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ENHANCING ACADEMIC SUCCESS: ASSISTIVE DEVICES FOR VISUALLY IMPAIRED STUDENTS

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Abstract: Visual impairment can pose significant challenges for students in their academic endeavors, particularly in general studies courses. In Nigeria, many students are affected by varying degrees of visual impairment, from mild to severe blindness, requiring assistive technology to support their academic performance. This study explores the impact of visual impairment on students and the need for technological aids to compensate for lost vision in general studies courses, which are essential for their graduation. Vision plays a critical role in acquiring information, and approximately 80% of learning relies on the sense of sight. Students with visual impairments face various challenges, such as note-taking, assignments, email communication, and internet browsing. Addressing these challenges is crucial for enhancing their academic success in these courses.

Keywords: Visual impairment, Assistive technology, General studies courses, Academic performance, Nigeria

Introduction

Eye is the gateway by which one explores the world, exploits natural resource and utilize one‟s full skills and potentials for one‟s benefit and the benefit of others. so if the eye is impaired as a result of diseases, accident, trauma, physical disaster and others, it will require some medications or compensation to make up for the vision lost. There are many students in Nigeria with visual impairment, though the statistics are not stated. They are some with mild visual impairment, moderate, severe and total blindness. Each of these groups requires a variety of technological devices for academic performance alongside their sighted colleague especially in general studies. Student with visual impairment are in our colleges and universities studying side by side with their sighted mates. They all offer the same general courses (GSS) together. These GSS courses include use of English (I and II), philosophy and Logic, History and Philosophy of science, citizenship Education, Computer Application (I and II), entrepreneurship education (I and II) etc. These GSS courses are compulsory for each student upon their graduation including students with visual impairment. A few are doing significantly well while others are struggling to cope due to their visual challenges. Vision is the major channel of acquiring information both in the classroom and in the real world. About 80% of man‟s total learning is through the sense of seeing. 80% of the task we perform daily is done with sight while the remaining 20% is done with other senses (Obi, 2016). Students with visual impairments have a lot of challenges in their academic endeavors. These include taking of notes in class, doing assignments, sending and receiving mails, browsing the net and so on. As a result, they need something to compensate for the visual loss in order to enhance their academic performance especially in these

GSS courses. Visual impairment is the functional limitation of the vision system. This leads to loss of visual acuity. Visual acuity is the clarity or sharpness of vision.

Persons with visual impairment are classified into four groups: mild vision loss, moderate visual impairment, severe visual impairment and blindness (Mandel, 2012). Moderate visual impairment combined with severe visual impairment are grouped under the term "Low Vision", Low Vision taken together with blindness represents all visual impairment. Those with refractive errors and albinism are included in this category. Persons with visual impairment in these different categories require compensatory devices to function effectively in their unique way. Compensatory devices are technological devices that help to make up visual loss for students with visual impairment. A student who is blind or visually impaired will be unable to make progress in his or her academics, if he or she cannot access the information in that curriculum. In addition, if that student does not have the same level of understanding or study skills as peers without disabilities, he or she will have difficulty with learning, reading and locating information (Kanu, 2004).

Students with visual impairments must learn how to use compensatory devices, effective listening skills and receive direct instruction in concepts in order to address the unique needs arising from their inability to casually observe the large environment. Students with visual impairments cannot access the same books and instructional materials provided for sighted students in the classroom. Therefore, teachers of students with visual impairment need to access the learning strengths and needs of their students to determine which compensatory devices are most appropriate and efficient for each. Students with visual impairments must be able to effectively use a variety of strategies and tools to access information, including visual, tactile and auditory materials. Otherwise, these students with visual impairment will be unable to access the core curriculum and make academic progress in general studies (American Foundation for the blind, 2012). Students with low vision can use screen magnification software or devices that will allow them to see letters, pictures and other objects without having to struggle or strain their remaining vision. Compensatory devices also help students with low vision to benefit from devices that magnify or enlarge objects or images. This equipment can help them take notes, read small prints on electronic devices and watch TV. In other words, simple cases that might have previously required the assistance of a sighted student can easily be done independently by students with some or no vision, with the help of cell phones and tablets. Students with visual impairment can download books in a matter of minutes or seconds onto their IPAD and begin listening to them in no time through the help of an application called Read2Go. Cell phones and tablets also enable students with visual impairments to do things that were previously impossible (Duhaney, 2000). It is now possible for a phone to describe the colour, shape and size of an object to someone who is blind through an application called *TapTapsee*. *TapTapsee* is a mobile camera application designed specifically for the blind and visually impaired users. The application utilizes the device‟s camera and voice over functions to photograph objects and identify them by saying aloud for the user. It helps the users to accurately analyze an object and define it within some seconds (American Foundation for the Blind, 2012). Compensatory devices are divided into three with its importance, namely; (i) Assistive (ii) Adaptive and (iii) Rehabilitative. Assistive devices are special software that enable students with visual impairment access information and general curriculum. It allows students with visual impairment to apply devices appropriately to complete educational goals. Closely related to assistive devices are adaptive devices. Adaptive device is a hardware and software used by students with visual impairment. It enables them to perform daily tasks without being prohibited to do so only because of their impairment. Some of the adaptive devices students with visual impairment use to acquire autonomy are: (i) text

to speech software, (ii) Braille embosser; (iii) colour contrast keyboard (Blackhurst, 2005). Text to speech enables students with visual impairment to read from a screen without the Braille language displayed; Braille embosser is both a hardware and a software that can give blind students the ability to print out written text in a language they can read; and colour contrast keyboard is use by students with low Vision. This visual keyboard creates a sense of confidence so students who are visually impaired don‟t feel isolated (Strongman, 2003). Furthermore, „Adaptive devices‟ is a broad term used to describe both the products and services of people with special needs. It enhances the vocation, recreation, education and independence of the users.

The third is the rehabilitative devices. These are software and hardware commonly used by students with refractive errors. Though others with visual impairment can use rehabilitative devices but most of their technological devices in this group are used by people with refractive errors. One of the recent rehabilitative device is the Binocular Vision device. This is a computer-based identification system for human rehabilitative process. The goal of this binocular system is to restore one with injury in the eye, the amount of freedom of movement and the ability to work as much as possible. Rehabilitative devices are also viewed as the application of devices to meet the needs of people with disabilities.

Its purpose is to eliminate barriers and enhance opportunities in education, rehabilitation, employment, transportation, independent living and recreation. Rehabilitation devices services are provided for people with severe mobility, learning, emotional, visual, hearing, neurological, and neuromuscular and other disabilities (Massachusetts Rehabilitation Commission, 2014; and Usang, 2018). It is as a result of the importance of compensatory devices and its unavailability in departments and its effects in the academic performance of students with visual impairment that the researchers decided to embark on this study.

Problem and Purpose of the study

It is evident that students with visual impairment do not perform effectively well due to the use of obsolete learning materials. Despite the use of Braille materials, tape recorders and typewriters, they still perform poorly in school. Majority of students with visual impairment in Universities find it difficult to take comprehensive notes in class. Some attend lectures without writing materials or recording devices for effective/efficient studies. Though the number of students with visual impairments in University of Calabar are not many, yet the technological devices available are not accessible to them. These students can hardly afford modern equipment which causes them to resort to obsolete and stressful materials, e.g. slate and Stylus. Even when the Disability Education Act (2004) has made education free for persons with disability, including those with visual impairment. The use of obsolete adaptive devices by students with visual impairment poses difficulty to them. The researchers wonder why students with visual impairment cannot perform credibly well especially those in the tertiary institutions, in spite of the availability of Braille materials, tape recorders and typewriters, though in their few number, could it be due to unavailability of compensatory devices or could it be that adaptive and assistive devices such as computers, cell phones etc., are not available and accessible to students with visual impairment? Could it be unaffordability of rehabilitative devices? These are some of the issues that prompted the researchers into investigating whether compensatory devices can improve the academic performance of students with visual impairment in General Studies (GSS) in University of Calabar, Calabar. Taken together, therefore, the study is intended to investigate the availability and utilization of compensatory devices and academic performance of GSS courses among students with visual impairment in the University of Calabar. Specifically, the objectives of this study are to: (i) examine the influence of utilization of compensatory devices for students with visual impairment

on their academic performance in GSS courses. (ii) Availability and utilization of assistive devices for students with visual impairment on their academic performance in GSS courses.

Related Literature

Compensation or make-up comes in form of compensatory devices. Therefore, compensatory devices are technological devices needed by students with visual impairment to make up for the vision loss for effective and efficient academic performance. Compensatory devices are all the technological skills needed by students with visual impairment to enable them access the general school curriculum. These skills include: Tactile, graphic, listening, functional skills and others (Willings, 2016). „Compensatory devices" is an umbrella term that includes assistive, adaptive and rehabilitative devices for people with disabilities including people with visual impairment and also includes the process used in selecting, locating and using them. Compensatory devices require compensatory skills for effective utilization. Compensatory skills are those skills needed by students who are blind or visually impaired to access all areas of the core curriculum. Functional skills, on the other hand refers to skills that students with multiple disabilities learn that provides them with the opportunity to work, play, socialize and take care of personal needs to the highest level possible. (Willing, 2016). Horn, Shell and Servers (2000) sought to determine availability and utilization of compensatory devices on academic performance of students with visual impairment. Two hypotheses were formulated and tested at 0.05 level of significance. A sample population size of2,500 was drawn from the population of all students in Public Secondary Schools in the zone. Stratified and simple random sampling were used. A 32 item questionnaire was constructed, validated and administered to the respondents.

The statistical analysis used were Pearson Product Moment Correlation, One-way Analysis of Variance (ANOVA), and independent and population t-test. The result indicated that compensatory devices are application that integrate the language generation, information processing, and communication capabilities of computers with the capabilities of the students to enhance overall functioning and alleviate limitations on participation.

The findings also revealed that compensatory application help students to be able to operate the computer hardware and software and enter text. Adaptive interface is necessary for students who cannot effectively use the standard computer interface of Keyboard, Video display screen or mouse. Compensatory devices are tools to unlock learning and expand the horizons of students. It is not, in essence a curriculum area. It is however added to the expanded core curriculum because it occupies a special place in the education of the blind and visually impaired students (American Foundation for the blind, 2017). Assistive devices are soft and hardware that help students with visual impairment access information, process, and store and retrieve data for their academic performance and to better their social life. These soft and hardware includes Linux, JAWS, windows computers, cell phones and others. This software helps to transform written text to speech. The foundation for Assistive Devices (FAST, 2001) viewed assistive devices as any product or service designed to enable independence for disable and older people. Nevertheless, the British Educational Communication and Devices Agency (BECTA, 2003) is with the view that assistive devices are software which help people with disabilities (including those with visual impairment) and special needs to overcome the additional barrier they face in communication and learning. Assistive devices are not trying to cure, fix or remediate disabilities nor is it intended to teach or instruct (as in Computer Aided Instruction, CAI). Rather, it strives to highlight strengths than weaknesses to enable expression of abilities at a level commensurate with intelligence and ultimately to enhance the quality of life of people with visual impairments.

The Adaptive Devices Centre for the Blind (ACTB) (2000 – 2003) states that „adaptive devices" is a broad term used to describe both the products and services for people with special needs. It enhances the vocation, recreation, education and independence of the user. Adaptive devices can provide equality between students with visual impairment and their peers within the emerging information society. With the aid of the appropriate technological devices, impaired persons can independently access, process and transmit the same information handled by sighted people. Adaptive devices can, in innumerable instances, assist individuals who are blind or visually impaired to become active participants in the society. Forschi, (2005) in an experiment, studied students from 23 urban and 33 rural areas on accessibility and utilization of adaptive devices on academic performance of students with visual impairment in India. Four hypotheses were formulated and tested at .05 and .01 levels of significance, a sample of 56 students and purposive sampling was used with a 44-item questionnaire, administered to the respondents. The statistical analyses used were Analysis of co-variance. The result indicated that adaptive devices helps people work around physical limitations. Computer-related examples include magnified screen displays, speech recognition devices and keyboard with latching shift and control keys for people who can press only one key at a time. Another study was on Adaptive Instructional Aids for teaching a Blind student" at Non-majors College in America by keefer and Bourbakis(2015) using an experimental design for blind College students who studied Chemistry. It was discovered that adaptive instructional aids assisted the students in the following ways:

1. Writing and balancing chemical reactions
2. Calculating unit conversions and concentrations
3. Drawing Lewis dot structures
4. Understanding structural representation of molecules with three-dimensional models.
5. And identifying organic functional groups

This study, of course, have proven that adaptive devices are technological devices required by students with visual impairments to compete favorably with their sighted counterparts in inclusive schools. Without these devices, students with visual impairments will not be able to take up difficult science subjects like Chemistry. Massachusetts Rehabilitation Commission (2014) Views rehabilitative devices as the application of devices to meet the needs of people with disabilities. Its purpose is to eliminate barriers and enhance opportunities in education, rehabilitation, employment, transportation, independent living and recreation. Rehabilitation devices services are provided for people with severe mobility, learning, emotional, visual, hearing, neurological, neuromuscular and other disabilities. Fields and Aunspach (2016) were interested in determining the influence of rehabilitative devices and academic performance of students with visual impairment in United Kingdom. Two hypotheses were formulated and tested at .05 and .01 levels of significance, a sample of 554 students and stratified as well as cluster sampling procedures were adopted with a 21item standardized questionnaire administered to the respondents.

The statistical analyses used were One-way Analysis of Variance. The result indicated that rehabilitative devices have a significant influence on students" academic performance.

Research Method

Participants

The study adopted the survey research design with the study area as University of Calabar – Calabar, Cross River State, Nigeria. The study drew a sample of (12) students with visual impairment. The population of the study comprised all the male and female students with visual impairment in the University of Calabar. Statistics of

students with visual impairment were taken from admission records of 2017/2018 academic session from the University's database.

Measures

The researchers used the following instruments in this study

(i) **Focus group discussion:** Focus group discussion is usually guided by a moderator or group facilitator who introduce the topic for discussion and helps the group to participate in a lively and natural discussion amongst themselves. It is a good way to gather together people with similar background or experiences to discuss a specific topic of interest. The researchers moderated the discussion by introducing the topic for discussion and subvariables with the population of 12 students with visual impairment. The discussion was on the availability and utilization of compensatory devices by students with visual impairment towards improved academic performance in GSS courses.

(ii) **Questionnaire:** This was the main instrument used in the study, using Likert type scale of Strongly Agree (SA), Agree (A) Disagree (DA); and Strongly Disagree (SA).Questionnaire **Title:** Availability and utilization of Compensatory Devices and Academic Performance in GSS Courses among students with visual impairment in University of Calabar Questionnaire **(**AUCTAPGSSCSVIUCQ).It consisted two sections; section A and B. Section A was used to gather respondents‟ demographic information while B consisted twenty-four items, covering all the variables which are compensatory, assistive, adaptive and rehabilitative devices. The questionnaire was produced in Braille and in prints.

Results

The results of the data analysis based on the objectives of the study are contained in tables 1, 2, 3, 4and 5.

TABLE 1 Descriptive statistics of the extent of availability and utilization of compensatory devices on academic performance in GSS courses among students with visual impairment in University of Calabar.

S/N	Extent of Availability	Response and Perce ntage			
		Yes	%	No	%
1	Compensatory devices	12	100	0	0
2	Assistive devices	4	33.33	8	66.67
3	Adaptive device	1	8.33	11	91.67
4	Rehabilitative devices	0	0	12	100

Table 1 presents the descriptive statistics on the extent of availability and utilization of compensatory devices on academic performance in GSS courses among students with visual impairment in University of Calabar. Compensatory devices recorded that the total respondents of 12 (100%) affirmed (yes) that they utilize those devices. For assistive devices, 4 respondents (33.33%) said yes to the utilization of assistive devices, while 8 (66.67%) said they do not utilize it in the teaching of GSS courses. Adaptive devices recorded 1 (8.33%) who said yes while 11 (91.67%) said no, they don‟t utilize the facilities. For rehabilitative devices, no respondents agreed that it is used while 12 (100%) said it is not used for teaching.

Table 2 Variance of the influence of availability and utilization of compensatory devices for students with visual impairment and their academic performance in GSS courses in University of Calabar

Levels of utilization of compensatory devices	N	X	SD
High	3	20.33	.58
Moderate	4	16.50	2.52
Low	5	19.40	1.14
Total	12	18.74	1.41

Source of variance	Sum of square	Df	Mean square	F-ratio	P-level

Between group	29.80	2	14.90		
			5.39*	0.029	
				9	
Total		54.67		11	
Within group	24.87	2.76			

*P< 0.05; df=2,9; P-value=0.029

The result obtained in table 2 showed that there were 12 respondents sampled for the study. Three said they highly utilized compensatory devices with mean and standard deviation of 20.33 and 0.58 respectively. four said they moderately utilized compensatory devices with mean and standard deviation of 16.50 and 2.52 respectively, while five were found to utilize compensatory devices lowly, with mean and standard deviation of 19.40 and 1.14 respectively. Result of one-way analysis of variance revealed that the P-value of 0.029 was found to be less than the chosen alpha of .05. thus, the null hypothesis was rejected, which implies that visual impairment does significantly influence their academic performance in GSS courses. This rejection resulted to a post hoc mean comparison using Fisher‟s Least Significant Difference (LSD) as presented in table 3. The result in table three revealed that the mean difference for high and moderate utilization of compensatory devices has a statistical mean difference as (*P<0.05; t=3.04; P=0.14; x=3.83). For high and low utilization of compensatory devices, the mean difference is not statistically significant as (P<0.05; t=-0.77; P=.462; x= -.93), while for moderate and low utilization of compensatory devices, there is a statistical mean difference as (*P<0.05; t=-3.45; P=.29; x=-3.56). This implies that the rejection of the hypothesis lies in the groups with high and moderately utilization of compensatory devices and moderate and low utilization of compensatory devices.

Table 3 Post-hoc comparison with Fisher's Least Significant Difference (LSD) of availability and utilization of compensatory devices for students with visual impairment in their academic performance in GSS courses

Level of utilization of compensatory devices	**N**	**High**	**Moderate**	**Low**
High	3	20.33	3.83*	-0.93
Moderate	4	3.04	16.50	-3.83*
Low	5	-0.77	-3.45	19.40
MSW = 2.77				

*the mean difference is significant at the 0.05 level

P<0.05; critical t = 2.228; df = 10

TABLE 4 Summary of One-Way Analysis Of Variance of the Influence of Availability and Utilization of Assistive devices for students with visual impairment and their academic performance in GSS courses.

Level of utilization of assistive devices			**N**	**X**	**SD**
High			4	21.78	.96
Moderate			4	20.25	.50
Low			4	18.25	2.22
Total			12	20.09	1.23
Source of variance	**Sum of square**	**Df**	**Mean square**	**F-ratio**	**P-level**
Between group	24.68	2	12.33		
				6.08*	.021
Within group	18.25	9	2.03		
Total	42.92	11			

*P< 0.05; df=2,9; P-value= .029

The analysis in table 4 above reveal that there were 12 respondents sampled for the study, 4 said that they highly utilized assistive devices, with mean and standard deviation of 21.78 and .96 respectively, 4 said that they moderately utilized assistive devices with mean and standard deviation of 20.25 and .50 respectively. while 4 were found to utilize assistive devices lowly, with mean and standard deviation of 18.25 and 2.22 respectively. The inferential statistics revealed that the P-value of .021 was found to be less than the chosen alpha of .05. thus, the null hypothesis was rejected, which implies that utilization of assistive devices for students with visual impairment has a significant influence on their academic performance in GSS courses. This rejection resulted to a post hoc mean comparison using Fisher‟s Least Significant Difference (LSD) as presented in table 5. The result as presented in table 5 reveal that the mean difference for high and moderate utilization of assistive devices has no statistical mean difference as (*P<0.05; t=1.50; P=.170; x=1.50). For high and low utilization of assistive devices, the mean difference is statistically significant as (*P<0.05; t=3.50; P= .007; x=3.50), while for moderate and low utilization of compensatory devices, there is a statistical mean difference as (*P<0.05; t=2.00; P= .78; x=2.00). This implies that the rejection of the null hypothesis lies in the groups with high and low utilization of assistive devices.

Table 5Post-hoc comparison with Fisher's Least Significant Difference (LSD) of availability and utilization of compensatory devices for students with visual impairment in their academic performance in GSS courses

Utilization of assistive devices	N	High	Moderate	Low
High	4	21.78	1.50*	3.50*
Moderate	4	1.50	20.25	2.00
Low	4	3.50	2.00	18.25
MSW = 2.03				

*the mean difference is significant at the 0.05 level P<0.05;
critical t = 2.228; df = 10

Discussion

One of the major objective of this study was to examine the availability and utilization of compensatory devices for students with visual impairment. The findings showed a significant influence on their academic performance in GSS courses. Arguably, a student who is blind or visually impaired will be unable to make progress in the general curriculum if he or she cannot access the information in that curriculum. In addition, if students do not have the same level of understanding or study skills as peers without disabilities, he or she will have difficulty learning, recalling and locating information. Students with visual impairment cannot access the same books and instructional materials provided to fully sighted students in the classroom. These findings agree with that of Horn, Shell and Sever (1988) and Usang (2018), whose results indicated that compensatory devices are applications that integrate the language generation, information processing and communication capabilities of computers with the capabilities of the students to enhance overall functioning and alleviate limitations on participation. The result of the second hypothesis indicated that there is a significant influence on their academic performance in GSS courses. There is also a provision of a list of online devices and literacy resources, students with visual impairment can use on their own to get ahead. Any adaptive device or service that increases participation, achievement or independence for a student with disability may be considered assistive devices. Assistive devices help students

who are visually impaired (with and without additional disabilities) increase their access to the general curriculum and improve their academic performance. The present finding agrees with that of Willing (2016) whose study revealed that these devices also help students with visual impairment to compete effectively with their sighted colleagues.

Devices can level the playing field, so to speak, for students with visual impairment and can be a great equalizer to students who are blind or have low vision need to acquire a range of technological skills that will give them option for gathering and conveying information. In addition, students with visual impairment can use assistive devices for note taking, studying for test, research and a variety of other academic uses.

Recommendations

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

i. University of Calabar should pay more attention to the welfare of students with visual impairment in providing appropriate and adequate educational resources that will assist them well in their school environment.

ii. Government should deploy professional Guidance Counselors in all institutions to counsel and make recommendations on suitable devices for the visually impaired students of such institutions, in order to enhance optimum academic performance.

iii. Government should equip all universities with compensatory devices, as this will enhance and make easy the acquisition of these devices at a subsidized cost.

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