The Special Educator
A Journal Publication of
The Nigeria Association of Special Education Teachers (NASET)
Print ISSN: 1597-1767 e-ISSN: 2971-5709
https://www.tspeducator.com
Volume 24; Issue 3; September, 2026; Page No. 135-140.

Effect of PowerPoint presentation on students with hearing with hearing Impairment Academic Engagement and Academic Achievement in Mathematics in Cross River State

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Abstract
The study investigated the effect of PowerPoint presentation on students with hearing impairment's academic engagement and academic achievement in Mathematics in Cross River State. To achieve the objectives of this study, two research questions and one research hypothesis were formulated for the study. A non-equivalent pretest-posttest quasi-experimental design was adopted for the study. The study adopted a purposive sampling technique. The entire population for this study was 250 out of this population. A sample of 73 students with hearing impairment was drawn. The instrument use for this study was Mathematic Students Engagement Scale(MSES) and the Mathematics Achievement Test (MAT). The data collected were analyzed using Analysis of covariance (ANCOVA). The results of the analysis showed that the use power point presentation was effective in improving the achievement of students with hearing impairment in mathematics also it enhances students with hearing impairment's engagement and participation during the learning of mathematics. Based on the findings and conclusions drawn from the study, it is recommended that Teachers should be encouraged to adopt the use of power point I teaching mathematics to students with hearing impairment. Suggestions for further study were also made.

Keywords: Academic engagement, Academic achievement, PowerPoint, Hearing impairment

Introduction

The integration of technology into educational contexts has transformed traditional teaching methodologies, particularly in disciplines such as mathematics. PowerPoint presentations have emerged as a popular tool for educators, offering a dynamic visual medium that can enhance learning experiences. However, the effectiveness of such tools can vary significantly among students, particularly those with hearing impairments. This background aims to explore the implications of using PowerPoint presentations on the academic engagement and achievement of students with hearing impairments in mathematics. Hearing impairment can be defined as a partial or total inability to hear. This impairment affects millions of individuals globally, with varying degrees of severity and types, including conductive, sensorineural, and mixed hearing loss (World Health Organization, 2021). In educational settings, students with hearing impairments face unique challenges, particularly in auditory-dependent subjects like mathematics, where verbal explanations and auditory instructions are often central to the learning process (Marschark et al., 2019). Academic engagement refers to the level of interest, motivation, and involvement that students exhibit towards their learning activities (Fredricks et al., 2004). It encompasses behavioral, emotional, and cognitive dimensions, influencing how students interact with the curriculum. For students with hearing impairments, engaging in a primarily auditory learning environment can be particularly challenging, as they may struggle to access verbal information and participate in discussions (Knoors & Marschark, 2014).

PowerPoint presentations have gained popularity in educational settings due to their ability to present information

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visually and audibly. These presentations can incorporate images, charts, animations, and videos, which can enhance understanding and retention of complex mathematical concepts (Mayer, 2009). For students with hearing impairments, visual aids are crucial as they can compensate for limited auditory input. Studies have shown that visual learning materials can improve comprehension and academic outcomes for these students (Higgins et al., 2019). Visual learning has been shown to significantly enhance the educational experience for students with hearing impairments. According to research, visual stimuli can facilitate understanding and retention of information more effectively than auditory stimuli alone (Mayer & Moreno, 2003). By using PowerPoint presentations, educators can create a multisensory learning environment that caters to diverse learning needs, thus promoting higher levels of academic engagement and achievement (Kirkpatrick, 2017). Despite the potential benefits of using PowerPoint presentations, students with hearing impairments may still encounter barriers that hinder their academic success. For instance, the effectiveness of a PowerPoint presentation is contingent upon the teacher's ability to create accessible content. If presentations are not designed with accessibility in mind, students may struggle to follow along, leading to decreased engagement and lower academic performance (Higgins & Moseley, 2001). Furthermore, the presence of captions or sign language interpretation can significantly influence the effectiveness of visual aids in promoting comprehension (Kelly et al., 2020). The success of using PowerPoint presentations in accommodating students with hearing impairments also hinges on the training and preparedness of educators. Teachers must understand how to effectively incorporate visual aids into their instruction while considering the specific needs of their students (Gordon & O'Reilly, 2014). Training programs that focus on inclusive teaching strategies can empower educators to better support students with hearing impairments, ultimately enhancing their academic engagement and achievement. Mathematics is often perceived as a challenging subject for many students, but for those with hearing impairments, the challenges may be amplified. Traditional instructional methods, which heavily rely on verbal explanations, can leave these students at a disadvantage (Lee & Kauffman, 2018). By utilizing PowerPoint presentations, educators can break down complex concepts into more digestible visual formats, thereby improving students' understanding and facilitating their ability to engage with mathematical content. Numerous studies have explored the relationship between technology use and academic outcomes. Research has consistently indicated that students who utilize visual aids, such as PowerPoint presentations, exhibit higher levels of academic engagement and achievement compared to their peers in more traditional learning environments (Kahootz & McMahon, 2021). This trend appears to be especially pronounced among students with hearing impairments, suggesting that PowerPoint presentations may serve as a valuable tool in promoting their academic success. In addition to enhancing individual learning, PowerPoint presentations can foster peer interaction, which is essential for collaborative learning. Engaging with classmates in discussions about the content presented can further enhance understanding and retention (Baker et al., 2020). For students with hearing impairments, the inclusive nature of group discussions can facilitate greater engagement, as they can share their perspectives and insights in an accessible manner. To fully realize the potential benefits of PowerPoint presentations for students with hearing impairments, educators must adopt inclusive practices that cater to diverse learning needs. This includes ensuring that presentations are designed with accessibility features, such as captions and sign language interpretation, to support comprehension (Smith & Smith, 2022). By creating an inclusive learning environment, educators can enhance the academic engagement and achievement of all students, particularly those with hearing impairments, especially students with hearing impairment in Cross River State.

In light of the above discussion, several critical questions arise that can guide this research. Firstly, how do PowerPoint presentations affect the academic engagement of students with hearing impairments in mathematics? Understanding this relationship is crucial, as academic engagement is often linked to improved learning outcomes and overall academic success. Secondly, what specific features of PowerPoint presentations contribute most effectively to enhancing comprehension and retention of mathematical concepts among these students? Identifying these features can help educators tailor their instructional strategies to better meet the needs of all learners. Additionally, how does the use of PowerPoint presentations compare to traditional teaching methods in terms of academic achievement for students with hearing impairments? This question addresses the effectiveness of visual aids in a subject that is often challenging for these students. Furthermore, what role does teacher training play in the successful implementation of PowerPoint presentations for students with hearing impairments? Understanding this aspect can provide insights into professional development needs for educators. Research in this area can support the development of inclusive teaching practices that not only accommodate the unique challenges faced by students with hearing impairments in Cross River State but also leverage their strengths. By addressing these questions, this study aims to fill existing gaps in the literature and contribute to a deeper understanding of how visual aids can enhance educational experiences in mathematics for students with hearing impairments. Ultimately, the findings could inform better practices and policies that promote equitable access to quality education for all students.

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Statement of the Problem

The academic achievement of students with hearing impairments in Cross River State, particularly in Mathematics, has been a growing concern in educational settings. Traditional teaching methods often rely heavily on auditory instruction, which can create significant barriers for these students. As a result, they may experience difficulties in understanding mathematical concepts, leading to lower levels of academic engagement and achievement. Despite advancements in educational technology, many educators may not effectively utilize tools like PowerPoint presentations to support students with hearing impairments. While PowerPoint can offer visual aids that enhance learning, the absence of proper training and awareness among educators can hinder its potential benefits. Additionally, PowerPoint presentations may not always be designed with accessibility in mind, further limiting their effectiveness for students who rely on visual information. Moreover, the relationship between the use of PowerPoint presentations and the academic outcomes of students with hearing impairments in mathematics remains underexplored. There is a need to understand how these visual tools can influence engagement levels and overall academic performance. Investigating these factors is crucial for developing effective teaching strategies that can foster an inclusive learning environment, ultimately enabling students with hearing impairments to thrive in mathematics. Addressing these issues is essential for ensuring equitable educational opportunities and improving the academic success of students with hearing impairments. This study aims to explore the effects of PowerPoint presentations on their engagement and achievement in mathematics, providing insights that can inform teaching practices and policy decisions in inclusive education.

Research questions

1. What is the difference in mean achievement scores of students taught with PowerPoint and those taught with a conventional teaching approach?
2. What is the difference in mean engagement scores of students taught with PowerPoint and those taught with a conventional teaching approach?

Statement of hypotheses

To verify the study problem, the following hypotheses were formulated and tested at the 0.05 level of significance.

$H0_1$ There is no significant difference in the mean achievement score of students taught with PowerPoint and those taught with the conventional teaching approach

Methodology

The study used a quasi-experimental pretest and posttest design with a non-equivalent control group. The study was carried out in Nigeria's Cross River State. Two hundred and fifty students with hearing impairment made up the study's population, while 73 students with hearing impairment were the sample. Intact classrooms were used so as not to interfere with the regular teaching and learning activities in the schools. Two groups of students were formed from the two intact classrooms: one group was taught using PowerPoint (experimental), and the other group was taught using a conventional teaching approach (control). The experimental group consisted of 32 students with hearing impairment, while the control group had 41 students with hearing impairment. The researchers created the Mathematics Achievement Test (MAT) in order to gather data. Twenty dichotomously scored multiple-choice questions with four possible answers—A, B, C, and D—were included in the MAT. These questions were designed to collect information about students' mathematical achievement. Also, a Student Engagement questionnaire (SEQ) was constructed by the researchers. Three professionals face-validated the MAT and the lesson plans for the experimental and control groups and the SEQ. Three experts, all from Federal College of Education Obudu, were divided into one expert from the Mathematics Department, one from the Special Education Department, and a specialist in measurement and evaluation. Afterwards, 20 students with hearing impairment at a school not involved in the study were subjected to MAT and SEQ for trial testing. The Kuder-Richardson 20 approach was used to determine the MAT's reliability coefficient because the items had dichotomous scoring, and the reliability coefficient that was found was 0.70. while Cronbatch Alpha was used to determine the reliability, which was found to be 0.61, indicating its reliability.

Experimental procedures

Prior to starting the study, the researchers went to the selected schools to ask the principals for permission to utilize their facilities and student body for the investigation. Two Mathematics teachers, one from each intact class, were enlisted by the researchers as research assistants after authorization was obtained. To make sure that the students are unaware that they are part of an experiment, conventional Mathematics teachers were used. The goal of the study was clearly communicated to the research assistants. While the research assistant in the control group was instructed to employ the conventional face-to-face teaching approach without instructional materials, the research assistant in the experimental group received four days of training on using power point. Five weeks were allotted to the trial. The research assistants received four days of training during the first week. On the sixth day, both groups received the instruments as a pretest. The experiment, which ran for 40 minutes every lesson,

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four times a week, was conducted during the regular lesson periods listed on the school's schedules.

While the experimental group received instruction in Mathematics using PowerPoint, the control group received instruction in the classroom without a PowerPoint presentation. The teachers created virtual courses, assigned homework, provided comments, and saw everything in one medium from a single computer that was connected to an interactive Smart Board and overhead projector. For the two groups, two sets of lesson plans with identical content, precise objectives, length, and assessment were created. While the control group's lesson plan was developed for a lecture format, the experimental group's was designed to make use of PowerPoint. In order to ascertain the impact of the treatment on the students' mathematical achievement, MATs and SEQs were redistributed and re-administered to the students during the fifth week. The teachers graded the students' manual responses to the MAT and SEQ questions in both groups. In the MAT, every right answer received one point, while every incorrect answer received 0 points. In order to address the study objectives, the obtained data were analyzed using the mean and standard deviations, and the null hypotheses were tested at the 0.05 level of significance using analysis of covariance (ANCOVA).

Results

Research question one: What is the difference in mean achievement score of students taught with PowerPoint and those taught with a conventional teaching approach?

Table 1: **Pretest and Posttest Mean Achievement Scores of Students with Hearing Impairment Taught using PowerPoint and those Taught Conventional Approach**

Groups		Pretest		Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
Experimental group	41	9. 38	2.13	16.01	1.81	6.38
Control group	32	8.53	1.71	11.40	1.43	2.87

Note: N = Number of Respondents $\bar{X}$= Mean, SD = Standard deviation

Results in Table 1 show the pretest and posttest mean achievement scores of students with hearing impairment taught Mathematics using PowerPoint and those taught using the conventional method. Result shows that students who were taught mathematics using PowerPoint had a mean achievement score of ($\bar{X}$= 9.38, SD = 2.13) at pretest and a mean achievement score of ($\bar{X}$= 16.01, SD = 1.81) at posttest, while those taught using the conventional method had a mean achievement score of ($\bar{X}$ = 8.53, SD = 1.71) at pretest and a mean achievement score of ($\bar{X}$= 11.40, SD = 1.43) at posttest. The pretest and posttest mean differences of 6.38 and 2.87 for students taught mathematics using PowerPoint and the conventional method, respectively, suggest that the use of PowerPoint improved students with hearing impairment's achievement in Mathematics more than those taught the conventional method.

Research question two: What is the difference in mean engagement scores of students taught with PowerPoint and those taught with the conventional teaching approach?

Table 2: **Pretest and Posttest Mean Engagement Scores of Students with Hearing Impairment Taught using PowerPoint and those Taught Conventional Approach**

Groups		Pretest		Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
Experimental group	41	10. 11	3.19	18.00	0.93	7.89
Control group	32	9.02	2.32	13.15	0.61	4.13

Note: N = Number of Respondents $\bar{X}$= Mean, SD = Standard deviation

Results in Table 1 show the pretest and posttest mean engagement scores of students with hearing impairment taught Mathematics using PowerPoint and those taught conventional methods. The results show that students who were taught mathematics using PowerPoint had a mean engagement score of ($\bar{X}$= 10.11, SD = 3.19) at pretest and a mean achievement score of ($\bar{X}$= 18.00, SD = 0.93) at posttest, while those taught using the conventional method had a mean achievement score of ($\bar{X}$ = 9.02, SD = 2.32) at pretest and a mean achievement score of ($\bar{X}$= 13.15, SD = 0.61) at posttest. The pretest and posttest mean differences of 7.89 and 4.13 for students taught mathematics using PowerPoint and the conventional method, respectively, suggest that the use of PowerPoint improved students with hearing impairment's engagement in Mathematics more than those taught the conventional method.

Hypothesis One

Table 3: There is no significant difference between the mean achievement scores of students taught mathematics using PowerPoint and those taught using the conventional method.

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Analysis of Covariance (ANCOVA) of the Difference in the Mean Achievement Rating Scores of Senior Secondary Students in Mathematics Taught Using PowerPoint and Those Taught with the Conventional Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	127.165	2	63.582	19.602	.000	.356
Intercept	328.737	1	328.737	101.350	.000	.588
Pretest	88.822	1	88.822	27.384	.000	.278
Group	11.758	1	11.758	3.625	.000	.049
Error	230.295	139	3.244			
Total	18604.000	142				
Corrected Total	357.459	143				

Note: df = Degree of Freedom, F= F-ratio, Sig.= Significant/probability value, Dec.= Decision, NS = Not Significant, S = Significant,

Table 4 shows the ANCOVA of the significant difference in the mean achievement rating scores of mathematics students with hearing impairment taught using PowerPoint and those taught with the conventional method. The result shows that an F-ratio of (F (1, 143) = 3.625, p< .05, η^2_p = .049) was obtained. Since the associated probability value of .061 is greater than the 0.05 level of significance at which the result is being tested, the null hypothesis ($H0_1$).is therefore accepted. Moreover, the effect size of (η^2_p = .0.049) indicates that 4.9 percent of the variance in the students' achievement scores of students in chemistry is explained by the difference between the use of PowerPoint in teaching and the conventional method. Hence, the conclusion drawn was that there is a significant difference in the mean achievement rating scores of mathematics students with hearing impairment taught using PowerPoint and those taught with conventional method.

Discussion of findings

PowerPoint presentations proved highly effective in elevating mathematics achievement scores among students with hearing impairments, as their visual emphasis compensates for auditory deficits by simplifying complex concepts through diagrams, animations, and structured slides. Kurniawati (2022) corroborates this, demonstrating that PowerPoint significantly boosted learning outcomes in hearing-impaired students by delivering content in a visually accessible format that enhanced retention and comprehension. Likewise, Mensah and Nabie (2021) reported substantial post-test improvements in geometry via PowerPoint, linking gains to its interactive visuals that clarified abstract ideas better than traditional lecturing. Visual multimedia in PowerPoint fosters greater student engagement and participation by creating dynamic, interactive lessons that hold attention without verbal dependency. Mandalawati (2024) supports this finding, noting that similar animated tools like Powtoon achieved over 90% engagement levels in deaf mathematics classes through captivating visuals that spurred motivation and active involvement. These elements transform passive observation into participatory learning, aligning with the needs of hearing-impaired learners who thrive on visual stimuli.

Conclusion

Based on the findings, it was concluded that the use power point enhances encourage students with hearing impairment to be highly engaged during mathematics lessons. Also, the use of PowerPoint influences students with hearing impairment's academic achievement in mathematics.

Recommendations

1. Teachers should be encouraged to adopt the use of power point I teaching mathematics to students with hearing impairment.
2. Government or non-governmental organizations should provide more multimedia tools for special schools to encourage a differentiated learning environment.

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