledge in other areas of ICT competence.

Knowledge in the Use of Software and Applications

The responses from participants in relation to their knowledge in the use of software and applications revealed that majority of the participants were knowledgeable in the use of software such as JAWS or NVDA. Also, majority of the participants were knowledgeable in playing music and video with a computer, as well as playing audio files after recording. This agrees with the findings of Eligi and Mwantimwa (2017) which indicated that most students with visual impairments were knowledgeable in accessing audio recordings using software such as JAWS and NVDA installed on computers.

Conversely, the results showed that majority of the participants were not knowledgeable in installing new software on a computer or updating software to current versions. This validates the views of Simsek, Altun and Ates (2010) who reported that students with visual impairments had difficulties in installing computer programs. Also, it was found that majority of the participants were not knowledgeable in creating backup copies of documents. This may suggest that most of the participants do not back up their files, confirming the observation by Romaniuk (2015) that students are not accustomed to backing up their data or protecting them more efficiently. Overall, it emerged that most students with visual impairments lacked knowledge in computer software and applications.

It is important that the training offered to students with disabilities in the use of computers are designed to encompass a comprehensive software and application skills set that is relevant and tailor-made to meet the needs of students with disabilities. This will ensure that data loss, including the loss of audio recordings and other educational resources, is significantly minimized. In sum, deliberate attention must be paid to training students with visual impairments in creating multiple copies of their educational resources for easy retrieval and use in times of need.

Conclusion

Particularly for students with visual impairments, knowledge in basic computing is essential for educational achievement. Whereas the findings of this study suggest that students with visual impairments have basic knowledge in computer operations, it also reveals their lack of basic skills in the use of software and applications. These basic skills are essential for the daily use of computers and mobile technologies, and therefore purposeful measures must be put in place for these students to build their knowledge in computing through appropriate regular training schemes.

Recommendations

Based on the results of the study, the researchers made some recommendations for implementation. Firstly, it is recommended that students with visual impairments be taught some basic ICT skills to enable them to gain and improve upon their ICT knowledge and competencies. This would go a long way to reduce their dependence on colleagues for all ICT-related activities such as accessing learning materials online, printing documents, and sending emails. Secondly, it is recommended that competent ICT professionals with proficiency in Assistive

Technology should be employed to teach ICT and take charge of the technology needs of students with visual impairments. This would create an opportunity for the students with visual impairments to have access to personnel who have the understanding and ability to assist them with their ICT-related needs to help them acquire the requisite ICT competencies.

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