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Differentiated Instruction: Exploring Classroom Opportunities Through The Use Of Technology For Students With Mild Learning Disabilities In Mathematics Classroom In Senior Secondary School In Sokoto State

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ABSTRACT
Secondary education plays a vital role in national development, serving as a foundation for further academic and societal advancement. This study investigates the impact of technology-based differentiated instruction on classroom instruction among mathematics students with learning disabilities in selected secondary schools in Sokoto Metropolis. The National Policy on Education underscores the importance of promoting equality in educational opportunities for all Nigerian children, irrespective of any disabilities. In the modern context, education must extend beyond traditional fields to encompass scientific and technical disciplines essential for 21st-century advancement. Differentiated instruction, a pedagogical approach tailored to individual student needs, is facilitated by technology, offering real-time data to support instructional decision-making. This study focuses on mathematics education, particularly its significance in mathematics educations and explores how differentiated instruction, coupled with PowerPoint presentations, impacts student achievement. PowerPoint presentations offer visual and auditory enhancements to traditional teaching methods, potentially increasing student engagement and comprehension. However, debates surround its efficacy, with proponents advocating for its ability to enhance learning and opponents critiquing its potential to stifle creativity and innovation. This research employs a quasi-experimental design to compare the outcomes of technology-based differentiated instruction teaching with traditional teaching methods. The sample comprises SS2 students from public science secondary schools in Sokoto Metropolis, with pre-tests and post-tests administered to measure academic achievement. Statistical analyses, including t-tests and correlation analyses, are conducted to evaluate the effectiveness of differentiated instruction. Findings reveal significant improvements in student achievement following technology-based differentiated instruction, particularly in geometry. Gender-specific outcomes also demonstrate no significant difference in achievement, suggesting inclusivity in the instructional approach. Recommendations include promoting the adoption of Interactive Whiteboards (IWB) and PowerPoint presentations in Nigerian schools to enhance teaching and learning outcomes. This necessitates governmental support in providing necessary infrastructure and teacher training.
Keywords: Differentiated instruction, Classroom opportunities, Mild Learning.

INTRODUCTION

Secondary school education serves as the cornerstone and basis for advancing to higher knowledge in tertiary institutions. It functions both as an investment and a tool for fostering accelerated economic, social, political, technological, scientific, and cultural development within the country. This perspective aligns with the National Policy on Education [federal ministry of education,2004]. The National Policy on Education [federal ministry of education,2004] asserts that secondary education is a crucial tool for national development, aiming to enhance the individual's value and development for further educational and overall societal progress. It emphasizes the promotion of equality in educational opportunities for all Nigerian children, regardless of any real or marginal disabilities. In the contemporary context, the future of any nation hinges significantly on the quality and nature of education its citizens receive. Nations that derive the greatest benefits are those with a well-educated populace. Beyond traditional fields such as languages, history, and religions, contemporary education must extend into scientific and technical disciplines characteristic of the 21st century. Science and technology have become intrinsic to modern civilization, serving as the primary catalyst for economic growth and development [university of islamabat, 2009].

Technology is taking differentiated instruction in education to a new level in terms of being responsive to student needs. Technology is making it easier than ever for teachers to have real-time data to support instructional decision-making. The data-drivendecisions bring more objective clarity to the zway in which to best meet the needs of students. The ability of technology to aid teachers in differentiating teaching and learning for today's students is critical to the success of the 21st Century classroom (Kleber, 2015).

The importance of mathematics and science in technical education studies cannot be overstated. It is widely acknowledged that mathematics and science form a fundamental prerequisite for admission into engineering and technical education programs in Nigeria and other places. Practitioners in the classroom, particularly science teachers and even those in non-science disciplines, hold the belief that a solid understanding of mathematics is essential for any student aspiring to make progress in science and technology. As noted by (Taylor,1970) there is a limited awareness that mathematics plays a central role in all scientific reasoning and is at the core of major theories in physical science. In recent years, all scientific fields have increasingly become more quantitative.

In the context of Differentiated instructions (Bearne, 1996) defines differentiated instruction as an approach wherein teachers proactively adjust curricula, teaching methods, resources, learning activities, and student products to cater to the diverse needs of individual students and small groups. The goal is to maximize learning opportunities for each student in a classroom. Differentiated instruction involves modifying teaching and learning routines and can accommodate a wide range of learners' readiness levels, interests, and learning modes (Tomlinson, 2009) This approach is rooted in a teacher's comprehensive understanding of how teaching and learning occur and is designed to respond effectively to the diverse needs of learners. . Lawrence, 2004) 32(3); 32-36 underscores the significant importance of differentiated instruction, particularly for students facing challenges in mastering the grade-level curriculum. Through differentiated instruction, two primary goals are achieved. Firstly, there is a focus on ensuring a high level of achievement in meeting grade-level standards for all students, with teachers providing necessary support for struggling learners. Secondly, curricular adaptations are made to address the specific needs of students requiring modifications (. Alice, 2011)

In a differentiated classroom setting, students can experience increased engagement, motivation, and excitement about learning, especially when the curriculum is authentic, meaningful, and aligned with appropriate learning goals. This is facilitated by providing necessary modifications to meet individual learning needs, whether these involve more challenging tasks or layered approaches to achieve mastery.

PowerPoint is part of the Information and Communications Technology (ICT) program developed by Microsoft in 1987. It is an application program of presentation bundled in Microsoft office (El-Ikhan, 2010). It consists of slides allowing the user to present messages (Asogwa, 2011). Information prepared on a computer could be better projected for larger audience using a Liquid Crystal Display (LCD) or DLP projector. PowerPoint presentation could be used in the classroom for supporting student learning by

combining computer and projector to display slides for illustrating a lesson.

Potentials of Microsoft PowerPoint include: its ability to do spell check, allowing the user to add, correct, make changes to the lessons, and finally use printout materials for students' personal use (Teachnology.com, 2007). PowerPoint gives the user the opportunity to incorporate visual and auditory aspects to a presentation. It permit variety of manipulations by editing or text modification, removal of existing slides and addition of new slides to make lesson more organized and flexible. PowerPoint presentations can be regarded as a good instructional medium and a key for facilitating an effective teaching- learning process. It would therefore not be out of place to explore such instructional medium in the field of Mathematics at Senior Secondary Level.

Proponents of PowerPoint argued that it increases visual quality in the learning process. They also contend that it takes less time to present a subject matter; therefore, more materials can be covered in the classroom. Opponents of PowerPoint believe that it diminishes creativity and innovation besides elevating format over content, betraying an attitude of commercialism that turns everything into a sales pitch (Tufte, 2003). Supporters of Power Point believe that it helps to keep students' interest and attention on the lecture (Szabo & Hastings, 2000), improves student learning (Lowry, 1999), and aids explanations of complex illustrations (Apperson, Laws, & Scepansky, 2006). On the other hand, Creed (1997) describes PowerPoint as a teacher-centered instructional tool that nourishes teacher-controlled lectures. Similarly, Tufte (2006) points out that PowerPoint reduces the analytical quality of a presentation, limits the amount of detail that can be presented, and often weakens verbal and spatial thinking.

Cognitive achievement connotes attainment in a school subject as symbolized by a score or mark on an achievement test (Okoro, 2002) while Antherson (2003) contended that cognitive achievement depends on several factors among which are the instructional methods, learning environment and the learner. The brain does not pay attention to boring things. What makes PowerPoint presentations so effective is that they add complementary, multisensory events designed to spark an emotional response among audience members. This helps maintain audience attention and improves cognitive achievement. The most effective presentations are the ones that are informative, educational, and entertaining (Gallo, 2009).

In recent years, studies have indicated conflicting findings about PowerPoint effectiveness in improving student learning (Craig & Amernic, 2006; Levasseur & Sawyer, 2006). For instance, Gier and Kreiner (2009) who studied the effectiveness of PowerPoint in a psychology class concluded that when students were actively engaged in the class using PowerPoint presentation, information retention increased. Another similar study conducted by Nouri and Shahid (2005) reported that students in a PowerPoint section of an Accounting Principles II class perceived higher understandability of the presented materials than their counterpart in another class. However, Daniels (1999) studied the effectiveness of PowerPoint in a college level economics class and found no significant difference in student performance. Another study on engineering students by Savoy et al. (2009) showed that there was no evidence that PowerPoint can enhance students' performance more than the traditional lectures. Similarly, Apperson et al. (2006); Bartsch and Cobern (2003); Beets and Lobingier (2001) Susskind (2005); and Szabo and Hastings (2000) found little effects of PowerPoint on students' academic achievement.

Students have diverse learning styles, encompassing visual and auditory learning, reflection and action, logical reasoning and intuition, memorization and visualization, analogical thinking, and building mathematical models. Teaching methods also vary, with some instructors favoring lectures, demonstrations, or discussions, and emphasizing principles or applications. The effectiveness of learning in a class depends not only on a student's inherent ability and prior preparation but also on the compatibility between their learning style and the instructor's teaching style.

In schools, differentiated instruction is perceived as a favorable method for addressing the diverse range of abilities present in the classroom. However, much of the research supporting this approach tends to be qualitative, particularly in classrooms with a heterogeneous mix of students. This study aims to address the question of the effectiveness of differentiated instruction on students' mathematics achievement in senior secondary schools in Sokoto State

The annual release of results from the Senior Secondary Certificate Examination (SSCE) conducted by the West African Examination Council (WAEC) serves to underscore the challenging nature and widespread occurrence of poor academic performance among secondary school students across various subjects. As an illustration, the following data represents the percentage of student scores in mathematics from 2009 to 2012.

Objectives of the Study

The study aims to achieve the following objectives:

1.Assess the impact of differentiated instruction on students' academic achievement in geometry at the senior secondary school level.

2'Explore the influence of differentiated instruction on gender-specific outcomes in geometry at the senior secondary school level.

Research Questions

1.To what extent does differentiated instruction impact students' academic achievement in geometry at the senior secondary school level?

2. In what ways does differentiated instruction influence the academic progress of students of a specific gender in geometry at the senior secondary school level?

Research Hypotheses

Derived from the research questions, the following null hypothesis has been formulated and will be tested at a 5% level of significance:

Ho1: There is no significant difference between the performances of students taught geometry using differentiated instructional techniques and those taught with the lecture method.

Ho2: There is no significant difference between the mean scores of male and female students in geometric concepts using differentiated instructional techniques.

l impacting conceptual understanding and overall academic achievement (Dempsey & Kuhn, 2011). And, finally, technology can be used to increase teacher understanding of student learning outcomes, so the teacher can better differentiate his or her instruction to meet unique individual learning needs (Smith & Throne, 2007). The next section examines the approach to and importance of differentiated instruction in the classroom.

METHODOLOGY

Research Design

Quasi-Experimental Design was used for this study. This design allows for comparing the student's learning outcomes those who receive technology-based differentiated instruction lecture with those who receive lectures using traditional method, without random assignment of variable. Also an ideal experiment, participants are randomly assigned to either the treatment or control group, or the intervention being studied. However, in certain situations, such as educational settings where it may not be possible to randomly assign students to groups due to practical or ethical reasons, quasi-experimental designs offer an alternative approach.

The primary objective of the study is to compare the outcomes of students who receive technology-based differentiated instruction lectures with those who receive traditional lectures.

Technology-Based Differentiated Instruction, this refers to an instructional approach that utilizes technology to tailor teaching methods and materials to meet the individual needs and learning styles of students. It often involves the use of computers, tablets, educational software, multimedia resources, or online platforms to deliver personalized instruction.

Traditional Method. This represents the conventional approach to teaching, which typically involves lectures, textbooks, written assignments, and other traditional classroom activities. It serves as the control group against which the effects of the technology-based differentiated instruction are compared.

a quasi-experimental design was chosen for the study to investigate the impact of technology-based differentiated instruction on student outcomes compared to traditional teaching methods, despite not being able to randomly assign students to groups. This design allows researchers to make meaningful

comparisons between the two instructional approaches while acknowledging the limitations inherent in the absence of randomization.

Population

The population for this study comprises all the Ten (10) public science secondary schools under the supervision of the ministry of science and technology Sokoto state. The schools are Nagarta college, Governments Technical college farfaru, Governments Technical college Runjin Sambo, Amadu Bello Academy, Governments Technical college Binji, Governments Girls college Sokoto, Governments Technical College Bafarawa, Governments Girls College Tambuwal,

Sample

The representative sample of the study were SS2 students selected through purposive sampling from two secondary schools in Sokoto Metropolis, namely Nagarta college Sokoto and Governments Girls college Sokoto, two classes were conveniently selected in each school. To Ensure inclusion criteria the two school was choosing because they are well equipped with modern technological gadget such as computers, projectors and internet facilities and based on the presence of mild learning disabilities in mathematics that are found in the two schools.

The two purposely sample schools comprises students who will receive lectures using traditional teaching methods and those who will receive lectures using traditional teaching method Similar the first group which also the experimental group include students from SS2A from Nagarta college Sokoto and the control group

are the students from SS2B also from Nagarta college Sokoto. Also in Governments Girls college Sokoto students from SS2B Recieve the treatments while the students from SS2A will serve as the control group the researcher used one classrooms where traditional methods -are being used.

Data Collection Instruments

The researcher first administered a Pre-test and Post-test Assessments Develop standardized tests to measure students' mathematics proficiency before and after the intervention.

The researchers also used develop an observation checklist to assess classroom instruction quality and implementation fidelity also the researcher administered surveys to gathered data on students' perceptions of the effectiveness of the instructional methods used.

Data Collection Procedure; The researcher administered the pre-test to both the experimental and control groups to establish baseline performance, he then Implemented technology-based differentiated instruction on the experimental group while the control group receives traditional instruction.

At the end of the quasi experiments the researcher Administered the post-test to both groups after the intervention period to measure changes in mathematics proficiency.

The researcher also ensured timely Observation of the classroom instruction in both groups to assess the quality and fidelity of implementation then the researcher administer surveys to students to gather their feedback on the effectiveness of the instructional methods used.

Data Analysis; Quantitative Analysis: The researcher Uses SPSS to analyse the data to compare pre-test and post-test scores between the experimental and control groups while Descriptive Statistics was used to Calculate means, standard deviations, and percentages to summarize survey responses and observational data. Correlation Analysis was used to explore relationships between variables such as students' perceptions of instruction effectiveness and their academic performance.

RESULT AND DISCUSSION;

Research Question one: *To what extent does differentiated instruction impact students' academic achievement in geometry at the senior secondary school level?*

To answer the research question paired t-test comparing the mean of experimental and that of control group for both pretest and posttest score in geometry has been done as shown in the table below:

Table I: impact of differentiated instruction on students' academic achievement in geometry at the senior secondary school level

Item		Mean	N	Std. Deviation	Std. Error Mean
Pre-test	Experimental Group	1.50	208	.501	.035
	Control group	1.61	208	.490	.034
Post-Test	Experimental Group	1.50	208	.501	.035
	Control group	3.63	208	.848	.059

From the above table the mean score of the experimental group is 1.5 and that of control group is 1.61 with standard deviation of 0.501 and 0.490 respectively on pretest. While on posttest the mean score of the ocontrol group is 1.5 and that experimental group is 3.613 with standard deviation of 0.501 and 0.848 respectively. This shows that there is no effect in using traditional method in teaching geometry in both pretest and posttest while in experimental group it significantly shows the mean in the posttest id greater than that of pretest 1.61 hence the effect of using technology based differentiated instruction in teaching geometry. Therefor Assessment shows the impact of differentiated instruction on students' academic achievement in geometry at the senior secondary school level.

Hypothesis one **Ho1:** There is no significant difference between the performances of students taught geometry using differentiated instructional techniques and those taught with the lecture method.

To test the above hypothesis the paired t-test was ran comparing the mean of the pretest and posttest of control group (traditional method of teaching geometry) and that of experimental group (technology based differentiate instruction) as shown in the table below

Table 2 illustrates a lack of noteworthy distinction between the academic achievements of students instructed in geometry through differentiated instructional techniques versus those taught via the lecture method.

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
									Sig. (2-tailed)
					Lower	Upper			
Pre-Test Result	Control Group Post test	-.106	.821	.057	-.218	.007	-1.857	207	.065
Post test	Experimental Group - Post Test	-2.125	1.135	.079	-2.280	-1.970	-26.998	207	.000

The pre-test results reveal a marginal discrepancy in means between the control and experimental groups, 1with values of -0.106 and -2.125 respectively. Notably, the post-test data indicates a significant divergence, with a mean difference of 2.280 on a 5-point scale, underscored by a t-test value of -26.98, well below the 0.5 significance level. Consequently, we reject the null hypothesis, affirming a substantial variance in performance between the two instructional methods. Students subjected to differentiated instructional techniques exhibit notably superior outcomes compared to their lecture-taught counterparts.

Research Question Two explores the impact of differentiated instruction on the academic advancement of students of a specific gender in senior secondary school geometry. Conducting paired t-tests comparing the mean scores of male and female students for both pretest and posttest geometry assessments offers insights.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pre-Test	Control Group Result	1.46	208	.500	.035
	Experimental Group Scores	1.61	208	.490	.034
Post-Test	Control Group Scores	1.46	208	.500	.035
	Experimental Group scores	3.63	208	.848	.059

In the pretest phase, both control and experimental groups display comparable mean scores, with male students averaging 1.46 and female students 1.61, indicating no discernible effect from traditional instructional methods on gender-specific academic performance. Standard deviations for both groups remain consistent, with male students at 0.500 and female students at 0.490.However, post-intervention, a notable disparity emerges. While the control group's mean scores remain unchanged at 1.46, the experimental group's male and female students demonstrate a significant increase, with a mean score of 3.63. This divergence suggests a considerable impact from technology-based differentiated instruction on gender-specific academic progress in geometry.

Thus, the findings underscore the efficacy of differentiated instruction in enhancing the academic achievement of students, particularly in the context of gender-specific educational outcomes in senior secondary school geometry.

Research Hypothesis Two; **:** There is no significant difference between the mean scores of male and female students in geometric concepts using differentiated instructional techniques.

To test the above hypothesis the paired t-test was ran comparing the mean of the pretest and posttest of Gender group (traditional method of teaching geometry) and that of experimental group (technology based differentiate instruction(PPT) as shown in the table below

Paired Samples Test

		Paired Differences					t	df	**Sig. (2-tailed)**
Items		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Gender of Respondents Pre Test Results	-.144	.754	.052	-.247	-.041	-2.759	207	.006
Pair 2	Gender of Respondents - Post Test Results	-2.163	.923	.064	-2.290	-2.037	-33.796	207	.000

The results from testing hypothesis one indicate a notable difference in learning achievements, favoring the group instructed in Mathematics concepts using PowerPoint presentations. This outcome resonates

with the conclusions drawn by Gier and Kreiner (2009), who observed increased retention among students in a psychology class when utilizing PowerPoint. Additionally, it aligns with the findings of Nouri and Shahid (2005), who reported enhanced understandability of presented materials in an Accounting Principles II class employing PowerPoint. However, this study's results diverge from those of Savoy et al. (2009), Apperson et al. (2006), Bartsch and Cobern (2003), Beets and Lobingier (2001), Susskind (2005), and Szabo and Hastings (2000), who found no discernible beneficial effects of PowerPoint on students' academic achievement.

Regarding hypothesis two, the research findings indicate that there is no gender-based difference in the achievement of male and female students when taught isometric and orthographic projection concepts using Interactive Whiteboards (IWBs). This conclusion aligns with the outcomes of previous studies such as Ogunkola and Bilesanmi-Awoderu (2000), who explored teaching methods in Biology and found no gender-specific effects on students' achievement. Similarly, it corroborates the findings of Gambari (2010), Oludipe (2012), and Yusuf and Afolabi (2010), which revealed that gender did not significantly impact students' performance in physics, biology, and basic science, respectively

CONCLUSION

The study discerned a necessity for a departure from conventional talk-and-chalk pedagogical approaches towards adopting PowerPoint presentations (PPT) owing to its perceived advantages for both educators and learners. Results indicated that students exposed to PPT-based instruction exhibited superior academic performance compared to those instructed via traditional chalkboard methods. The integration of innovative technology, particularly through PPT, emerged as a promising solution. Notably, PPT was identified as an effective instructional tool in Mathematics education, catering to the learning needs of students across various proficiency levels, namely high, medium, and low achievers. Furthermore, the utilization of PPT was found to promote inclusivity by accommodating diverse gender groups within the learning environment.

RECOMMENDATIONS

In the contemporary era marked by technological advancements, Nigerian educational institutions and instructors are urged to lead the charge in integrating various Information and Communication Technology (ICT) tools to enhance teaching and learning outcomes. Consequently, it is suggested that the adoption of Interactive Whiteboards (IWB), specifically employing tools like PowerPoint (PPT), should be actively promoted across Nigerian schools, particularly for instructing courses with a technological or practical orientation.

To facilitate this transition, concerted efforts are needed from governmental bodies and other stakeholders in the education sector. This entails providing schools with adequate infrastructure to support the implementation of IWB (PPT) systems and ensuring educators receive comprehensive training on utilizing these tools effectively within the classroom setting. By embracing these measures, Nigerian schools can cultivate an environment conducive to leveraging modern technology for optimized educational delivery and attainment.

1. It is advisable to promote the utilization of Interactive Whiteboards (IWB) coupled with PowerPoint presentations for teaching basic technology at the junior secondary school level. This approach can enhance engagement and comprehension among students, fostering a dynamic learning environment conducive to grasping fundamental technological concepts effectively.
2. Given the study's revelation that low and medium achievers experienced notable improvements in performance when exposed to PowerPoint presentations, there is a compelling argument for equipping Nigerian public schools with essential ICT infrastructure. By providing necessary facilities and resources, particularly those conducive to leveraging the potential of PowerPoint presentations, schools can facilitate enhanced learning outcomes across student cohorts, thereby contributing to overall academic advancement

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