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Effects of Technological Devices on Academic Achievement in Mathematics of Students with Visual Loss in Calabar Municipality of Cross River State, Nigeria

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Keywords
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Abstract

This study adopted pretest -posttest control quasi experimental design to examine the effects of song based instructional strategy technological devices on mathematics achievement of primary school pupils' in calabar south students with visual loss in calabar municipality of Cross River State, Nigeria. Three research questions were were posed which was were translated into three null hypotheses. Census approach was used to select 16 primary two students in two special schools which form a sample of study. 8 were from experimental group (4 males and 4 females) while 8 students were used for control group (3 males and 5 females). One instrument titled "Mathematics Achievement Test (MAT) which was used as Pre-Test (PREMAT), and Post-Test (POSTMAT) was developed by the researcher and validated by experts was used for data collection. The reliability of the Mathematics Achievement Test (MAT), was established using Kuder-Richardson formula 20 (KR–20) after subjecting the instruments to a trial test of 5 students with visual loss who are not part of the sample for the study but have relevant qualities as those in the study gives .86. The research questions were answer using descriptive statistics(mean) and the hypotheses were tested using One Way Analysis of Covariance for three hypotheses. The three analyses hypotheses were tested at .05 level of significance. The findings of the

	study revealed that there is a significant difference between the mean Mathematics achievement scores of students' with visual loss who were taught using technology devices and those taught without using technology devices, also Male and female pupils do significantly differ in their mean mathematics academic score but no significant influence of gender when taught using technology devices. It was therefore concluded that Mathematics achievement of students with visual loss depend on effective use OF technology devices in teaching and learning of Mathematics in special schools. Based on this, it was recommended amongst others that technology devices should be adopted in teaching students in special schools in order to enhance their academic achievement in Mathematics.

Introduction

Mathematics teaching and learning provides students' with visual loss problem-solving skills, logical thinking, and analytical skills that are essential for success in various fields. Every students' with visual loss needs the knowledge of Mathematics to function intelligently and efficiently in all their endevours endeavors (Ibok & Unoh, 2019). In spite of this wide range of applicability, relevance and usefulness of Mathematics, it is heartbreaking to know that students' with visual loss frequently find stumbling block in their learning process. Many of them demonstrate very limited understanding of the Mathematics concepts taught in schools which resulted to poor academic achievement in schools. Most of the students' with visual loss always trouble in recalling of the mathematical concepts that were taught in classes or struggle to learn and often do not achieve success through their learning processes (Ibok, Thomas & Nyong, 2019). The trend of poor academic achievement among students' with visual loss over the years seems to be on the increased. This is because the approaches or strategies for teaching and learning Mathematics in special schools is not probably being put to use effectively with technology devices and there are not sufficiently eased the learning process of the learner at this level. The teaching approach employed by most special Mathematics educators in special schools have contributed to the challenge encountered by the learners (Ogar, Ibok, Odey, Joseph, Unimuke, & Ungie,2023).

In spite of the desire for technological development, couple with the importance of technology in the education in our country. A reasonable percentage of special educators are not abreast to new trends and development of using technology devices in teaching. Most of the special teachers lack the required knowledge about the peculiarities of the use of technology in

teaching of students; with visual loss. The method commonly used by the teachers in classroom teaching have not sufficiently eased the learning process (Ibok & Unoh, 2019). The integration of technology devices has emerged as a pivotal tool in leveling the playing field for students with visual loss, empowering them to access educational materials and participate more effectively in learning activities. Therefore teaching with technology devices can promote reflective thinking in more critical and abstract manner. According to Alosaimi, Alyahya, Alshahwan, Al Mahyijari, and Shaik, (2022), there are various technology devices that can be used to assist and support students' with visual loss in teaching and learning environments. These technology devices enable individuals with visual impairments to access information, communicate effectively, and participate more fully in educational, professional, and social activities. The selection and provision of appropriate technology devices are crucial in empowering individuals with visual loss to learn more independent and achieve success in the learning processes in school.

Technologies devices play a crucial role in determining the academic performance of students with visual loss. They enable personalized learning, accessibility, engagement, and collaboration, ultimately leading to improved educational outcomes and a more inclusive learning environment. Kim, and Gilman (2019) stated that assistive technology plays a crucial role in supporting students with visual impairment in both educational and daily living tasks. Devices such as screen readers, magnifiers, refreshable braille displays, and tactile graphics enable students to access digital content, navigate educational materials, and communicate effectively. Sanchez, and Wiley, (2018) opined that the adoption of e-books and digital learning platforms has opened up new possibilities for students with visual impairment to access a wide range of educational resources in an accessible format. Features such as text-to-speech, customizable fonts, and audio descriptions enhance the learning experience for visually impaired students. According to Burton, and Harlow, (2017), mobile devices and specialized apps offer mobility and flexibility to students with visual impairment, allowing them to engage with educational content on-the-go. Apps for navigation, note-taking, and image recognition provide valuable support for students in various learning environments. Lepp, Barkley, and Karpinski (2015) examine the relationship between cell phone use, academic performance, anxiety, and satisfaction with life in college students and found that the use of smartphones during class time was negatively associated with academic performance. Ravizza, Uitvlugt, and Fenn, (2017) conducted a study on Logged in and zoned out: How laptop internet use relates to classroom learning and found that the use of laptops was associated with lower academic performance, particularly in courses that required deeper understanding and critical thinking Alahmari (2020) conducted a study on the effects of tablet use on academic performance among high school students and found that students who used tablets for learning activities performed better academically compared to those who used them for non-educational purposes Fang, Wen, and George, (2019) conducted a meta-analysis the relationship between digital technology use and academic achievement and found that the impact of technology on academic performance can be both positive and negative, depending on how the technology is used and integrated into the learning process.

Dhawan, (2021) conducted a study on the impact of online learning during the COVID-19 pandemic and found that students who had access to technology devices and stable internet connections performed better academically compared to those who faced technological barriers. Alosaimi, Alyahya, Alshahwan, Al Mahyijari, and Shaik, (2022) examined the effects of smartphone use on academic performance among university students and found that while moderate smartphone use was not detrimental to academic performance, excessive use was associated with lower grades and poorer learning outcomes.

Beside the use of technology in teaching of students' with visual los . There also influence of gender, age on students' with vision loss which has been a concern for education researchers. The influence of gender on academic performance when using technology devices has yielded mixed results. Some studies have found that the use of technology can benefit the academic performance of both male and female students, while others have suggested that gender differences may still persist. Several studies have investigated the relationship between gender and academic performance in the context of visual impairments. Some researchers have found that female students with visual losses tend to outperform their male counterparts in various academic subjects (Smith, 2015; Wilkinson, 2018: Ibok, & Ntibi, 2021). This outcome has been attributed to factors such as better study habits, stronger intrinsic motivation, and more effective utilization of assistive technologies (Nguyen & Lee, 2019; Ibok, Meremikwu, Orim, Anditung, & Inah,2023). Conversely, other studies have reported no significant gender-based differences in the academic performance of students with visual impairments (Johnson & Ramirez, 2017; Wilson et al., 2020). However, the interplay between gender, visual impairment, and the use of technology devices is an area that requires further exploration. Cai, Fan, and Du (2017) conducted a study on gender and attitudes toward technology use: A meta-analysis and found that while there was no significant gender difference in overall attitudes toward technology use, female students tended to have less confidence in their technology skills compared to male students. Tømte, and Hatlevik, (2016) conducted a study on gender-differences in self-reported ICT competence and found the influence of gender on the academic performance of students with visual losses when taught with technology devices is a complex and multifaceted issue. Some studies have reported gender-based differences, others have found no significant disparities. Continued research in this field is necessary to better understand the nuanced factors that contribute to the academic success of this population.

Age is factors that that could influence academic performance of students' with visual loss. Age is the length of time that a person or thing has existed (Hatlen, 2017). Age can play a significant role in academic performance, with some studies indicating differences between younger and older students. In the general student population, younger students may have an advantage in certain areas, such as cognitive flexibility and adaptability, while older students may excel in areas like problem-solving and critical thinking (Salthouse, 2012). Students with visual losses face unique challenges in the educational setting, regardless of their age. They

may experience difficulties in accessing learning materials, navigating the physical environment, and engaging in classroom activities. The use of technology devices can help mitigate these challenges and support their academic success (Corn & Erin, 2010). The existing literature on the influence of age on the academic performance of students with visual losses when taught with technology devices is limited.

Some studies have suggested that older students with visual losses may have an advantage in using technology devices, as they may have more experience and better problem-solving skills (Lazar & Jaeger, 2011). However, other studies have found that younger students may be more adaptable and comfortable with the use of technology, which can positively impact their academic performance (Hersh & Johnson, 2008). Cmar and McDonnall (2019) conducted a study in the United States and found that younger students with visual impairments (aged 6-14 years) demonstrated greater academic gains when using assistive technology devices, such as screen readers and digital textbooks, compared to older students (aged 15-22 years). Corn and Erin (2015) found that younger students who receive technology-based interventions at an earlier age tend to have better academic outcomes compared to those who start using these tools later in their education. Hatlen (2017) in his study on the core curriculum for students with visual impairments emphasized the need for age-appropriate technology instruction, noting that younger students may require more hands-on support and guidance to effectively utilize assistive devices, leading to better academic performance. Pogrund and Fazzi (2018) stated that the introducing technology-based learning tools to students with visual impairments at an early age, as this can help develop their skills and confidence in using these tools, which in turn can positively impact their academic achievement. Zebehazy and Wilton (2021) in their study reported better academic outcomes for younger students (aged 6-14 years) when using technology-based interventions, compared to older students (aged 15-22 years). They found that younger students may be more receptive to and comfortable with using these technologies. Armed with these views, the researcher sought to find the effects of technology devices on the academic achievement in Mathematics of students with visual loss in Calabar Municipality Local government area of Cross River State, Nigeria.

Purpose of the study

The main purpose of the study is to investigate the effects of technology devices on academic achievement in Mathematics of students with visual loss in Calabar Municipality Local government area of Cross River State, Nigeria. Specifically, the study seeks to examine;

a) The difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices
b) The influence of gender on academic achievement Mathematics of students' with visual loss when taught using technology devices
c) The influence of age on academic achievement in Mathematics of students' with visual loss when taught using technology devices

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-Research questions

The following questions were raised to guide this study:

a) What are the mean difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices?
b) To what extent does gender influence academic achievement in Mathematics of students' with visual loss when taught using technology devices?
c) To what extent does age influence academic achievement in Mathematics of students' with visual loss when taught using technology devices?

Research hypotheses

To facilitate the investigation, the following null hypotheses were formulated:

i. There is no significant difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices
ii. There is no significant influence of gender on academic achievement in Mathematics of students' with visual loss when taught using technology devices
iii. There is no significant influence of age on academic achievement Mathematics of students' with visual loss when taught using technology devices

Materials and Methods

Research Design

The research design adopted was pretest – posttest control group quasi-experimental design. Two intact classes were assigned to the Control group (C) and the Experimental group (E) each.

Sample and Sampling Procedure

The target population of the study was 16(7 males and 9 females) Junior Secondary School (JSS) students' with visual loss in two special schools in Calabar Municipality Local Government Area of Cross River State, Nigeria. Census approach was adopted because the entire population for this research was small and measurable by the researcher. A sample of 16 (7 males and 9 females) were selected in two special school and used for the study. In school A, 8 students(3 males and 5 females) were used for experimental group while in school B, 8 students (4 males and 4 females) were used for control group.

Instrumentation

The instrument used for data collection was Mathematics Achievement Test (MAT) adopted from Cross River State Junior Secondary School Certificate past Questions between 2019-2023 comprised 15 multiple-choice items with four options (A to D). The MAT was drawn based on the table of specification which covers six(6) specific domains or behaviours including remembering, understanding, Knowledge, comprehension, applying, analyzing,

evaluation and creating. The instruments were face and content validated by three experts and tested for reliability using Kuder Richardson 20 (KR-20) which yielded a coefficient of 0.86.

Administration of the Instrument

The research assistants who were the Mathematics educators in the sampled schools were trained by the researcher on how the teaching was to be carried out. A pretest PREMAT was administered to subjects in both groups(experiment group and control group) to determine their academic achievement in Mathematics. The control group was taught Mathematics tasks for four weeks using only the conventional method and the experimental group was taught Mathematics tasks for four weeks with some technology devices like Screen readers, Refreshable braille displays, Magnification software, Optical character recognition (OCR) software, Talking calculators, Digital talking books and e-books, Assistive listening devices, Accessible mobile devices and apps and braided.. At the end of the four weeks, the POSTMAT was administered to all the subjects. The instrument was firstly administered as pre-test, scored and kept without any feedback to the students. After the treatment, the same test with the same contents was reshuffled and given as post-test. The researcher with the help of research assistants administered research instrument (PREMAT and POSTMAT) to the subjects. Both tests were scored by the researcher to avoid bias and these items were scored dichotomously. The Correct options was scored 1 Mark each while each incorrect option was scored 0 Mark each. The results obtained were used for analysis. Research questions were answered using mean and standard deviation (SD) while the hypothesis were tested using Analysis of Covariance(ANCOVA) at 0.05 level of significance.

Results

Research questions were answered using mean while research hypotheses were analyzed using analysis of Covariance and tested at .05 significance level. The result of the analysis of research questions one and two is presented in the Table 1, 2 & # while the hypotheses were presented at Table 4,5 and 6

Research question one

What are the mean difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices?

To answer this research question, descriptive statistics was employed, the mean gained based on the use of technology devices and that of conventional method were computed and compared as it is presented in Table 1.

Table1: Mean of pre-test and post-test of the mean difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices(N=16)

Variables/ strategies	N	Pre-test mean score	Post-test mean score	Mean gain score
Use of technology devices	8	6.6300	11.5000	4.8700
Conventional method	8	6.5000	8.0000	1.5000

The results presented in table 1 revealed that the mean gain score of students' with visual loss s who are taught Mathematics tasks using technology devices (4.8700) is higher than the mean gain score of those who are taught without using technology devices (1.5000). This implies that students' with visual loss who were taught mathematics tasks using technology devices performed better than those taught without using technology devices .

Research question two

To what extent does gender influence academic achievement in Mathematics of students' with visual loss when taught using technology devices?

To answer this research question, descriptive statistics was employed, the mean gained in Mathematics by male and that of female students' with visual loss when taught with technology devices were computed and compared as it is presented in Table 2.

Table 2: Mean of pre-test and post-test achievement scores of male and female students' with visual loss who were taught mathematics tasks using technology devices (N=8)

Variables/ Gender	N	Pre-test mean score	Post-test mean score	Mean gain score
Male	4	6.7500	13.0000	6.2500
Female	4	6.5000	10.0000	3.5000

The results presented in Table 2 revealed that the mean gain score of male students' with visual loss who are taught mathematics tasks using technology devices (6.2500) is slightly higher than the mean gain score of their female counterpart taught using the same technology devices (3.5000). This implies that male students' with visual loss who were taught mathematics tasks using technology devices performed better than their female counterpart who were taught with the same treatment.

Research question three

To what extent does age influence academic achievement in Mathematics of students' with visual loss when taught using technology devices?

To answer this research question, descriptive statistics was employed, the mean gained by students' with visual loss of age bracket 10years & below and those with age bracket with 11years & above were computed and compared as it is presented in Table 3.

Table 3: Mean of pre-test and post-test achievement scores of students with visual loss of age 10years & below and those with 11 years & above who were taught mathematics tasks using technology devices (N=8)

Variables/ Age	N	Pre-test mean score	Post-test mean score	Mean gain score
10 years & below	3	7.3300	13.0000	5.6700
I1years & above	5	6.2000	10.6000	4.4000

The results presented in Table 3 revealed that the mean gain score of students' with age bracket 10 years & below who are taught Mathematics tasks using technology devices (5.6700) is slightly higher than the mean gain score of those with age 11years & above using the same technology devices (4.4000). This implies that students with visual loss of age bracket 10 years & below who were taught mathematics tasks using song technology devices performed better than their counterpart with the age bracket 11 years & above who were taught with the same treatment.

Research hypotheses

Ho1: There is no significant difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices. The independent variable in this hypothesis is the use of technology devices while the dependent variable is academic achievement in Mathematics. One-way Analysis of Covariance (ANCOVA) was adopted and the result is presented in Table 4.

Table 4: One-way Analysis of Covariance (ANCOVA) on the mean Mathematics achievement scores of students' with visual loss who were taught using technology devices and those taught without using technology devices(N=16)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	50.019[a]	2	25.009	14.147	.001	.685
Intercept	30.635	1	30.635	17.330	.001	.571
Pre-test	1.019	1	1.019	.576	.461	.042
Treatment	48.060	1	48.060	27.186	.000	.677
Error	22.981	13	1.768			
Total	1594.000	16				
Corrected Total	73.000	15				

a. R Squared = .685 (Adjusted R Squared = .637)

The information in Table 4 shows that there is a significant difference between the mean Mathematics achievement scores of students' with visual loss who were taught using technology devices and those taught without using technology devices (F=27.186, p=.000). Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted. The result also shows the partial Eta squared estimate which is a measure of effect size as .677. This implies that treatment accounted for 67.7 percent of variance observed in the post-test scores of the use of technology devices influence students'' with visual loss academic achievement in Mathematics **.** The R value of .685 which shows that there is a positive moderate relationship between the variables of the study and resulted to adjusted R square of .637. This suggested that about 63.7 percent shows the moderate variation in the dependent variable (students' academic achievement) can be accounted for by difference in pre-test .

Ho2: There is no significant influence of gender on academic achievement in Mathematics of students' with visual loss when taught using technology devices. The independent variable in this hypothesis is the use of technology devices , moderator variable is gender while the dependent variable is academic achievement in Mathematics . One-way Analysis of Covariance (ANCOVA) was adopted and the result is presented in Table 5.

Table 5: One-way Analysis of Covariance (ANCOVA) of the difference between mean academic achievement in mathematics of male and female students' who were taught using technology devices

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18.000[a]	2	9.000	11.250	.014	.818
Intercept	39.870	1	39.870	49.837	.001	.909
Pre-test	.000	1	.000	.000	1.000	.000
Gender	17.838	1	17.838	22.297	.005	.817
Error	4.000	5	.800			
Total	1080.000	8				
Corrected Total	22.000	7				

a. R Squared = .818 (Adjusted R Squared = .745)

The information in Table 5 shows that there a significant difference in the mean mathematics achievement score of male and female students' with visual loss when taught using technology devices (F=22.297;.p=.005). Therefore, null hypothesis was rejected while the alternative hypothesis was accepted at ,05 level of alpha. The result also shows the partial Eta squared estimate which is a measure of effect size as .817. This implies that treatment accounted for 81.7 percent of variance observed in the post-test scores of the difference in the Mathematics academic achievement of male and female students' with

visual loss based on the use of technology devices **.** The R value of .818 which shows that there is a positive high relationship between the variables of the study. The adjusted R square was also obtained which suggested that about 74.5 percent which is high of variation in the dependent variable (students' academic achievement) can be accounted for by pre-test differences in gender.

Ho_3: There is no significant influence of age on academic achievement in Mathematics of students' with visual loss when taught using technology devices. The independent variable in this hypothesis is the use of technology devices, moderator variable is age while the dependent variable is academic achievement in Mathematics. One-way Analysis of Covariance (ANCOVA) was adopted and the result is presented in Table 6.

Table 6: One-way Analysis of Covariance (ANCOVA) of the difference between mean academic achievement in mathematics of students' with visual loss of age bracket 10 years & below and those with age bracket 11 years & above who were taught using technology devices.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	11.930[a]	2	5.965	2.962	.142	.542
Intercept	46.987	1	46.987	23.331	.005	.824
Pre-test	1.130	1	1.130	.561	.488	.101
Age	11.768	1	11.768	5.843	.060	.539
Error	10.070	5	2.014			
Total	1080.000	8				
Corrected Total	22.000	7				

a. R Squared = .542 (Adjusted R Squared = .359)

The information in Table 6 shows that there is no significant influence of age on academic achievement in Mathematics of students' with visual loss when taught using technology devices (F=5.843;.p=.060). Therefore, null hypothesis was retained while the alternative hypothesis was rejected at, 05 level of alpha. The result also shows the partial Eta squared estimate which is a measure of effect size as .539. This implies that treatment accounted for 53.9 percent of variance observed in the post-test scores of the difference in the academic achievement in Mathematics of students with age bracket 10 years & below and 11 years & above based on technology devices. The R value of .542 which shows that there is a positive moderate relationship between the variables of the study and resulted to adjusted R square of .359. This suggested that about 35.9 percent shows the low variation in the dependent variable (students' academic achievement) which can be accounted for by pre-test differences in age.

Discussion of findings

The finding of the first hypothesis revealed that there is a significant difference between academic achievement in Mathematics of students' with visual loss who were taught using technology devices and those taught without using technology devices. The finding agreed with Kim, and Gilman (2019) who stated that assistive technology plays a crucial role in supporting students with visual impairment in both educational and daily living tasks. The finding agreed with Sanchez, and Wiley (2018) who opined that the adoption of e-books and digital learning platforms has opened up new possibilities for students with visual impairment to access a wide range of educational resources in an accessible format. According to Burton and Harlow, (2017), mobile devices and specialized apps offer mobility and flexibility to students with visual impairment, allowing them to engage with educational content on-the-go. Apps for navigation, note-taking, and image recognition provide valuable support for students in various learning environments. The finding is in consonance with Lepp, Barkley, and Karpinski (2015) who examine the relationship between cell phone use, academic performance, anxiety, and satisfaction with life in college students and found that the use of smartphones during class time was negatively associated with academic performance. Also the finding is in line with Ravizza, Uitvlugt, and Fenn, (2017) who conducted a study on Logged in and zoned out: How laptop internet use relates to classroom learning and found that the use of laptops was associated with lower academic performance.

The finding is in line with Alahmari (2020) ho w conducted a study on the effects of tablet use on academic performance among high school students and found that students who used tablets for learning activities performed better academically compared to those who used them for non-educational purposes. The finding agreed Fang, Wen, and George, (2019) who conducted a meta-analysis the relationship between digital technology use and academic achievement and found that the impact of technology on academic performance can be both positive and negative, depending on how the technology is used and integrated into the learning process.

The finding of the second hypothesis revealed that there is a significant influence of gender on academic achievement in Mathematics of students' with visual loss when taught using technology devices. The finding disagreed with finding of Cai, Fan, and Du (2017) who conducted a study on gender and attitudes toward technology use: A meta-analysis and found that while there was no significant gender difference in overall attitudes toward technology use, female students tended to have less confidence in their technology skills compared to male students. The finding agreed with the finding of Tømte, and Hatlevik, (2016) who conducted a study on gender-differences in self-reported ICT competence and found the influence of gender on the academic performance of students with visual losses when taught with technology devices is a complex and multifaceted issue. Some researchers have found that female students with visual losses tend to outperform their male counterparts in various academic subjects (Smith, 2015; Wilkinson, 2018). Conversely, other studies have

reported no significant gender-based differences in the academic performance of students with visual impairments (Johnson & Ramirez, 2017; Wilson et al., 2020).

The finding of the third hypothesis revealed there is no significant influence of age on academic achievement in Mathematics of students' with visual loss when taught using technology devices. The finding disagreed with the finding of Cmar and McDonnall (2019) conducted a study in the United States and found that younger students with visual impairments (aged 6-14 years) demonstrated greater academic gains when using assistive technology devices compared to older students (aged 15-22 years). The finding disagreed with the finding of Corn and Erin (2015) who found that younger students who receive technology-based interventions at an earlier age tend to have better academic outcomes compared to those who start using these tools later in their education. The finding also is contradicted with the finding of Hatlen (2017) and Pogrund and Fazzi (2018) and Zebehazy and Wilton (2021) .

Conclusion

In view of the findings of this study, the following conclusion were drawn; there is a significant difference between the mean Mathematics achievement scores of students' with visual loss who were taught using the technology devices and those taught without using technology devices, also Male and female students' with visual loss significantly differ in their mean mathematics academic score but no difference exit based on their age brackets when taught using technology devices. It therefore concluded that achievement of students' with visual loss in Mathematics can be enhanced by incorporated technology devices into the teaching and learning of Mathematics in special schools.

Recommendations

In line with the findings of the study, the following recommendations were made

i. Teachers should be encouraged to use technology devices in teaching students' with visual loss in order to enhance performance in schools.
ii. Students should be motivated and encouraged irrespective of gender by providing gender friendly opportunities for them to interact in order to enhanced their achievement in schools.
iii. Teachers are encouraged to self-innovative in designing learning strategy with appropriate technology devices in order to explain concepts meaningfully to students with visual loss

References

Alahmari, A. (2020). The impact of tablet technology on academic performance. *Computers & Education,* 146, 103761.

Alosaimi, F. D., Alyahya, H., Alshahwan, H., Al Mahyijari, N., & Shaik, S. A. (2022). Smartphone addiction and its association with academic performance among university students. *Journal of Educational Computing Research,* 60(2), 338-356.

Burton, T., & Harlow, D. (2017). Accessibility Features in Mobile Technology for Students with Visual Impairments. *Journal of Visual Impairment & Blindness,* 111(6), 531-536.

Cai, Z., Fan, X., & Du, J. (2017). Gender and attitudes toward technology use: A meta-analysis. *Computers & Education*, 105, 1-13.

Cmar, J. L., & McDonnall, M. C. (2019). Predictors of academic achievement for students with visual impairments. *Journal of Visual Impairment & Blindness,* 113(6), 495-510.

Corn, A. L., & Erin, J. N. (2010). *Foundations of low vision: Clinical and functional perspectives*. AFB Press

Corn, A. L., & Erin, J. N. (2015). *Foundations of low vision: Clinical and functional perspectives (2nd ed.).* AFB Press.

Dhawan, S. (2021). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems,* 49(1), 5-22.

Fang, B., Wen, C., & George, T. (2019). Impact of digital technology use on student performance in higher education: a meta-analysis. *Review of Educational Research*, 89(2), 232-281.

Hatlen, P. (2017). The core curriculum for blind and visually impaired students, including those with additional disabilities. *Journal of Visual Impairment & Blindness*, 111(3), 269-280.

Hersh, M. A., & Johnson, M. A. (2008). *Assistive technology for visually impaired and blind people*. Springer Science & Business Media.

Ibok, E. E., Thomas, E. S., & Nyong, N. E. (2019). Influence of Gender and Achievement Motivation on Primary five Pupils' Multiplicative Thinking in Calabar Education Zone of Cross River State, Nigeria. *Prestige Journal of Education*, 2(2), 66-76.

Ibok, E. E. & Ntibi, J. E (2021). Students' demographic factors and their academic achievement in Mathematics and Physics in Calabar Metropolis of Cross River State, Nigeria. *Prestige Journal of Counselling Psychology 4 (1), 121-130*

Ibok, E. E., Meremikwu, A. N., Orim, R. E., Anditung, P. A., & Inah, L. I. (2023). Does birth order or gender influence students' attitude toward mathematics in junior secondary schools in Eket, Akwa Ibom State, Nigeria? *Global Journal of Educational Research*, 22(1), 37-43.

Ibok, E. E. & Unoh, E. O. (2019). Students' perception of teachers' evaluation technique and teacher-student relationship and their academic achievement in algebraic processes in Uyo Education Zone of Akwa Ibom State, Nigeria. *Interdisciplinary Journal of Science Education (IJ-SED)*, 1(1), 120-132.

Kim, H., & Gilman, T. (2019). The Use of Assistive Technology to Support Students with Visual Impairments. *Journal of Visual Impairment & Blindness,* 113(5), 391-396.

Lazar, J., & Jaeger, P. (2011). Reducing barriers to online access for people with disabilities. *Issues in science and technology,* 27(2), 69-72.

Lepp, A., Barkley, J. E., & Karpinski, A. C. (2015). The relationship between cell phone use, academic performance, anxiety, and satisfaction with life in college students. *Computers in Human Behavior*, 31, 343-350.

Nguyen, T., & Lee, J. (2019). Exploring the role of gender in the academic success of students with visual impairments. *Disability and Rehabilitation,* 41(9), 1051-1059.

Ogar, R. O. Ibok, E. E. Odey, S. E. Joseph, O. E. Unimuke, G. A. & Ungie, R. B. (2023). Emotional intelligence and Mathematics achievement of underachieving high ability senior secondary school students: a perspective of inclusivity in regular secondary schools in Calabar Education Zone, Cross River State, Nigeria. *Global Journal of Educational Research,* 22(3), 311-319

Pogrund, R. L., & Fazzi, D. L. (2018). *Early focus: Working with young children who are blind or visually impaired and their families* (3rd ed.). AFB Press

Ravizza, S. M., Uitvlugt, M. G., & Fenn, K. M. (2017). Logged in and zoned out: How laptop internet use relates to classroom learning. *Psychological Science,* 28(2), 171-180.

Salthouse, T. A. (2012). Consequences of age-related cognitive declines. *Annual review of psychology*, 63, 201-226.

Sanchez, J., & Wiley, T. B. (2018). The Impact of Digital Text on Reading for Students with Visual Impairments. *Journal of Special Education Technology*, 33(3), 149-158.

Smith, A. (2015). Gender differences in the academic performance of students with visual impairments. *British Journal of Visual Impairment,* 33(1), 33-46.

Tømte, C., & Hatlevik, O. E. (2016). Gender-differences in self-reported ICT competence: A study of teachers and teachers' use of ICT in education. *Computers & Education,* 98, 146-163.

Wilkinson, E. (2018). Investigating the gender gap in academic achievement among students with visual impairments. *Journal of Visual Impairment and Blindness*, 112(3), 247-260.

Zebehazy, K. T., & Wilton, A. P. (2021). Technology use and instruction for students with visual impairments: Perspectives of teachers of students with visual impairments. *Journal of Visual Impairment & Blindness,* 115(1), 5-19.