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The Application of Assistive Technology in the Orientation and Mobility of Learners with Visual Impairment

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Abstract

Background: There are inadequate assistive technologies available in the institutions which hinders in the ability to fulfill the educational needs of visually impaired students.

Objective: This study examined the Application of Assistive Technology in the Orientation and Mobility of Learners with Visual Impairment in Nnamdi Azikiwe University, Awka, Anambra State. The study was guided by three research questions.

Method: The research adopted a descriptive survey design. The population was made up of all students with visual impairment from the university. The instrument for data collection was 18 item(s) structured questionnaire validated by two experts. Reliability of the instrument was determined using the test-retest technique on 20 randomly selected students. Scores were computed using Cronbach Alpha Correlation technique and a value of 0.81 was obtained,

which indicated that the instrument was valid. Data collected in this study was analyzed using the arithmetic mean.

Results: Findings reveals that assistive technology has a significantly positive impact on their educational performance through the use of assistive devices which is why the school management should carefully determine whether an assistive technology would make a difference to the visually impaired learners in the learning process.

Conclusion: Assistive technology is beneficial to foster the educational process of visually impaired learners and this can be further improved by proper training and guidance provided to them so that visually impaired students can enhance their skills to use assistive devices independently, effectively and efficiently.

Keywords: Assistive Technology, Orientation of Learners, Mobility of Learners, Visual Impairment

1. Introduction

Globally, education has been considered to be the corner stone for development. It forms the basis for literacy, skill acquisition, technological advancement and ability to harness human and material resources towards the achievement of social goals^[1], the goal of education evolves around giving or receiving knowledge. It is also the discipline that is concerned with methods of teaching and learning norms, knowledge and other disciplines of life. Education is also the process by which society aims to assist the young to learn and understand the ways of the past, participate productively in the society and

contribute meaningfully for the development of the society at large [2].

Education is expected to be compulsory for everyone to enroll in school including those with special needs. Quality and affordable education must be provided from the elementary school to higher education as enshrined in the national policy of education in Nigeria. It is an undeniable fact that every society recognizes the importance of developing its human resources, especially the young ones who have diverse needs. Thus, education is globally acclaimed as the critical engine that drives the vehicle of development in any nation [3]. As a consequence, a plethora of attempts have been made by different countries and international organizations to legalize, appropriate and harness the developmental potentialities of education for the benefit of all citizens of the world. Based on these internationally recognized documents, it is therefore a truism that education remains a viable and indispensable means of developing human capacity regardless of individual differences and abilities [4], including learners with visual impairment.

Visual impairment is an umbrella term which includes two groups with distinct characteristics and needs: Individuals with low vision and individuals with blindness. Blindness and low vision are described in the legal definitions in terms of visual acuity and field of vision. In simple terms, visual acuity indicates how clearly a person can view an object from a fixed distance. This is generally measured using Snellen chart. The standard visual acuity of a person is 20 /20 (expressed in feet) or 6/6 (expressed in meters). Field of vision is the area that is visible to the eye when looking at a fixed point and it is measured in degrees. Standard forward-facing horizontal field of vision is almost 180 degrees [5].

Visual impairment and visual disability are both the same thing. It also caused by poor eye care, it can also be hereditary. Minor visual impairment can often be treated with different treatments like eye drops, medicated glasses. However, more severe cases may need an advance treatment like Braille technology, GPS device, text to speech translator. There are different types of visual impairment/disability. They affect people in different ways and can differ in severity too: Night blindness: This impairment means that people with it struggle to see at night. This also apply to dimly lit rooms [6]. People with this may also have trouble adjusting from bright areas to dark areas. Night blindness can be helped by prescribing specific glasses or contact lenses for help with night vision. Blurred vision: This can affect how people see close up or far away. Glasses can be prescribed to help with blurred vision, but they don't always stop it. Blurred vision can appear in one or both eyes. Nystagmus: This is a condition where the eye moves involuntarily up and down or side to side constantly [7]. Typically, people with this condition can't see the movement and others may find it hard to notice. It can result in poor vision, such as not being able to see things that are far away and it can get worse when the person is stressed or upset. Children with this eye defect may need extra support, example, being seated near the front of the class if they can't see far away, or giving them longer time to read. Color blindness: This is the inability to see certain colors. People who are color blind can see some colors but not all of them. The most common way to notice color blindness in other people is their inability to see the difference between same colors. Tinted glasses and some computer apps can be used

to help some of the visually impaired, however these only works for some people. Short sightedness: Also known as myopia [8]. An eye condition in which close objects appear more clearly while distant objects appear blurry. Short sightedness can range from mild, where treatment may not be required, to severe, where the vision is significantly affected and requires treatment. It is usually corrected with glasses or contact lenses [8]. Long sightedness: Also known as hypermetropia ojanent cure but with the aid of canes, computers, the individual may be able to live an independent life.

There are still many types of visual impairments/disabilities but with the aid of assistive technology, these impairments can be corrected or aided to make orientation and mobility for these learners with visual impairment. Most teachers stated that the use of assistive technology resources has different applicability for blind and low vision students. They also declared that specific programs for student with visual impairment are necessary in schools.

Globally, an estimated 40 to 45 million people are totally blind, 135 million have low vision and 314 million have some kind of visual impairment [9]. The incidence and demographics of blindness vary greatly in different parts of the world. In most industrialized countries, approximately 0.4% of the population is blind while in developing countries it rises to 1.0%. The global assistive technologies for visually impaired market is expected to reach USD 6,105.7 million by 2025. Increasing awareness about assistive technologies for visually impaired is a major factor fueling the growth of this market. Moreover, stringent government regulations and the high cost of hi-tech technologies may hinder the market growth. (See Fig 1).



Fig 1: Assistive Technologies for Visually Impaired Market

It is estimated that 87% of the world's blind live in developing countries for which Nigeria is part. Over the last decades, visual impairment and blindness caused by infectious diseases have been greatly reduced (an indication of the success of international public health action), but there is a visible increase in the number of people who are blind or visually impaired from conditions related to longer life expectancies [10].

Orientation and Mobility (O&M) instruction provides students who are visually impaired with a set of foundational skills to use residual visual, auditory and other sensory information to understand his or her environment. For the learner who is visually impaired movement is an opportunity to gather sensory information, to communicate, and to make choices. Orientation and Mobility of learners with visual disability aimed at training these individuals with the skill needed to travel safely and independently through his or her environment. Common techniques taught

to these learners by O&M specialists included cane travel, trailing, locating dropped objects, navigating street crossing and others [11]. The effective use of technologies in the orientation and mobility of learners is to enable them gain stable employment in the future (vocational rehabilitation – adults workforce commission). This study examined the Application of Assistive Technology in the Orientation and Mobility of Learners with Visual Impairment in Nnamdi Azikiwe University, Awka, Anambra State. The study was guided by three research questions.

2. Methods

2.1 Design of the Study

The design for this study was a descriptive survey design. This design was considered appropriate for the present study because it was used to determine the opinion of students and lecturers regarding the orientation and mobility of learners with visual impairment using assistive technology in Nnamdi Azikiwe University, Awka.

2.2 Area of the Study

The area of the study was carried out in Nnamdi Azikiwe University, Awka campus. The school consists of two campuses and two separate faculties. Its main campus is in Awka, located along-side Enugu-Onitsha express Road. While the other campus is in Nnewi. The separate faculties are located in Agulu in Aniocha local government area and Ifite-Ogwuiri in Ayamelum local government area in Anambra state. The main campus is located along Onitsha-Enugu express way Awka south. Awka south shares boundaries with Awka north L.G.A, Anaocha L.G.A, Dunukofia L.G.A, Idemili L.G.A, Njikoka L.G.A. The major towns that make up Awka south local government area are; Amawbia, Ifite-Awka, Ezinato, Isiagu, Mbaukwu, Nibo, Nise, Okpuno and Umuawulu. It is a region marked with many infrastructures and many urban businesses. The research was carried out within the school environment as it affects the students and teachers of the school.

The school is made up of 15 faculties and 73 departments, comprising of 24,706 regular students and 12,476 part-time students. The university has a total of 2,702 academic staffs and 5, 335 non-teaching staffs.

2.3 Population of the Study

The target population of the study consisted of all students with visual impairment in Nnamdi Azikiwe University, Awka.

2.4 Sample and Sampling Techniques

The researcher used purposive sampling technique to sample 50 persons with visual impairment from across all faculties.

2.5 Instrument for Data Collection

The instrument for data collection was a structured questionnaire designed by the researchers titled: "Questionnaire on Assistive Technology for Learners with Visual Impairment". The questionnaire was divided into two parts: Part A and B. Part A sought information on the personal data of the respondents, while part B is divided into three sections, namely section A, B and C. Section A sought information into the quality of assistive technologies that is available for learners with visual impairment. Section B sought information into the adaptability and usability of assistive technologies for the orientation and mobility of

learners with visual impairment. Section C sought information regarding the remedial measures. The questionnaire contained 18 items which were constructed in a way that that the respondent had to respond in the mode of two-point rating scale of Strongly Agree (SA=4), Agree (A=3), Disagree (D=2), and Strongly Disagree (SD=1) for research question one, two and three.

2.6 Validation of the Instrument

The face and content validity of the instrument was ascertained by two experts from the department of Educational Foundations, all in the faculty of Education, Nnamdi Azikiwe University, Awka. The validators were requested to examine items on the questionnaire to determine their suitability, clarity and coverage of the research purpose. The corrections and suggestions made by the were used to produce the final copy. The experts were given the title of the study, purpose and research questions to guide them in the task.

2.7 Reliability of the Instrument

The pilot test method was used to establish the reliability of the instrument.

Copies of the questionnaire were administered to a sample of 20 learners with visual impairment from outside the sample. After 2 weeks, the same questionnaire was re-administered to the same subjects and the two sets of scores obtained from the two administrations were collated and correlated using Cronbach Alpha assessment. Reliability coefficient value of 0.81 was obtained and this was considered high enough to confirm the instrument as reliable.

2.8 Method of Data Collection

The researchers personally administered copies of the questionnaire to 50 students with visual impairment along with the help of research assistants. For those with total blindness, the questionnaire was read out to them and their response noted. This exercise lasted for one week.

2.9 Method of Data Analysis

The data collected was analyzed using the simple mean. The cut-off point of 2.50 was adopted. Thus, any item with mean score of 2.50 and above showed positive responses while any item below 2.50 showed negative response.

3. Results

The data collected from the field for this study were analyzed and the summaries were presented in tables to highlight the findings. The presentation was sequentially done starting with the answers to the research questions and hypotheses.

Table 1: Respondents' mean and standard deviation ratings on the quality of assistive technology available for learners with visual impairment

S. No	Item Statements	X	SD	Decisions
1	Availability of Canes	2.4	0.87	disagree
2	Availability of Voice Recorders	3.0	1.05	Agree
3	Use of Braille computers	3.81	0.99	Agree
4	Availability Gps devices	3.33	0.82	Agree
5	Availability of text to speech translator	2.0	0.89	disagree
6	Availability of magnifiers that aids vision	2.3	0.97	disagree
7	Availability of human guide or aid	3.0	0.93	Agree
	Grand Mean	2.83	0.95	Agreed

Table 1 reveals the item-by-item analysis of the quality of assistive technology available for learners with visual impairment the result revealed that items 2,3,4 ad 7 with mean scores of 3.02, 3.81, 3.33 and 3.0, were above the criterion mean of 2.5, hence, they were agreed to be the available technological facilities for visually impaired students in NAU Awka. Items 1, 5 and 6 falls below he criterion mean of 2.5 and therefore are not among the technological facilities available for use by visually the impared students in Unizik. The standard deviation scores ranging from 0.82 – 1.05 means that the difference between the standard deviation scores were not much, therefore this shows that the items are homogenous and significant.

Table 2: Respondents’ mean and standard deviation ratings on how well are these assistive technologies being used in the orientation and mobility of learners with visual impairment

S. No	Item Statements	X	SD	Decisions
8	Used for classroom/ school environment arrangement?	3.25	0.77	Agreed
9	Used for assignments/projects?	3.00	0.86	Agreed
10	Used for the mobility (movement) of learners with visual impairment around the school environment?	3.04	0.93	Agreed
11	Used during teaching/ learning in the classroom?	3.23	1.06	Agreed
12	Used during class assessment	3.13	0.71	Agreed
	Grand Mean	3.11		Agreed

Table 2 shows the mean ratings of how well assistive technologies are being used in the orientation and mobility of learners with visual impairment. The result showed that items 8,9,10,11,12,13 and 14 had mean scores above the criterion mean of 2.5, hence seen to be significant. The grand mean of 3.11 indicates that respondents agreed that the item statements are the common usage of assistive technology in orientation and mobility of learners with visual impairment. The standard deviation scores ranging from 0.71 – 1.06 means that the difference between the standard deviation scores were not much, therefore this shows that the items are homogenous.

Table 3: Respondents’ mean and standard deviation ratings on the measures that can be taken to improve the use assistive technology in the orientation and mobility of learners with visual impairment in Unizik?

S. No	Item Statements	X	SD	Decisions
15	Orientation of learners with visual impairment by Orientation and Mobility(O&M) specialists?	3.31	0.89	Agree
16	Provision of both low and high techs for learners with visual impairment?	3.88	0.97	Agree
17	Arrangements of the classroom/school environment to suit learners with visual impairment?	3.15	0.93	Agree
18	Availability of inclusive library in the school system?	3.04	1.20	Agree
19	Government involvement in providing teaching aids	3.94	0.84	Agree
20	Orientation of learners with visual impairment by Orientation and Mobility(O&M) specialists?	3.23	0.94	Agree
21	Adequate funding for provision of technologies in schools	3.17	1.05	Agree
	Grand Mean	3.4		

Table 3 reveals the item-by-item analysis of the measures that can be taken to improve the use assistive technology in the orientation and mobility of learners with visual impairment in Unizik. The result revealed that the mean scores of items 15,16,17,18,19,20 ad 21 were above the criterion mean of 2.50. Hence, these items were agreed on as the solution to improve the use assistive technology in the orientation and mobility of learners with visual impairment. The grand mean of 3.4 indicates that the above listed measures can improve the use assistive technology in the orientation and mobility of learners with visual impairment.

3.1 Findings of the Study

1. The study revealed from the analysis in table one that there is inadequate availability and use of assistive technology by the visually impaired learners in Nnamdi Azikiwe University, Awka.
2. The study also revealed that there are significant benefits derivable from the use of assistive technology by visually impaired learners Nnamdi Azikiwe University, Awka. The study showed that Assistive technology has the tendency of improving visually impaired students’ motivation to learn, simplifying complex concepts, used for assignments, enhance their mobility, facilitate classroom interaction, improves efficiency, encourages collaboration and eases stress and burden on teachers.
3. The study also showed that measures such as government provision of assistive technologies, adequate funding, availability of inclusive library, orientation of learners with visual impairment by specialists on the use of technology among others can significantly improve the adoption and usage of assistive technologies by visually impaired learners in Nnamdi Azikiwe University, Awka.

4. Discussion

This study reveals that there were insufficient number of assistive devices found in several institutions, and students are very much dependent on the assistive devices available in their institutions for which they have recommended that school should have brought new assistive devices to fulfill their needs, more over they’ve also insisted on including programs to provide proper training of these devices to facilitate their educational processes. Wojcik and Douglas, stated that the most important factor in the education process is the effective use of the assistive technologies in supporting the students' functional skills, such as reading, communication, movement, etc [12]. They also expressed that the students' educational performance should be supported, be sure to take into consideration that assistive technology is not specific to one certain group of disability or one certain skill. They recommended to first use the low-cost and easy-to-use low technologies, and then move on to considering the high technologies when making a decision on the assistive technologies to be used in the education process. The study revealed inadequacy in the quality and availability of assistive technologies used by visually impaired learners in Nnamdi Azikiwe University, Awka. The study showed that outside smart phones, smart watches, computers, voice recorders, text o speech translators, which were not even adequate in the right proportion, Learning Gadgets such as smart boards, smart walking sticks, vision magnifiers, translators were scarcely available. This demonstrates poor availability and wide digital divide in our

school system as it concerns the welfare of visually impaired learners. One of the aims of special/inclusive education is to ‘provide adequate education for people with special needs in order that they may fully contribute their own quota to the development of the nation’. To achieve this objective, it is necessary that adequate arrangements be made to cater for special needs of each of these individuals. This finding is in tandem with the views of Unegbu (2016), who posited that in the school setting, services and materials to cater for the need of people with disabilities such as visually impaired persons should be provided. Such materials according to him includes reading, speech and language therapy, daily living skills, counseling, identification screen and evaluation service among others.

Research question 2, which assesses the use of assistive technologies in orientation and mobility of learners with visual impairment. The study revealed that there are significant benefits derivable from the use of assistive technology by visually impaired learners Nnamdi Azikiwe University, Awka. The study showed that Assistive technology has the tendency of improving visually impaired students’ motivation to learn, simplifying complex concepts, used for assignments, enhance their mobility, facilitate classroom interaction, improves efficiency, encourages collaboration and eases stress and burden on teachers. This finding corroborates the findings of Omede^[13] where he asserted that people with visual impairment need higher education to be set free from the bond of pity. The study also found out that to be well educated, the visually impaired need optical aids, Braille writing materials and other library resources. They also need to surmount the challenges of mobility, funding, computer application and personnel availability.

The third research question examined measures that can be taken to improve the use assistive technology in the orientation and mobility of learners with visual impairment. The study showed that measures such as government provision of assistive technologies, adequate funding, availability of inclusive library, orientation of learners with visual impairment by specialists on the use of technology among others can significantly improve the adoption and usage of assistive technologies by visually impaired learners. Students with unique characteristics and needs should be provided with equal learning opportunities in the education process. Providing access to the appropriate assistive technologies and supporting their education are among the fundamental factors in creating equal education opportunities for persons with special educational needs.

The results of this study show that assistive technologies that are used for supporting persons with visual impairment in their educational processes has a positive impact on their performance academically and are very beneficial to facilitate the academic performance of students with visual impairment. Similar other studies suggested the same results that websites and concept mapping software have opened new pathways for students with alternative learning styles. Many assistive devices and software programs designed for children with disabilities are also useful resources for any struggling student^[14]. Another study by Isaila^[15] analyzed the effect of assistive software for students with visual disability, and emphasized that assistive technologies are important tools and computer-aided education is a preferred method in education. Screen reader program, a type of assistive technologies, provide students with visual

disability with access to the information in written texts via computers.

5. Conclusion

Assistive technology has a significantly positive impact on their educational performance through the use of assistive devices which is why the school management should carefully determine whether an assistive technology would make a difference to the visually impaired learners in the learning process.

Assistive technology is beneficial to foster the educational process of visually impaired learners and this can be further improved by proper training and guidance provided to them so that visually impaired students can enhance their skills to use assistive devices independently, effectively and efficiently. There are inadequate assistive technologies available in the institutions which hinders in the ability to fulfill the educational needs of visually impaired students.

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