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INTERACTION EFFECT OF GENDER ON STUDENTS' INTEREST AND ACHIEVEMENT IN GEOMETRY TAUGHT VIA ZOOM AND GOOGLE CLASSROOM IN AMAC, ABUJA, NIGERIA

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Abstract

This study examined the interaction effect of gender on students' interest and achievement in geometry taught via Zoom and Google Classroom within Abuja Municipal Area Council (AMAC), Nigeria. Using a quasi-experimental design, the research addressed two core research questions and associated null hypotheses. The population consisted of all SS2 students in AMAC for the 2023/2024 academic session, with a randomly selected sample of 172 students. Data collection involved the Geometry Interest Scale (GIS) and Geometry Achievement Test (GAT) with a reliability index of 0.80. Descriptive statistics, mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at a 0.05 significance level. Findings revealed that students taught using Zoom and Google Classroom showed significantly greater interest than those taught by conventional methods, though no notable interaction effect between gender and instructional method on achievement was found. Gender differences were significant in interest but not in achievement outcomes. The study recommends integrating Zoom and Google Classroom into curricula to enhance student engagement and professional training programs for teachers on technology integration into education. Adopting a blended teaching approach is also advised to further foster student interest and achievement in geometry.

Keywords: Zoom, Google Classroom, Students' Interest, Retention, Geometry, AMAC.

Introduction

Mathematics, universally acknowledged as the foundational language governing the world, has a profound impact across various disciplines, particularly in science, technology, and societal advancement. Smith and Johnson (2023) emphasize its critical role as a universal medium for conveying complex concepts, facilitating effective communication in scientific research and promoting global collaborations. Brown et al. (2021) highlight mathematics' versatility in modeling dynamic systems, which allows for the exploration of real-world phenomena through numbers, structures, and patterns. Key branches such as algebra, calculus, and statistics illustrate mathematics' central importance in advancing knowledge. Algebra provides the framework for solving complex equations, essential in modern technology and scientific research, while calculus plays a crucial role in fields like physics and engineering, enabling the analysis of rates of change and optimization. Statistics, as Brown and Davis (2020) suggest, is vital for data science and

decision-making. Additionally, geometry's practical applications span from computer graphics to architectural design, as explored by Patel and Lee (2021). Despite its undeniable significance, mathematics is often perceived as difficult, which hinders educational progress and societal development.

Table 1. West African Senior Secondary Certificate Examination Result in Mathematics in the Federal Capital Territory, Abuja from the year 2018 to 2023

Year	No. of Reg. Candidates	No. that Sat for the Exam	Total Credits (A1-C6)	% Pass	Total Failure (D7-F9)	% Failure
2018	13031	13022	7016	53.88	6006	46.12
2019	13036	13036	8084	62	4952	38
2020	15062	14570	5545	36.8	9517	63.2
2021	13896	13843	10878	78.3	3018	21.7
2022	16078	15935	11021	69.2	4914	29.8
2023	17895	16754	13062	77.9	3692	22.1

Source: Education Resource Center, FCT, Abuja

Analysis of the West African Senior School Certificate Examination (WASSCE) mathematics results in the Federal Capital Territory (FCT), Abuja, between 2018 and 2023 shows a fluctuation in student achievement. During this period, the number of registered candidates rose from 13,031 in 2018 to 17,895 in 2023, with attendance rates closely matching registration figures, reflecting high levels of participation. However, the percentage of students securing passing grades (A1-C6) varied each year. The highest achievement was recorded in 2021, with 78.3% of students passing, while the lowest was in 2020, when only 36.8% achieved passing grades. Similarly, the failure rate (D7-F9) followed this pattern: the lowest failure rate of 21.7% was seen in 2021, while the highest, at 63.2%, occurred in 2020. Over the six-year period, an average of 63.01% of students passed, while 36.82% failed.

In 2022, the Chief Examiner of the West African Examination Council (WAEC) highlighted students' persistent difficulties in trigonometry, geometry, and bearings, with a particular emphasis on struggles in geometry. Egwu et al. (2018) also noted that geometry is widely perceived as one of the most challenging areas of mathematics due to its complex rules and formulas, which require both memorization and deep understanding. The transition from two-dimensional (2D) to three-dimensional (3D) shapes poses additional challenges, demanding spatial reasoning, deductive proofs, and real-world applications.

In response to these challenges, technology-based platforms like Zoom and Google Classroom are being adopted as learning platforms. Zoom enables real-time interaction with features such as polls and breakout rooms, promoting engagement. Similarly, Google Classroom offers integrated tools for managing course materials and interactive communication. This study investigated the effectiveness of Zoom and Google Classroom in improving students' interest and achievement in geometry, emphasizing their role in fostering engagement and academic success.

Additionally, by assessing whether male and female students respond differently to these digital platforms in terms of engagement and achievement, the study it seeks to uncover any significant patterns resulting from the interaction between gender and teaching method. These insights are essential for developing more customized and effective educational strategies that address both instructional techniques and gender dynamics.

Statement of Problems

Technological platforms like Zoom and Google Classroom have gained prominence in

educational settings, yet educators remain uncertain about their relative effectiveness in enhancing student interest and retention of concepts. Persistent low achievement in geometry, as noted by the National Mathematical Center and WAEC, has been partly attributed to the inefficacy of conventional teaching methods. Furthermore, a notable gap exists in the research investigating the influence of gender on geometry education, underscoring the need for further investigation in this area.

Objectives of the Study

The main objective of this research was to investigate the influence of gender on students' interest and achievement in geometry taught via zoom and google classroom. Specifically, the study aimed to:

1. investigate the interaction effect of methods and gender as measured by geometry interest scale.
2. investigate the interaction effect of methods and gender as measured by geometry Achievement Test.

Research Questions

The following questions were raised to guide the study:

1. What is the interaction effect of teaching strategies and gender as measured by Geometry Interest Scale?
2. What is the interaction effect of teaching strategies and gender as measured by Geometry Achievement Test?

Research Hypotheses

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

H_{01}: There is no significant interaction effect of methods and gender as measured by the Geometry Interest scale

H_{02}: There is no significant interaction effect of method and gender as measured by the geometry achievement Test.

Literature Review

Enoch (2024) examined gender differences in geometry performance among final-year students. The study sampled 360 students, with 52% male and 48% female, using a stratified random sampling technique to select 186 students from four classrooms. Data were collected through a questionnaire and a Geometry Achievement Test (GAT) administered as pretest and posttest measures. The questionnaire, built using a 4-point Likert scale, and the GAT, comprising 25 multiple-choice questions from WASSCE past exams, provided the data for analysis. Paired samples t-tests revealed a significant gender gap in pretest scores ($t = 15.302$, $p < 0.001$), with males outperforming females. Posttest scores also indicated a marginal difference ($t = 2.000$, $p = 0.047$). Limitations included an unspecified selection process, lack of questionnaire validation, and limited generalizability due to the study's quasi-experimental design and focus on a single school.

Abidin, Mathrani, and Hunter's (2021) study, "Gender-related Differences in the Use of Technology in Mathematics Classrooms," examined student participation, learning strategies, and attitudes in technology-driven math classes. Conducted with 137 junior high school students (70 boys, 67 girls) from five schools in Semarang, Indonesia, the study explored innovative teaching practices using Google Classroom and Zoom. Students were divided into two groups based on their learning strategies: Group I employed shared devices in small groups, while Group II used individual devices. Data were collected through a survey titled "Attitude Toward Technology and Mathematics" (ATM), which measured technological and mathematical confidence, attitudes toward technology, and motivational mindset. Results indicated that Group II students exhibited higher technological confidence and more positive attitudes, with boys showing stronger positive attitudes. Despite notable findings, limitations included unclear sampling

and potential bias from self-reported data, warranting further research to understand gender differences in tech-based mathematic education.

Efa and Frimpong (2023) investigated gender's influence on performance and perception of core mathematics among senior high school students in Cape Coast, Ghana. The study involved 393 students, sampled from 23,209 across 10 schools (boys', girls', and co-educational). Using a mixed-methods approach, data were collected via questionnaires, mathematics tests, and interviews. The questionnaire assessed socio-demographics and perceptions of mathematics, while the test was based on the Ghana Education Service syllabus. Statistical analysis revealed no significant gender impact on performance or perception. Strengths of the study include its mixed-methods design, valid instruments, and robust sample size. However, limitations included reliance on self-reported data, lack of longitudinal insights, and limited generalizability beyond Cape Coast, highlighting areas for future research.

Methodology

This study employed a quasi-experimental design comprising three groups: one control group and two experimental groups, all of which participated in pretest and posttest assessments focused on geometry. The population for the research was 833 senior secondary school II students within the Abuja Municipal Area Council (AMAC). From this population, a sample of 172 students was randomly selected across three schools, with 43, 67, and 62 students in each respective school. Data were collected using the Geometry Interest Scale (GIS), which exhibited a reliability index of 0.80, and the Geometry Achievement Test (GAT), with a reliability index of 0.76. The GAT comprised 30 multiple-choice questions designed to evaluate students' geometry proficiency, while the GIS included 20 opinion-based items on a 4-point Likert scale to assess students' interest in geometry. One experimental group received instruction through Zoom, another through Google Classroom, while the control group was taught using conventional methods. Pretests were administered before the intervention, with posttests following immediately afterward. Data analysis was conducted using mean, standard deviation, and Analysis of Covariance (ANCOVA) at a significance level of 0.05 to address the research questions and test the study's hypotheses.

Results

Research question One:

What is the interaction effect of teaching strategies and gender as measured by Geometry Interest Scale?

The information used to answer this research question is displayed in Table 2

Table 2: Mean and Standard Deviation of the Interaction Effect of Methods and Gender on Students' Interest in Geometry

Methods	Gender		Pre-intervention Interest	Post-intervention Interest
Zoom	Male	Mean	45.54	54.5
		N	24	24
		Std. Deviation	7.401	6.84
	Female	Mean	49.11	63.79
		N	19	19
		Std. Deviation	5.763	3.521
Google Classroom	Male	Mean	50.14	64.28
		N	36	36
		Std. Deviation	6.128	3.94
	Female	Mean	48.9	57.97
		N	31	31
		Std. Deviation	5.822	4.736

Table 2 details the interaction effect of instructional methods (Zoom and Google Classroom) and gender on students' interest in geometry, showing variations in mean interest ratings and standard deviations pre- and post-intervention. Male students taught via Zoom had a pre-intervention mean interest rating of 45.54 (SD = 7.401), which increased to 54.50 (SD = 6.840) post-intervention. Female Zoom students' mean rating rose from 49.11 (SD = 5.763) to 63.79 (SD = 3.521). Male students using Google Classroom improved from 50.14 (SD = 6.128) to 64.28 (SD = 3.940), while females' mean interest increased from 48.90 (SD = 5.822) to 57.97 (SD = 4.736).

Hypothesis One:

There is no significant interaction effect of methods and gender as measured by the Geometry Interest scale

The result of the test of this hypothesis is on Table 3

Table 3: Analysis of Covariance (ANCOVA) on Interaction Effect of Methods and Gender on Students' Interest in Geometry

Source	Tupe III Sum of Square	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1988.057a	4	497.014	22.648	0.000	0.463
Intercept	4261.913	1	4261.913	194.21	0.000	0.649
PreInterest	211.141	1	211.141	9.621	0.002	0.084
Methods	55.469	1	55.469	2.528	0.115	0.024
Gender	38.783	1	38.783	1.767	0.187	0.017
Methods * Gender	1319.433	1	1319.433	60.125	0.000	0.364
Error	2304.207	105	21.945			
Total	404021	110				
Corrected Total	4292.264	109				

a. R Squared = 0.463 (Adjusted R Squared = 0.443)

Table 3 displays the outcomes of the ANCOVA procedure investigating the interaction effect of instructional methods and gender on students' interest in geometry. The results reveal a statistically significant interaction effect, with $F_{(1,105)} = 60.125$ and $p = 0.000$, which falls below the predetermined significance level of 0.05. This indicates that the interaction effect between instructional methods and gender on students' interest in geometry is statistically significant. This necessitates the rejection of the null hypothesis.

Profile Plots

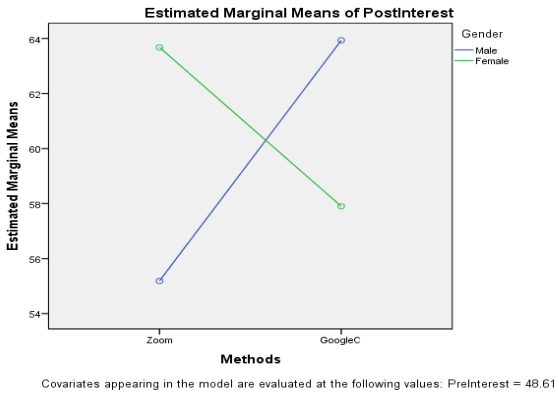

Fig 1: Graph of Interaction Effect of Methods and Gender on Students' Interest in Geometry.

Figure 1 illustrates the interaction effect of teaching methods and gender on students' interest in geometry. The graph displays two intersecting lines, with the blue line representing male students and the green line representing female students, across two instructional groups: Zoom and Google Classroom. The intersection of the lines indicates a significant interaction effect between teaching methods and gender, suggesting that gender plays a moderating role in the relationship between instructional methods and students' interest in geometry. The results imply that gender significantly influences the way students' interest in geometry is affected by different teaching methods.

Research question Two

What is the interaction effect of teaching strategies and gender as measured by Geometry Achievement Test?

The information used to answer this research question is displayed in Table 4.

Table 4: Mean and Standard Deviation of the Interaction Effect of Methods and Gender on Students' Achievement in Geometry

Method	Gender		Pre-intervention Achievement Test Score	Post-intervention Achievement Test Score
Zoom	Male	Mean	11.67	72.33
		N	24	24
		Std. Dev.	4.565	21.733
	Female	Mean	13	71.05
		N	19	19
		Std. Dev.	5.66	26.693
G. Classroom	Male	Mean	12.53	82.56
		N	36	36
		Std. Dev.	6.872	9.53
	Female	Mean	12.74	84.1
		N	31	31
		Std. Dev.	5.507	17.48

Table 4 presents the mean and standard deviation of the interaction effect of instructional methods (Zoom and Google Classroom) and gender on students' geometry achievement. The results indicate that, Male students taught with Zoom had pre-intervention mean scores of 11.67 with standard deviation of 4.565 and post-intervention mean scores of 72.33 with standard deviation of 21.733. Female students taught with Zoom had pre-intervention mean scores of 13.42 with standard deviation of 5.660 and post-intervention mean scores of 71.05 with standard deviation of 26.693. Conversely, Male students taught with Google Classroom had pre-intervention mean scores of 12.53 with standard deviation of 6.872 and post-intervention mean scores of 82.56 with standard deviation of 9.530, while Female students taught with Google Classroom had pre-intervention mean scores of 12.74 with standard deviation of 5.507 and post-intervention mean scores of 84.10 with standard deviation of 17.480, respectively.

Hypothesis Two

There is no significant interaction effect of method and gender as measured by the geometry achievement Test.

The result of the test of this hypothesis is on Table 5.

Table 5: Analysis of Covariance (ANCOVA) on Interaction Effect of Methods and Gender on Students' Achievement in Geometry

Source	Type III Sum of squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3521.442[a]	4	880.361	2.565	0.042	0.089
Intercept	112381.382	1	112381.4	327.47	0.000	0.757
Pretest	0.003	1	0.003	0.000	0.998	0.000
Method	3507.22	1	3507.22	10.22	0.002	0.089
Gender	0.43	1	0.43	0.001	0.972	0.000
Method * Gender	51.433	1	51.433	0.15	0.699	0.001
Error	36033.876	105	343.18			
Total	722121	110				
Corrected Total	39555.318	109				

a. R Squared = .089 (Adjusted R Squared = .054)

Table 5 presents the results of the Analysis of Covariance (ANCOVA) examining the interaction effect of instructional methods (Zoom and Google Classroom) and gender on students' geometry achievement. The analysis reveals a non-significant interaction effect, with $F_{(1,105)} = 0.150$ and $p = 0.699$, ($p = 0.699 > \alpha = 0.05$) which exceeds the predetermined significance level of $\alpha = 0.05$. Since the p-value is greater than the significance threshold, there is no statistically significant interaction effect between methods and gender on students' geometry achievement. The null hypothesis is therefore not rejected.

Profile Plots

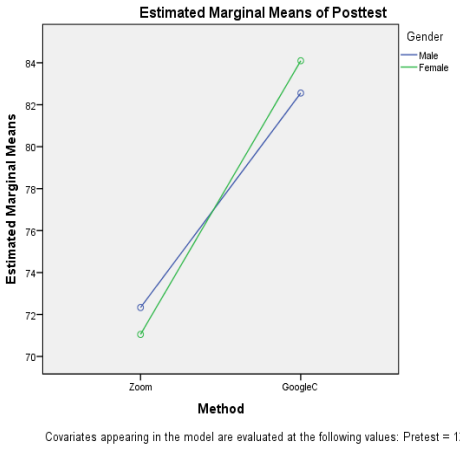

Fig 2: Graph of Interaction Effect of Methods and Gender on Students' Achievement in Geometry.

The graph illustrates the relationship between teaching methods (Zoom and Google Classroom) and gender on students' geometry achievement. The plot displays two lines: blue representing male students and green representing female students. The lack of a pronounced intersection between the lines suggests a non-significant interaction effect between methods and gender. This indicates that gender does not have a substantial impact on the interaction between teaching methods and students' geometry achievement, implying that the effect of teaching methods on achievement is consistent across both genders.

Discussion of Results

The findings of this study on hypothesis four indicate a significant interaction effect between teaching methods and gender on students' interest. Understanding this interaction effect enables educators to create personalized learning experiences that take into account both the teaching method and the gender of the student, thereby enhancing educational outcomes.

The findings of this study on hypothesis eight indicate that there is no significant interaction effect between teaching methods and gender on students' achievement in geometry. This suggests that both male and female students respond similarly to the applied teaching methods and gender does not significantly influence the effectiveness of these methods on academic achievement. This aligns with Udu and Nmadu's, (2022) publication in the Journal of Social Sciences and Humanities that there is no interaction effect of method and gender on the students' retention of knowledge in science. It is possible that individual differences among students, such as learning styles, interests and prior knowledge, have a greater impact on academic achievement than gender. Thus, the effectiveness of teaching methods is more likely to be influenced by these personal factors rather than by gender differences.

Conclusion

The study reveals a significant interaction effect between teaching methods and gender on students' interest in geometry, highlighting the importance of considering both factors for personalized learning. However, no significant interaction was found between teaching methods and gender on students' achievement, suggesting that male and female students respond similarly to these methods. Overall, factors like learning style and prior knowledge may have a greater impact on academic achievement than gender, suggesting that tailored teaching methods should prioritize individual learning needs.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Schools should incorporate digital platforms such as Zoom and Google Classroom into their curriculum to foster enhanced student engagement and interest in subjects like geometry.

2. Professional development initiatives should be implemented to equip educators with the requisite skills and knowledge to effectively leverage digital teaching tools. This will enable teachers to optimize the educational potential of platforms like Zoom and Google Classroom.

References

Abidin, Z., Mathrani, A., & Hunter, R. (2018). Gender-related differences in the use of technology in mathematics classrooms: Student participation, learning strategies, and attitudes. *International Journal of Information and Learning Technology, 35*(2). https://doi.org/10.1108/IJILT-11-2017-0109

Andortan, J. A., Aneshie-Otakpa, V. O., & Ubebe, S. A. (2022). Effect of activity-based learning on junior secondary school students' interest and achievement in geometrical contents of mathematics. *African Journal of Science Technology and Mathematics Education, 8*(3), 232-238.

Bender, W. N. (2017). 20 strategies for increasing student engagement. *Learning Sciences International*.

Chapagai, P. P., Zangmo, D., & Zangmo, T. (2022). Comparative Study between Zoom and Google Meet for 21st Century Education in Royal Thimphu College.

Steinmayr, R., Meibner, A., Weidinger, A. F., & Wirthwein, L. (2015). Academic achievement. Retrieved from http://www.oxfordbibliographies.com/view/document/obox-9780199756810-0108

Suglo, Enoch Kabinaa. (2024, March). Exploring gender disparity in geometry learning using van Hiele's model: A Quasi-experimental study of final year male and female students' performance. *Research Article*]. Retrieved from https://doi.org/10.21203/rs.3.rs-4014502/v1

Wiseman, P. J., Kennedy, G. E., & Lodge, J. M. (2016). Models for understanding student engagement in digital learning environments. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning. Proceedings ASCILITE 2016* (pp. 666-671). Adelaide.

Wu, H. K., & Huang, Y. M. (2007). Trends of e-learning research from 2000 to 2008: Use of text-mining and bibliometric analysis. *British Journal of Educational Technology, 41*(1), 8-E10.