

Effect of Microsoft Power Point Instructional Strategy on ... Kankia, A. D. & Sabo, A. (2026)

Effect of Microsoft PowerPoint Instructional Strategy on Performance in Mensuration Concept among Senior Secondary School Mathematics Students in Katsina State, Nigeria

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Abstract

This study examined the effect of Microsoft PowerPoint instructional strategy on students' performance in Mensuration among Senior Secondary School students in Katsina State, Nigeria. A 3×2 factorial quasi-experimental pretest–posttest non-randomized control group design was adopted. A total of 180 students were selected using a multistage sampling technique and assigned to three instructional groups: Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology. Data were collected using a Mensuration Performance Test (MPT), which was validated by experts in Mathematics Education and Measurement and Evaluation. The instrument yielded a reliability coefficient of 0.81. Descriptive statistics (mean and standard deviation) and Analysis of Covariance (ANCOVA) were used for data analysis at the 0.05 level of significance using the Statistical Package for the Social Sciences (SPSS). The results revealed that students taught using Interactive PowerPoint recorded the highest performance scores, followed by those taught using Linear PowerPoint, while students taught using Non-Digital Technology recorded the lowest performance scores. ANCOVA showed a significant effect of instructional treatment on students' performance in Mensuration, $F(2, 173) = 5.018, p = .008$, partial $\eta^2 = .055$. Gender also had a significant effect on students' performance, $F(1, 173) = 10.029, p = .002$, partial $\eta^2 = .055$. Furthermore, a significant interaction effect was found between instructional treatment and gender, $F(2, 173) = 6.743, p = .002$, partial $\eta^2 = .072$. Post hoc analysis revealed a significant difference between the Interactive PowerPoint and Linear PowerPoint groups, while no significant differences were found between the Interactive PowerPoint and Non-Digital Technology groups or between the Linear PowerPoint and Non-Digital Technology groups. The study concluded that instructional treatment significantly influenced students' performance in Mensuration and that the effectiveness of the instructional strategies varied according to students' gender. The study recommended the adoption of Interactive PowerPoint in the teaching of Mensuration and the provision of adequate technological resources and teacher training to support its implementation.

Keyword: Mensuration, Interactive PowerPoint, Linear PowerPoint, Non-Digital Technology, Performance.

Introduction

Mathematics is a compulsory subject in the Nigerian senior secondary school curriculum and serves as a foundation for scientific, technological, and economic development. Success in Mathematics is essential for students' progression to higher education and for national development goals. However, persistent poor performance and declining interest in Mathematics have continued to pose serious challenges in Nigerian secondary schools, particularly in concept-laden topics such as Mensuration (WAEC, 2023; Yusuf & Afolayan, 2024). Mensuration involves the understanding and application of formulas related to lengths, areas, volumes, and surface areas of geometric figures. The abstract nature of these concepts, coupled with students' weak spatial visualization skills, has contributed to widespread learning difficulties and low achievement in the topic (Abdulrahman & Sadiq, 2023). Recent examination reports have consistently identified Mensuration as one of the Mathematics topics where students perform poorly at the senior secondary school level (WAEC, 2024). In many Nigerian classrooms, including those in Katsina State, the teaching of Mathematics is still largely dominated by non-interactive instructional approaches, such as teacher-centered lectures, chalk-and-talk methods, and linear Microsoft PowerPoint presentations. These approaches emphasize passive content delivery, with limited student engagement, minimal classroom interaction, and little opportunity for learners to explore concepts actively (Bello, Danjuma, & Musa, 2023). Although non-interactive methods allow teachers to cover syllabus content efficiently, they may not adequately stimulate students' interest or promote deep understanding of mathematical concepts. Students' interest plays a critical role in determining their academic performance in Mathematics. Interest influences students' attention, motivation, and persistence in learning challenging concepts. Recent studies have shown that when instructional methods fail to engage learners actively, students are more likely to develop negative attitudes toward Mathematics, resulting in

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reduced interest and poor academic performance (Okeke & Nwoye, 2024; Salami & Ahmed, 2023). This effect is more pronounced in topics such as Mensuration, which require visualization, practical examples, and continuous learner involvement. Empirical studies conducted between 2023 and 2025 indicate that interactive and learner-centered instructional strategies, including the use of Microsoft PowerPoint with interactive features, significantly improve students' interest and achievement in Mathematics when compared to conventional, non-interactive methods (Ogunleye & Babatunde, 2024; Mohammed, Lawal, & Garba, 2025). These findings suggest that reliance on non-interactive instruction may contribute to students' poor interest and low performance. However, most of these studies focus on general Mathematics performance or other topics such as Algebra and Geometry, with limited emphasis on Mensuration. This study is anchored on Cognitive Learning Theory and Constructivist Learning Theory. Cognitive Learning Theory posits that learning is most effective when students actively process information, make connections, and engage with content meaningfully (Piaget, 1972; Bruner, 1966). Microsoft PowerPoint, particularly interactive presentations, provides opportunities for learners to visualize concepts, receive immediate feedback, and integrate knowledge, thereby enhancing cognitive processing. Constructivist Learning Theory emphasizes that learners construct knowledge through active participation, exploration, and interaction with learning materials (Vygotsky, 1978; Fosnot, 2013). Interactive PowerPoint aligns with this perspective by allowing students to engage with animations, problem-solving activities, and visual demonstrations, which promote deeper understanding and retention of Mensuration concepts. Furthermore, there is a noticeable scarcity of empirical research specifically examining the effect of Microsoft PowerPoint-based instruction on students' interest and performance in Mensuration at the senior secondary school level in Katsina State. Given the continued use of traditional teaching methods in the state's public secondary schools, it is necessary to investigate how interactive and non-interactive Microsoft PowerPoint instruction influences students' learning outcomes in Mensuration. Therefore, this study seeks to examine the effect of Microsoft PowerPoint on students' performance in Mensuration among senior secondary school students in Katsina State. The findings are expected to provide empirical evidence that will guide Mathematics teachers, curriculum planners, and educational policymakers in improving instructional practices and enhancing students' learning experiences in Mathematics.

Statement of the Research Problem

Mathematics remains a core subject in Nigerian senior secondary schools, yet students continue to show low interest and poor performance, particularly in Mensuration, a topic requiring strong visualization and application skills (WAEC, 2023; Abdulrahman & Sadiq, 2023). In Katsina State, teaching is largely dominated by non-interactive methods, such as teacher-centered lectures and linear PowerPoint presentations, which limit student engagement and active learning (Bello, Danjuma, & Musa, 2023; Salami & Ahmed, 2023). Studies indicate that passive instructional approaches reduce motivation and hinder understanding, while interactive methods improve both interest and performance (Ogunleye & Babatunde, 2024; Mohammed, Lawal, & Garba, 2025). Despite this, there is limited research on how non-interactive instruction specifically affects students' interest and performance in Mensuration in Katsina State. This gap raises concerns about the continued reliance on passive teaching approaches and their potential contribution to students' learning difficulties. Hence, this study seeks to investigate the effect of Microsoft PowerPoint instructional strategies Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology on students' performance in Mensuration among senior secondary school students in Katsina State.

Objectives of the study

The objectives of this study were to:

1. Determine the effect of Microsoft PowerPoint instructional strategies (Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology) on students' performance in Mensuration.
2. Examine the effect of gender on students' performance in Mensuration.
3. Determine the interaction effect of instructional treatment and gender on students' performance in Mensuration.

Research Questions

The study answered the following questions:

1. What is the effect of Microsoft PowerPoint instructional strategies (Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology) on students' performance in Mensuration?
2. What is the effect of gender on students' performance in Mensuration?
3. What is the interaction effect of instructional treatment and gender on students' performance in Mensuration?

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Hypotheses

The following hypotheses were formulated and tested at a 0.05 significance level:

1. There is no significant effect of Microsoft PowerPoint instructional strategies (Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology) on students' performance in Mensuration.
2. There is no significant effect of gender on students' performance in Mensuration.
3. There is no significant interaction effect of instructional treatment and gender on students' performance in Mensuration.

Methodology

This study employed a 3×2 factorial quasi-experimental pretest–posttest non-randomized control group design to investigate the effects of instructional treatment and gender on students' performance in Mensuration. The population consisted of all Senior Secondary School II (SSII) students offering Mathematics in public schools in Katsina State. A sample of 180 students was drawn using a multistage sampling technique, which involved random selection of educational zones followed by purposive selection of co-educational schools. The participants were assigned to three instructional groups: Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology. Data was collected using the Mensuration Performance Test (MPT) which was validated by experts in Mathematics Education and Measurement and Evaluation. The reliability coefficient of the test was found to be $r = 0.81$. The instructional intervention lasted three months, after which post-tests were administered to assess students' performance. Descriptive statistics were used to answer the research questions, while ANCOVA was conducted to test the hypotheses at the 0.05 level of significance using SPSS application.

Presentation of Results

The results were presented in the tables as follows:

Research Question 1: What is the effect of Microsoft PowerPoint instructional strategies (Interactive PowerPoint, Linear PowerPoint, and Non-Digital Technology) on students' performance in Mensuration?

Table 1:

Mean and Standard Deviation of Students' Performance in Mensuration by Instructional Treatment

Group	N	Mean	SD
Interactive PowerPoint	60	56.20	6.7
Linear PowerPoint	60	45.47	5.85
Non-Digital Technology	60	39.93	3.8

Table 1 shows that students taught using Interactive PowerPoint obtained the highest mean performance score ($M = 56.20$, $SD = 6.77$), followed by those taught using Linear PowerPoint ($M = 45.47$, $SD = 5.85$). Students taught using Non-Digital Technology recorded the lowest mean performance score ($M = 39.93$, $SD = 3.28$).

Research Question 2: What is the effect of gender on students' performance in Mensuration?

Table 2:

Descriptive Statistics of Gender on students' performance in Mensuration.

Gender	N	Mean	SD
Male	90	48.4333	8.23537
Female	90	33.0889	23.53035

Table 2 shows that male students recorded higher performance in Mensuration, with a mean score of 48.43 ($SD = 8.24$), compared to female students who had a lower mean score of 33.09 ($SD = 23.53$). This indicates that male students performed better than their female counterparts in Mensuration. The relatively higher standard deviation among female students suggests greater variability in their performance, while the lower standard deviation among male students indicates more consistency in their scores.

Research Question 3: What is the interaction effect of instructional treatment and gender on students' performance in Mensuration?

Table 3:

Descriptive Statistics of Students' Interaction effect of the treatment and gender on students' performance in mensuration

Group	Gender	N	Mean	SD
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Interactive	Male	30	58.4333	1.0400
	Female	30	53.9667	9.04961
Linear	Male	30	47.6333	1.09807
	Female	30	43.3000	7.66159
Non-Digital	Male	30	39.2333	3.76631
	Female	30	40.6333	2.59287

Table 3 shows the interaction effect of instructional group and gender on students' performance in Mensuration. In the Interactive PowerPoint group, male students recorded a slightly higher mean score of 58.43 (SD = 1.04) compared to female students who had a mean score of 53.97 (SD = 9.05). This indicates that while both male and female students benefited from the interactive method, male students performed slightly better, and female scores were more varied. In the Linear PowerPoint group, male students also outperformed female students, with a mean score of 47.63 (SD = 1.10) compared to 43.30 (SD = 7.66) for females. This suggests a similar pattern as observed in the Interactive group, though overall performance was lower. However, in the Non-Digital Technology group, female students recorded a slightly higher mean score of 40.63 (SD = 2.59) than male students, who had a mean score of 39.23 (SD = 3.77). This indicates that in the traditional teaching method, female students performed marginally better than male students. Overall, the results suggest that the Interactive PowerPoint method was the most effective for both genders, with male students generally outperforming females in the technology-based groups, while females showed a slight advantage in the Non-Digital group.

Hypotheses

Table 4: ANCOVA Summary Table for Students' performance in Mensuration

Tests of Between-Subjects Effects							
Dependent Variable: Posttest							
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	9031.554 ^a	6	1505.259	57.394	.000	.666	
Intercept	171.561	1	171.561	6.541	.011	.036	
Pretest	212.688	1	212.688	8.110	.005	.045	
Treatment	263.215	2	131.608	5.018	.008	.055	
Gender	263.019	1	263.019	10.029	.002	.055	
Treatment * gender	353.679	2	176.840	6.743	.002	.072	
Error	4537.246	173	26.227				
Total	414580.000	180					
Corrected Total	13568.800	179					

a. R Squared = .666 (Adjusted R Squared = .654)

Table 4 results reveals that an analysis of covariance (ANCOVA) was conducted to examine the effects of treatment and gender on students' performance in Mensuration while controlling for pretest scores. The covariate (pretest scores) had a significant effect on posttest performance, $F(1, 173) = 8.11, p = .005$, partial $\eta^2 = .045$, indicating that students' initial performance contributed to their posttest scores. There was a significant main effect of treatment on students' performance, $F(2, 173) = 5.02, p = .008$, partial $\eta^2 = .055$, suggesting that students exposed to different Microsoft PowerPoint instructional methods performed differently. Similarly, gender had a significant effect on posttest performance, $F(1, 173) = 10.03, p = .002$, partial $\eta^2 = .055$, indicating that male and female students differed in their performance. Importantly, the interaction between treatment and gender was also significant, $F(2, 173) = 6.74, p = .002$, partial $\eta^2 = .072$. This suggests that the effectiveness of the instructional treatment depended on students' gender; in other words, certain teaching methods may have been more effective for one gender than the other. The overall model was statistically significant and explained a substantial proportion of the variance in students' performance, $R^2 = .666$, adjusted $R^2 = .654$. Hence, there is need to consider pairwise comparison test to determine the specific groups where the differences exist.

Table 5:

Pairwise Comparisons of Instructional Treatment on Students' Performance

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Dependent Variable: Posttest						
(I) Treatment	(J) Treatment	Mean Difference (I- J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Interactive	Linear	4.919*	2.246	.030	.487	9.351
	Non-Digital	4.965	4.077	.225	-3.082	13.013
Linear	Interactive	-4.919*	2.246	.030	-9.351	-.487
	Non-Digital	.046	2.142	.983	-4.181	4.273
Non-Digital	Interactive	-4.965	4.077	.225	-13.013	3.082
	Linear	-.046	2.142	.983	-4.273	4.181

Post hoc comparisons using the Least Significant Difference (LSD) test indicated that students in the Interactive PowerPoint group performed significantly better than those in the Linear PowerPoint group (M difference = 4.92, $p = .03$). However, there was no significant difference between the Interactive and Non-Digital groups (M difference = 4.97, $p = .23$), nor between the Linear and Non-Digital groups (M difference = 0.05, $p = .98$). These results suggest that the Interactive instructional method was more effective than the Linear method, while performance in the Non-Digital group was not significantly different from either of the other groups.

Discussion of Findings

The findings of this study revealed that instructional treatment had a significant effect on students' performance in Mensuration. Specifically, students taught using Interactive PowerPoint recorded the highest mean performance scores, followed by those taught with Linear PowerPoint, while students exposed to Non-Digital Technology recorded the lowest performance scores. This indicates that instructional strategies that actively engage students through visual presentations, animations, and interactive learning experiences can enhance students' understanding and achievement in Mensuration. The finding supports previous studies that emphasized the effectiveness of interactive teaching tools in improving students' academic performance in Mathematics (Okeke & Chukwu, 2022; Musa & Bello, 2023). The post hoc analyses further revealed that students taught using Interactive PowerPoint performed significantly better than those taught using Linear PowerPoint. However, no significant differences were observed between the Interactive PowerPoint and Non-Digital Technology groups or between the Linear PowerPoint and Non-Digital Technology groups. Although Interactive PowerPoint produced the highest performance scores, its significant advantage was established only over Linear PowerPoint. These findings suggest that the incorporation of interactive elements into instructional delivery can improve students' engagement and conceptual understanding of Mensuration concepts, supporting earlier findings on the effectiveness of multimedia-based instructional approaches in Mathematics education (Adebayo & Oladipo, 2021; Fatima & Hassan, 2022). The study also revealed a significant effect of gender on students' performance in Mensuration. The results showed that male and female students differed significantly in their performance scores, with male students recording higher mean scores than their female counterparts. This finding suggests that gender may influence students' achievement in Mensuration and supports studies that reported significant gender differences in Mathematics performance among secondary school students (Abubakar, 2023). Furthermore, the findings revealed a significant interaction effect between instructional treatment and gender on students' performance in Mensuration. This implies that the effectiveness of the instructional strategies varied according to students' gender. While Interactive PowerPoint produced the highest performance scores for both male and female students, the magnitude of its effect differed across gender groups. This finding suggests that learner characteristics such as gender may interact with instructional approaches to influence academic achievement, thereby highlighting the need for instructional strategies that accommodate diverse learner needs (Salisu & Ibrahim, 2022).

Conclusion

The study concluded that instructional treatment significantly influenced students' performance in Mensuration among Senior Secondary School students in Katsina State. Students taught using Interactive PowerPoint recorded the highest performance scores, followed by those taught using Linear PowerPoint, while students taught using Non-Digital Technology recorded the lowest performance scores. The study further concluded that gender had a significant effect on students' performance in Mensuration, indicating that male and female students differed significantly in their achievement. In addition, a significant interaction effect was found between instructional treatment and gender, suggesting that the effectiveness of the instructional strategies varied according to students' gender. The findings therefore underscore the



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importance of adopting interactive instructional approaches, particularly Interactive PowerPoint, to enhance students' learning outcomes in Mensuration while taking into consideration gender-related differences in instructional effectiveness.

Recommendations

1. Mathematics teachers should adopt Interactive PowerPoint as an instructional strategy for teaching Mensuration, since students exposed to this approach recorded the highest performance scores and performed significantly better than those taught using Linear PowerPoint.
2. School administrators and educational authorities should provide adequate technological facilities, such as computers, multimedia projectors, and reliable power supply, to facilitate the effective use of Interactive PowerPoint in Mathematics classrooms.
3. Educational stakeholders should organize regular training, workshops, and professional development programmes to equip Mathematics teachers with the skills required to design and effectively implement Interactive PowerPoint presentations in classroom instruction.
4. Mathematics teachers should consider gender differences when implementing instructional strategies, since the study found that the effectiveness of instructional treatment varied according to students' gender.
5. Further studies should investigate the effects of Interactive PowerPoint on students' performance in other Mathematics concepts and at different educational levels to determine the generalizability of the findings.

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