



EFFECT OF DIGITAL CLASSROOM ANXIETY ON MATHEMATICS PERFORMANCE AMONG SECONDARY SCHOOL STUDENTS IN OHAFIA EDUCATION ZONE OF ABIA STATE, NIGERIA

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Abstract

This study examined digital classroom anxiety on mathematics performance among secondary school students in Ohafia Education Zone of Abia. The increasing integration of digital tools in classroom instruction has transformed teaching and learning processes; however, it has also introduced psychological challenges such as anxiety, which may negatively influence students' academic outcomes, particularly in mathematics. The study was guided by three research questions and three hypotheses. A descriptive survey research design was adopted, with a population of 6,853 Senior Secondary School Two (SS2) students, from which a sample of 234 students was selected using a multistage sampling technique. Data were collected using the Digital Classroom Anxiety Scale (DCAS) and a Mathematics Achievement Test (MAT). The instruments were validated by experts and yielded a reliability coefficient of 0.83 using Cronbach Alpha and Kuder-Richardson 20. Data were analyzed using mean, standard deviation, Pearson Product Moment Correlation, independent samples t-test, and regression analysis at 0.05 level of significance. Findings revealed that students experienced a moderate to high level of digital classroom anxiety. The study also showed a significant negative relationship between digital classroom anxiety and mathematics performance. Students with low digital classroom anxiety performed significantly better than those with high anxiety, and digital classroom anxiety significantly predicted students' mathematics performance. The study concluded that digital classroom anxiety adversely affects students' mathematics achievement. It was recommended that teachers adopt supportive digital instructional strategies, while schools provide adequate ICT training and counselling support to reduce anxiety and improve mathematics performance among students.

Keywords: Digital classroom anxiety; Mathematics performance; Secondary school students; Academic achievement; Digital learning environment

Introduction

Digital learning has become an important feature of modern education, with secondary schools increasingly adopting computers, online platforms, and smart devices to enhance teaching and learning, particularly in mathematics. While these digital tools are intended to improve instructional delivery and student engagement, they may also introduce psychological challenges that affect learning outcomes. One emerging issue is digital classroom anxiety, which refers to the feelings of fear, tension, or discomfort experienced by students when using digital learning tools or participating in technology-based instruction. In mathematics classrooms, such anxiety can reduce students' concentration, confidence, and willingness to participate in problem-solving activities, thereby affecting their academic performance. In Ohafia Education Zone, where digital instructional methods are gradually being integrated into secondary school mathematics teaching, concerns have been raised that students' performance has not improved as expected despite technological exposure. This situation suggests that emotional responses to digital learning environments may play a significant role in determining students' achievement in mathematics, making it necessary to investigate the effect of digital classroom anxiety on their performance.

Mathematics is a core subject in secondary education because it develops logical reasoning, critical thinking, and problem-solving skills that are essential for scientific, technological, and economic development (Hattie, 2023). It also provides learners with the ability to make informed decisions and apply quantitative reasoning in everyday life situations (OECD, 2024). Despite its importance, students' academic performance in mathematics has remained persistently low in many educational systems, including Nigeria, largely due to both cognitive and psychological barriers that interfere with effective learning (Aremu & Sokan, 2023). Academic performance in mathematics refers to the level of achievement attained by students in mathematics tests or examinations, usually measured through scores that reflect their understanding of mathematical concepts and problem-solving abilities (UNESCO, 2024). Poor performance in mathematics has been linked to anxiety, lack of motivation, and ineffective learning environments, which reduce students' ability to engage meaningfully with mathematical tasks (Darling-Hammond et al., 2023).

Despite the growing importance of mathematics in secondary education, students' achievement in the subject has remained persistently low across many educational contexts. Mathematics is widely recognized as a discipline that develops logical reasoning, analytical thinking, and problem-solving skills essential for national development and technological advancement (Zawacki-Richter et al., 2019; Darling-Hammond et al., 2023; Hattie, 2023; National Council of Teachers of Mathematics, 2023). However, despite its relevance, students continue to record poor performance, particularly in abstract areas of mathematics, due to persistent instructional and learner-related challenges (Aremu & Sokan, 2023; Okeke & Nwosu, 2024; Eze & Okafor, 2024; World Bank, 2024). A major gap identified in literature is that while many studies have focused on instructional strategies and curriculum

content, less attention has been given to psychological and technology-related factors that may influence students' engagement and performance in mathematics, especially in digital learning environments.

Academic performance in mathematics refers to the level of achievement demonstrated by students in assessments, examinations, and tasks that measure their understanding and application of mathematical concepts (Zawacki-Richter et al., 2019; National Council of Teachers of Mathematics, 2023; Hattie, 2023; Klapper et al., 2024). Research has consistently shown that performance is shaped by cognitive ability, instructional methods, learning environment, and learner motivation (Aremu&Sokan, 2023; Darling-Hammond et al., 2023; Okigbo & Osuafor, 2024; World Bank, 2024). However, a key gap in literature is that most studies treat academic performance broadly without isolating how it is affected within digital classroom contexts. There is limited empirical evidence explaining how students' psychological responses to technology-based instruction influence their mathematics achievement, particularly in localized settings such as Ohafia Education Zone in Abia state.

Digital classroom anxiety has emerged as a significant psychological factor affecting students in modern learning environments. It is described as the feeling of fear, tension, or discomfort experienced by learners when interacting with digital tools during instruction (Zawacki-Richter et al., 2019; UNDP, 2023; Darling-Hammond et al., 2023; World Bank, 2024). Studies have shown that anxiety can negatively affect attention, working memory, and problem-solving abilities, especially in cognitively demanding subjects such as mathematics (Aremu & Sokan, 2023; Hattie, 2023; Okigbo & Osuafor, 2024; Klapper et al., 2024). Despite these findings, there is still a noticeable gap in literature regarding the specific effect of digital classroom anxiety on mathematics performance, as most existing studies focus on general academic anxiety or traditional classroom settings rather than technology-based learning environments.

Furthermore, although digital learning technologies have been widely introduced to improve teaching and learning processes, empirical evidence on their psychological impact remains limited. Some studies report that digital tools enhance interactivity, engagement, and conceptual understanding in mathematics (Darling-Hammond et al., 2023; Hattie, 2023; National Council of Teachers of Mathematics, 2023; World Bank, 2024), while others indicate that lack of digital competence and fear of technology may lead to anxiety and reduced participation among learners (UNDP, 2023; Aremu & Sokan, 2023; Okeke & Nwosu, 2024; Eze & Okafor, 2024). However, a clear contextual gap still exists, as few studies have specifically examined how digital classroom anxiety influences mathematics performance among secondary school students in Ohafia Education Zone. This lack of localized empirical evidence justifies the need for the present study.

Purpose of the Study

The main purpose of this study is to examine the effect of digital classroom anxiety on mathematics performance of secondary school students in Ohafia Education Zone.

Specifically, the study seeks to:

1. determine the level of digital classroom anxiety among secondary school students in mathematics;
2. assess the effect of digital classroom anxiety on students' mathematics performance;
3. compare the mathematics performance of students with high and low digital classroom anxiety.

Research Questions

The following research questions guided the study:

1. What is the level of digital classroom anxiety among secondary school students in mathematics?
2. What is the effect of digital classroom anxiety on students' mathematics performance?
3. What is the difference in mathematics performance between students with high and low digital classroom anxiety?

Hypotheses

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

- HO₁: There is no significant relationship between digital classroom anxiety and students' mathematics performance.
- HO₂: There is no significant difference in the mathematics performance of students with high and low digital classroom anxiety.
- HO₃: There is no significant effect of digital classroom anxiety on students' mathematics performance in secondary schools in Etinan Education Zone.

Methodology

Design

This study adopted a descriptive survey research design. This design is considered appropriate because it enables the researcher to obtain data from respondents without manipulating any variable, thereby allowing for the examination of the effect of digital classroom anxiety on mathematics performance among secondary school students in their natural school environment.

Population

The population of the study consisted of 6,853 Senior Secondary School Two (SS2) students in public secondary schools in Ohafia Education Zone of Abia State. SS2 students were chosen because they have sufficient exposure to mathematics instruction and digital learning experiences, making them suitable for providing reliable information on digital classroom anxiety and mathematics performance.

Sample and Sampling Technique

A sample size of 234 SS2 students was drawn from the population. The sample was selected using a multistage sampling technique. The schools used for the study are; Igbere secondary school, Igbere, Enuda High School, Abiriba, and Ovim High School. First, the schools were selected through simple random sampling. Secondly, intact SS2 classes were used to avoid disrupting normal classroom structure. Finally, proportional sampling was applied to ensure fair representation of students across selected schools.

Instruments for Data Collection

The instrument for data collection was a structured questionnaire titled Digital Classroom Anxiety Scale (DCAS) and a Mathematics Achievement Test (MAT). The DCAS was used to measure students' level of anxiety during digital classroom instruction, while the MAT was used to assess students' academic performance in mathematics.

Validity

The instruments were validated by experts in Mathematics Education, Educational Psychology and Measurement and Evaluation to ensure clarity, relevance, and adequacy of content coverage.

Reliability

The reliability of the instruments was established using Cronbach Alpha for the questionnaire and Kuder-Richardson 20 (KR-20) for the achievement test. A reliability coefficient of 0.83 was obtained, indicating that the instruments were reliable and suitable for the study.

Method of Data Analysis

Data collected were analyzed using mean and standard deviation to answer the research questions. The hypotheses were tested using Pearson Product Moment Correlation (PPMC) and independent samples t-test at 0.05 level of significance. Mean was used to determine the level of anxiety and performance, while inferential statistics were used to determine the relationship and differences between variables.

Result

The results of the study are presented according to the research questions and hypotheses that guided the study. The analysis was based on data collected from a sample of 234 secondary school students in Ohafia Education Zone of Abia State.

Research Question 1: What is the level of digital classroom anxiety among secondary school students in mathematics?

Table 1: Mean score analysis of students' digital classroom anxiety (N = 234)

Anxiety Level	N	Mean	SD
High Anxiety Group	118	3.42	0.76
Low Anxiety Group	116	2.11	0.69

The result shows that students recorded a moderate to high level of digital classroom anxiety, with a higher mean score observed in the high anxiety group ($M = 3.42$) compared to the low anxiety group ($M = 2.11$). This indicates that many students experience discomfort when engaging in digital mathematics learning activities.

HO₁: There is no significant relationship between digital classroom anxiety and students' mathematics performance.

Table 4: Pearson correlation analysis

Variables	N	r-value	Sig. (p)
Anxiety vs Performance	234	-0.62	0.000

The result shows a **significant negative relationship** ($r = -0.62$, $p < 0.05$) between digital classroom anxiety and mathematics performance. The null hypothesis was rejected.

Research Question 2: What is the effect of digital classroom anxiety on students' mathematics performance?

Table 2: Mean mathematics performance based on anxiety level

Anxiety Level	N	Mean Score	SD
High Anxiety	118	41.35	9.21
Low Anxiety	116	58.74	8.56

The result shows that students with low digital classroom anxiety performed better in mathematics ($M = 58.74$) than those with high anxiety ($M = 41.35$). This indicates a clear negative effect of digital classroom anxiety on students' mathematics performance. **HO₂:** **There is no significant difference in the mathematics performance of students with high and low digital classroom anxiety.**

Table 5: Independent t-test analysis

Group	N	Mean	SD	t-cal	p-value
High Anxiety	118	41.35	9.21	10.84	0.000
Low Anxiety	116	58.74	8.56		

The result shows a significant difference ($t = 10.84$, $p < 0.05$) in mathematics performance between the two groups. The null hypothesis was rejected.

Research Question 3: What is the difference in mathematics performance between students with high and low digital classroom anxiety?

The analysis of data on mathematics performance based on levels of digital classroom anxiety is presented below.

Table 3: Mean and Standard Deviation of Mathematics Performance by Anxiety Level (N = 234)

Anxiety Level	N	Mean Score	SD	Mean Difference
High Digital Classroom Anxiety	118	41.35	9.21	17.39
Low Digital Classroom Anxiety	116	58.74	8.56	

The result in Table 3 shows that students with low digital classroom anxiety recorded a higher mean mathematics performance score ($M = 58.74$, $SD = 8.56$) compared to students with high digital classroom anxiety ($M = 41.35$, $SD = 9.21$). The mean difference of 17.39 indicates a substantial gap in performance between the two groups.

H₀₃: There is no significant effect of digital classroom anxiety on students' mathematics performance.

Table 6: Regression analysis

Source	Beta	R ²	F	Sig.
Anxiety → Performance	-0.62	0.38	142.56	0.000

The regression result shows that digital classroom anxiety explains 38% of the variance in students' mathematics performance ($R^2 = 0.38$). The result is significant ($F = 142.56$, $p < 0.05$). The null hypothesis was rejected.

Discussion

The findings of this study revealed that digital classroom anxiety has a significant effect on students' mathematics performance in secondary schools in Ohafia Education Zone of Abia state.. Specifically, students with low digital classroom anxiety demonstrated higher achievement in mathematics compared to those with high anxiety levels. This suggests that emotional and psychological responses to digital learning environments play a crucial role in determining how well students perform in mathematics. The result aligns with the view that anxiety interferes with cognitive processes such as attention, working memory, and problem-solving, which are essential for success in mathematics learning (Hattie, 2023; Darling-Hammond et al., 2023; Aremu & Soka, 2023; Okigbo & Osuafor, 2024).

The finding that students with low digital classroom anxiety performed significantly better than those with high anxiety is consistent with previous research which established that anxiety negatively affects academic achievement in technology-based learning environments. For instance, Zawacki-Richter et al. (2019), UNDP (2023), World Bank (2024), and Klapper et al. (2024) reported that learners who experience discomfort or fear when interacting with digital tools tend to withdraw from active participation, leading to reduced academic performance. Similarly, Darling-Hammond et al. (2023), Hattie (2023), National Council of Teachers of Mathematics (2023), and Eze & Okafor (2024) emphasized that learner engagement is significantly reduced when students lack confidence in using instructional technologies, which negatively affects mathematics achievement.

The significant relationship found between digital classroom anxiety and mathematics performance also agrees with earlier studies that identified psychological barriers as strong predictors of academic success in mathematics. Aremu & Soka (2023), Okeke & Nwosu (2024), Okigbo & Osuafor (2024), and World Bank (2024) reported that students who experience anxiety during learning situations often show poor concentration and reduced problem-solving ability, especially in abstract subjects such as mathematics. This finding reinforces the argument that academic performance is not determined solely by instructional methods but also by emotional readiness and psychological comfort in the learning environment.

Furthermore, the study revealed that digital classroom anxiety significantly predicts students' performance in mathematics, explaining a considerable proportion of the variance in achievement scores. This supports the position of Hattie (2023), National Council of Teachers of Mathematics (2023), Darling-Hammond et al. (2023), and Klapper et al. (2024) that learner-related psychological factors can strongly influence academic outcomes. It also highlights the growing concern that while digital learning environments are designed to improve instruction, they may inadvertently create anxiety among students who are not fully comfortable with technology.

However, the findings of this study specifically contribute to existing literature by providing contextual evidence from Ohafia Education Zone, an area where limited empirical studies have been conducted on digital classroom anxiety and mathematics performance. While previous studies have largely focused on general academic anxiety or broad digital learning benefits, this study establishes a clear link between digital classroom anxiety and mathematics achievement at the secondary school level. This fills an important gap by showing that psychological factors associated with digital learning environments are critical determinants of students' success in mathematics.

Conclusion

Based on the findings of this study, it is concluded that digital classroom anxiety has a significant influence on secondary school students' mathematics performance in Ohafia Education Zone. The study established that students who experience low levels of anxiety in digital learning environments perform better in mathematics compared to those with high levels of anxiety, indicating that emotional comfort plays an important role in academic success.

It was also concluded that digital classroom anxiety is a strong predictor of students' performance in mathematics, as it negatively affects their concentration, confidence, and ability to engage effectively with learning tasks. This implies that even with the use of modern digital instructional tools, students' academic achievement may still be hindered if anxiety-related challenges are not properly addressed. Furthermore, the study concludes that psychological readiness is as important as instructional delivery in determining students' success in mathematics. Therefore, reducing digital classroom anxiety through supportive teaching strategies and improved digital literacy can enhance students' performance and overall learning experience in mathematics.

Recommendations

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

1. Teachers of Mathematics should adopt learner-friendly digital instructional strategies and provide gradual exposure to digital tools to reduce students' anxiety and build confidence in using technology during mathematics lessons.
2. School administrators and policymakers should ensure adequate provision of functional digital learning resources and stable technological infrastructure in secondary schools to create a supportive and stress-free learning environment.
3. Teachers should incorporate digital literacy training and orientation into classroom practice so that students become familiar with digital tools before engaging in complex mathematical tasks, thereby reducing fear and uncertainty associated with digital learning environments.
4. Guidance counsellors in schools should organize regular counselling sessions aimed at helping students manage anxiety related to digital classroom experiences, especially in mathematics.
5. Curriculum planners and education stakeholders should integrate structured digital learning support systems into the mathematics curriculum to ensure that technology use in classrooms is accompanied by proper student support mechanisms that enhance learning and reduce anxiety.

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