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Examination Anxiety of Male and Female Mathematics Education Students during Paper-Based and Computer-Based Testing at Joseph Sarwuan Tarka University, Makurdi

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Abstract

This study compared the level of examination anxiety experienced by male and female Mathematics Education students during Paper-Based Testing (PBT) and Computer-Based Testing (CBT) at Joseph Sarwuan Tarka University, Makurdi. Two objectives, two research questions and two null hypotheses guided the study. The ex post facto (causal-comparative) design was adopted. The analytic sample comprised 132 final-year Mathematics Education students of the 2025/2026 academic session (107 males and 25 females) who completed both testing sessions in MTE 401: Advanced Studies in Mathematics Education, out of a population of 214. Examination anxiety was measured with the Questionnaire on Mode of Examination (PBT vs CBT) and Students' Test Anxiety (QMEPCSTA), a 20-item, 4-point scale with 10 items for each mode, administered immediately after each examination. The instrument was validated by experts and yielded a Cronbach's alpha of 0.74. Mean and standard deviation were used to answer the research questions, while the paired samples t-test was used to test the hypotheses at the 0.05 level of significance. Male students reported significantly higher anxiety during PBT (M = 2.52, SD = 0.57) than during CBT (M = 2.37, SD = 0.45), t(106) = 2.07, p = .041, d = 0.20. Female students also reported higher anxiety during PBT (M = 2.51, SD = 0.59) than during CBT (M = 2.26, SD = 0.47), but the difference was not statistically significant, t(24) = 1.70, p = .102, d = 0.34. The study concluded that PBT was associated with higher anxiety for both genders and that the non-significant female result reflects the small female group rather than an absence of effect. It recommended anxiety management programmes that address the pressures of both examination modes.

Keywords: *Examination anxiety, test anxiety, gender, paper-based testing, computer-based testing, Mathematics Education*

1.0 Introduction

Examination anxiety is a recognised barrier to fair assessment in Mathematics Education. Test anxiety, a profile of worry, negative affect and physiological arousal before or during examinations, interferes with working memory and has been shown to reduce performance on mathematical tasks, particularly those that require complex reasoning under time constraints (Owens et al., 2014; Ashcraft & Krause, 2007). As universities increasingly adopt Computer-Based Testing (CBT) alongside or in place of Paper-Based Testing (PBT), an important question is whether the mode of examination itself changes the anxiety that students experience. For some learners, an unfamiliar digital interface, fear of technical failure and a visible countdown timer raise anxiety in CBT, while others report that CBT reduces anxiety by providing clear formatting and automatic submission, a comfort that often depends on prior experience with the platform (Khoshsima et al., 2019).

Gender is frequently discussed as a moderator of examination anxiety. Several studies have reported higher situational test anxiety and lower computer self-efficacy among female students, which may interact with timing and interface demands during CBT (Campos & Scherer, 2024). When female students anticipate negative stereotypes about their performance in Mathematics, worry may consume working memory resources needed for reasoning, an effect that may be magnified when a testing mode adds unfamiliar technical demands (Arias et al., 2023). Where female students have had less hands-on computing practice, CBT may pose an additional source of anxiety (Galasso & Profeta, 2024). Nigerian studies have similarly reported higher anxiety among female students in some contexts, although such differences appear to diminish with deliberate exposure and practice (Adeyemi, 2018).

In Nigerian universities, infrastructural problems such as device failure, slow networks and irregular electricity can generate anxiety during CBT even among competent students (Abdulkareem & Lennon, 2023; Adamu, 2024). At Joseph Sarwuan Tarka University, Makurdi, both CBT and PBT are used for large courses such as MTE 401: Advanced Studies in Mathematics Education. However, there is no institutional evidence on whether male and female Mathematics Education students experience different levels of anxiety in the two modes. Because anxiety can distort the measurement of what future Mathematics teachers know, such evidence is needed to guide gender-sensitive student support. The present study therefore compared the examination anxiety of male and female Mathematics Education students during PBT and CBT.

1.1 Objectives of the Study

The main objective of the study was to compare the examination anxiety of male and female Mathematics Education students during Paper-Based Testing and Computer-Based Testing. Specifically, the study sought to:

1. compare the level of examination anxiety experienced by male Mathematics Education students during Paper-Based Testing and Computer-Based Testing; and
2. compare the level of examination anxiety experienced by female Mathematics Education students during Paper-Based Testing and Computer-Based Testing.

1.2 Research Questions

i. What is the level of examination anxiety experienced by male Mathematics Education students during Paper-Based Testing and Computer-Based Testing?
ii. What is the level of examination anxiety experienced by female Mathematics Education students during Paper-Based Testing and Computer-Based Testing?

1.3 Hypotheses

The following null hypotheses were tested at the 0.05 level of significance.

i. H01: There is no significant difference in the level of examination anxiety experienced by male Mathematics Education students between Paper-Based Testing and Computer-Based Testing.
ii. H02: There is no significant difference in the level of examination anxiety experienced by female Mathematics Education students between Paper-Based Testing and Computer-Based Testing.

2.0 Literature Review

2.1 Theoretical Framework

The study was anchored on the Attentional Control Theory propounded by Eysenck, Derakshan, Santos and Calvo in 2007. The theory states that anxiety impairs the efficiency of cognitive processing by disrupting the balance between two attentional systems: the goal-directed system, which keeps attention on the task, and the stimulus-driven system, which responds to threats and distractions. When anxiety is high, the stimulus-driven system becomes stronger and the goal-directed system weaker, so attention is drawn towards worry and away from problem solving. The theory further holds that performance declines under anxiety not because of a lack of knowledge but because of poor attentional control, and that tasks demanding speed and accuracy are the most affected.

The theory is relevant to this study because each examination mode presents its own set of potential threats. In CBT, countdown timers, navigation requirements, login procedures and fear of system failure can capture stimulus-driven attention. In PBT, the pressure to write quickly, fear of irreversible mistakes on answer sheets, comparison with peers who appear to be writing faster and the silence of the examination hall may play a similar role. Gender may influence which of these threats is most salient, depending on students' prior exposure to each mode and their confidence in using computers. The theory therefore provides a basis for expecting differences in anxiety between modes and for examining whether those differences vary between male and female students.

2.2 Review of Related Empirical Studies

Studies comparing Computer-Based Testing and Paper-Based Testing have multiplied as institutions adopt digital assessment, and a number of them have examined the emotional side of examinations, particularly anxiety and its relationship with gender. The following empirical studies, arranged by year of publication, provide the background against which the present study was conducted.

Cassady and Gridley (2005) examined the effects of online formative and summative assessment on test anxiety and performance among undergraduates at Ball State University, United States. A quasi-experimental design compared two intact educational psychology classes, one of 84 students who took paper-and-pencil examinations and another of 92 students who took the same examinations online in a proctored computer laboratory. The Cognitive Test Anxiety scale, the Bodily Symptoms subscale of the Reactions to Tests, a perceived test threat measure and a study skills survey were used, and data were analysed using multivariate analysis of variance, analysis of covariance and structural equation modelling. Students who tested online reported significantly lower perceived test threat, while cognitive test anxiety and performance did not differ significantly between the formats. The study suggests that computer-based examinations need not raise anxiety, but it did not analyse anxiety by gender and did not involve Mathematics Education students.

Bennett et al. (2008) undertook the study "Does it matter if I take my Mathematics test on computer? A second empirical study of mode effects in NAEP" in the United States. Eighth-grade students participating in the National Assessment of Educational Progress were randomly assigned to computer and paper versions of a Mathematics test in a parallel-group quasi-experimental design, with 1,072 students taking the computer test and 954 the paper test. NAEP Mathematics items and a computer facility questionnaire were used, and the data were analysed using Item Response Theory and regression. The computer version proved more difficult, and computer familiarity strongly predicted performance. The study did not measure examination anxiety, did not compare male and female students and did not involve Mathematics Education undergraduates.

Putwain (2014) investigated the prevalence of test anxiety and gender differences among higher education students in the United Kingdom. A cross-sectional survey design was used, and several hundred undergraduates from different faculties were drawn through institutional sampling. Data obtained with a standard Test Anxiety Inventory and demographic items were analysed using descriptive statistics, t-tests and chi-square. The study established that test anxiety was prevalent and that female students reported higher levels than males. The study is closely related to the present one in its focus on gender and anxiety among tertiary students, but it did not consider how anxiety varies between CBT and PBT and did not involve Mathematics Education students at Joseph Sarwuan Tarka University, Makurdi.

Owens et al. (2014) investigated when anxiety helps or hinders cognitive test performance and the role of working memory capacity, in a study by researchers at the University of Southampton, United Kingdom. A correlational design was used with 96 adolescents aged 12 to 14 years, who completed a self-report trait anxiety measure, working memory tasks and a demanding cognitive test. Moderated regression analysis showed that working memory capacity moderated the relationship between anxiety and performance: anxiety was associated with poorer performance for students with low capacity and better performance for those with high capacity. The study did not compare anxiety across testing modes or between male and female students, and it involved adolescents rather than Mathematics Education undergraduates.

Hensley et al. (2017) compared upper-elementary pupils' performance on paper-based and computer-based Mathematics curriculum-based measures in the United States. Using a within-subjects repeated-measures design, 197 pupils from intact classes completed identical fact-fluency probes in both modes, and paired t-tests were used to compare their scores. Performance was significantly higher on paper than on computer. The study did not measure anxiety or examine gender, and it involved elementary pupils rather than Mathematics Education undergraduates.

Awofala et al. (2019) studied attitudes toward computers, computer anxiety and gender as determinants of the computer self-efficacy of pre-service Science, Technology and Mathematics teachers at the University of Lagos, Nigeria. A descriptive survey design was adopted, and 2,100 pre-service teachers participated voluntarily. Computer attitude, computer anxiety and computer self-efficacy scales were used, and data were analysed using descriptive statistics, t-tests, correlation and stepwise regression. Computer anxiety and gender significantly predicted computer self-efficacy, and male students showed more computer confidence than females. The study suggests that anxiety associated with computer use may differ between male and female teacher trainees, but it did not measure examination anxiety during actual CBT and PBT sessions.

Smolinsky et al. (2020) compared computer-based and paper-and-pencil tests in a Calculus II course for STEM majors at Louisiana State University, United States. A quasi-experimental design was used involving 324 students in three intact sections tested on paper only, on computer only or in mixed mode. Course examinations and submission logs were analysed using descriptive and inferential comparisons. Scores were largely equivalent across modes, although the paper-only section

performed slightly better. The study did not measure anxiety or gender differences and did not involve Mathematics Education students.

Okolie and Nwafor (2020) investigated the influence of Computer-Based Testing on the learning outcomes of Mathematics Education students in two Colleges of Education in Anambra and Imo States, Nigeria. In a quasi-experimental design, 120 second-year students from intact classes were purposively sampled into CBT and PBT groups and assessed with a Mathematics Achievement Test (KR reliability = 0.81). Data were analysed with mean, standard deviation, analysis of covariance and t-test. Students in the CBT group performed better, which the authors attributed partly to reduced examination tension in CBT. Although this points to lower tension in CBT, the study did not measure anxiety directly with a validated instrument and did not examine gender differences.

McClelland and Cuevas (2020) compared Computer-Based Testing and paper-and-pencil testing in Mathematics among 80 sixth-grade students from intact classes in the United States. A quasi-experimental within-subject design was used with unit Mathematics tests in both modes and a computer familiarity survey, and the data were analysed using descriptive statistics and t-tests. Mode effects appeared in some units, and question type and computer familiarity influenced performance. The study did not measure anxiety and involved younger learners rather than Mathematics Education undergraduates.

Fegha and Daomi (2021) examined undergraduate students' attitude towards Mathematics Computer-Based Tests at Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria. A descriptive survey design was used with 200 Mathematics Education students selected by simple random sampling. A validated questionnaire with a reliability of 0.87 was administered, and data were analysed with frequencies, percentages, mean, standard deviation, chi-square and t-test. Students had a positive attitude towards CBT, regarding it as time-saving and fair, although some experienced computer anxiety. The study did not compare anxiety in CBT with anxiety in PBT and did not examine gender differences in anxiety.

Yu et al. (2021) compared the performance and experiences of English-major undergraduates in Paper-Based Testing and Computer-Based Testing at a large university in China. A mixed-methods design was used in which 92 second-year students were randomly assigned to CBT and PBT groups and took the Test for English Majors-Band 4. A computer familiarity questionnaire, an attitude questionnaire and interviews were used, and data were analysed with multivariate analysis of variance, correlation and thematic analysis. Performance did not differ significantly between the modes, but some CBT participants reported feeling nervous and anxious and found other candidates' typing distracting. The study did not measure anxiety with a standardised scale in both modes and did not examine gender differences in anxiety.

Usman and Olaleye (2022) studied the effect of Computer-Based Test examination on the learning outcomes of Colleges of Education students in Nigeria. A quasi-experimental design was used, and 120 NCE students were purposively placed into CBT and PBT groups. Researcher-developed Mathematics tests and a structured questionnaire (Cronbach's alpha = 0.78) were used, and data were analysed using mean, standard deviation and independent t-test. CBT improved knowledge retention, but some students reported technical difficulties, time pressure and higher anxiety during CBT. The study did not use a psychometrically validated anxiety scale for both modes and did not analyse anxiety by gender.

Sheu and Evanero (2022) examined the comparability of Computer-Based and Paper-and-Pencil Tests on students' performance in an Educational Assessment course at the Federal University Gusau, Zamfara State, Nigeria. A comparative quasi-experimental design with repeated measures was used, involving the entire cohort of about 450 undergraduates in the Department of Science and Mathematics Education. The course test in both formats and an ICT competence questionnaire were analysed using descriptive statistics, paired and independent t-tests and regression. Significant differences existed between CBT and PBT scores, and ICT competence strongly predicted CBT performance. The study did not investigate examination anxiety or gender.

Dyrvold and Bergvall (2023) carried out a study of computer-based assessment in Mathematics focusing on digital competence and validity in the Nordic context. Using a mixed conceptual-empirical approach, the researchers observed students during computer-based assessment sessions and conducted interviews, analysing the data qualitatively together with a validity evaluation. Digital competence influenced test validity, and computer-based environments imposed extra cognitive load on students. The study did not measure anxiety quantitatively and did not involve Nigerian Mathematics Education undergraduates.

Franco-Buriticá (2023) investigated gender as a differentiating factor in Mathematics anxiety among pre-service teachers in Colombia. A cross-sectional survey design was used with 235 pre-service teachers selected through convenience sampling. A Mathematics anxiety scale and a demographic questionnaire were used, and data were analysed using descriptive statistics and t-tests. Female pre-service teachers reported higher Mathematics anxiety than males, and anxiety was strongly associated with attitudes towards Mathematics. The study measured general Mathematics anxiety rather than anxiety experienced during a particular examination mode.

Horsfall and Wordu (2023) studied the influence of test anxiety on the academic performance of Mathematics students in public senior secondary schools in Port Harcourt, Rivers State, Nigeria. A descriptive survey design was adopted, and 400 SS2 and SS3 students were selected through stratified random sampling across schools and gender. An adapted Mathematics Test Anxiety Scale and examination scores were analysed using mean, standard deviation, Pearson correlation and multiple regression. High test anxiety lowered performance, and female students reported significantly higher anxiety than males. The study was conducted with secondary school students and did not examine whether anxiety differs between CBT and PBT.

Öz and Özturan (2023) examined whether test administration mode influences the reliability and validity of achievement tests at a Turkish university. In a true experimental design, 97 undergraduates were randomly assigned to CBT and PBT groups and took a standardised multiple-choice achievement test. Data were analysed using classical test theory indices and validity statistics. Achievement did not differ significantly between the groups, and the test functioned similarly in both modes. The study did not measure test anxiety or computer anxiety and was not conducted in Nigeria.

Abanobi et al. (2024) investigated the effects of Computer-Based Test and Paper-and-Pencil Test on the academic achievement and test anxiety of tertiary institution students in educational research in Delta State, Nigeria. A quasi-experimental pretest-posttest non-randomised control group design was adopted with 113 final-year students, 50 in the CBT group and 63 in the paper group, drawn from purposively selected institutions. Achievement was measured with the Educational Research Achievement Test and anxiety with the Test Anxiety Inventory, and data were analysed using mean and analysis of covariance. Students in the paper group reported higher test anxiety than those in the CBT group, although the difference was not significant, and the interaction between gender and test mode on anxiety was also not significant. The study used separate groups for the two modes and did not involve Mathematics Education students at Joseph Sarwuan Tarka University, Makurdi.

Galasso and Profeta (2024) examined gender differences in Mathematics tests and the role of time pressure at Bocconi University, Milan, Italy. In a laboratory experiment, 776 undergraduates took a 20-item Mathematics test under one of three randomly assigned time conditions ranging from 45 seconds per question to no time limit. Female students answered about two fewer items correctly than males under very tight time limits, and the gap narrowed by up to 40 percent when more time was given. The authors attributed the gap mainly to time-induced anxiety, noting that female students' working memory performance declined after they were told time was limited while male students' did not. The study links gender, anxiety and testing conditions but did not compare CBT with PBT among Mathematics Education students.

Weirich et al. (2024) compared test-taking effort in paper-based and computer-based tests among 2,676 ninth-grade students in Germany. Using a within-subjects repeated-measures design, students took equivalent tests first on paper and later on computer and rated their effort after each session. Multilevel mixed-effects models showed that effort declined over sessions and was lower in the computer mode. The study examined effort, a motivational variable related to but distinct from anxiety, and did not involve Mathematics Education students or consider gender.

2.3 Summary of Literature Reviewed

The empirical studies reviewed show that test anxiety is common among students and that several studies found higher anxiety among female students (Putwain, 2014; Franco-Buriticá, 2023; Horsfall & Wordu, 2023), and that time pressure can heighten anxiety and widen gender gaps in Mathematics performance (Galasso & Profeta, 2024). Studies that considered assessment mode reported mixed evidence on anxiety, with some indicating higher anxiety during CBT (Usman & Olaleye, 2022) and others pointing to reduced tension in CBT (Abanobi et al., 2024; Cassady & Gridley, 2005; Fegha & Daomi, 2021; Okolie & Nwafor, 2020). However, most studies measured general or Mathematics anxiety rather than anxiety experienced in each examination mode, and none compared the examination anxiety of male and female university Mathematics Education students

in both CBT and PBT. No such study had been conducted at Joseph Sarwuan Tarka University, Makurdi, and this gap informed the present study.

3.0 Methodology

3.1 Research Design

The study adopted the ex post facto research design of the causal-comparative type because assessment mode was an existing condition that the researcher did not manipulate. Each student reported anxiety for both modes, and the data were therefore analysed as paired observations within each gender group.

3.2 Area and Participants of the Study

The study was conducted at Joseph Sarwuan Tarka University, Makurdi, Benue State, Nigeria. The population was 214 final-year (400 level) Mathematics Education students of the 2025/2026 academic session registered for MTE 401, and the entire population was included. Due to absenteeism, only the 132 students who completed both the PBT and the CBT sessions and the corresponding anxiety questionnaires were retained. This analytic sample comprised 107 male and 25 female students.

3.3 Instrument for Data Collection

Examination anxiety was measured with the Questionnaire on Mode of Examination (PBT vs CBT) and Students' Test Anxiety (QMEPCSTA). The instrument had a background section for gender and two anxiety sections of 10 items each, one on anxiety experienced during PBT and the other on anxiety experienced during CBT. The PBT items addressed experiences such as nervousness before starting, fear of forgetting, loss of confidence when others write faster and fear of mistakes on answer sheets. The CBT items addressed experiences such as anxiety on logging in, the effect of the on-screen countdown, fear of the computer shutting down and anxiety caused by the interface and navigation. Items were rated on a 4-point scale of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). Mean scores were interpreted using the decision rule of 1.00 to 1.49 (very low), 1.50 to 2.49 (low), 2.50 to 3.49 (high) and 3.50 to 4.00 (very high).

3.4 Validity and Reliability of the Instrument

The QMEPCSTA was face and content validated by one expert in Test and Measurement, two Mathematics Educators and two experts in Guidance and Counselling at Joseph Sarwuan Tarka University, Makurdi, and inappropriate items were modified. The instrument was trial-tested on 300 level Statistics Education students of the same university, and Cronbach's alpha yielded an internal consistency coefficient of 0.74, which exceeds the commonly accepted threshold of 0.70.

3.5 Procedure for Data Collection

The PBT section of the questionnaire was administered immediately after students completed the paper-based MTE 401 achievement test so that responses reflected anxiety while the experience was still fresh. Four weeks later, the CBT section was administered immediately after students completed the computer-based MTE 401 achievement test. The researcher was assisted by departmental staff and the university's ICT unit, and all questionnaires were retrieved on the spot. The PBT was taken first after four weeks then the CBT was taken.

3.6 Method of Data Analysis

Mean and standard deviation were used to answer the research questions, while the paired samples t-test was used to test the hypotheses at the 0.05 level of significance for male and female students separately. Effect sizes were reported as Cohen's d for paired samples (dz), computed as the mean difference divided by the standard deviation of the differences, and interpreted as small (0.20), medium (0.50) and large (0.80).

4.0 Results

4.1 Research Question One

What is the level of examination anxiety experienced by male Mathematics Education students during Paper-Based Testing and Computer-Based Testing?

4.2 Research Question Two

What is the level of examination anxiety experienced by female Mathematics Education students during Paper-Based Testing and Computer-Based Testing?

Table 1 ***Mean and Standard Deviation of Examination Anxiety of Male and Female Mathematics Education Students during PBT and CBT***

Gender	Testing Mode	N	Mean	SD	SE Mean	Decision
Male	PBT	107	2.52	0.57	0.06	High
Male	CBT	107	2.37	0.45	0.04	Low
Female	PBT	25	2.51	0.59	0.12	High
Female	CBT	25	2.26	0.47	0.09	Low

Note. Decision rule: 1.00 to 1.49 = very low; 1.50 to 2.49 = low; 2.50 to 3.49 = high; 3.50 to 4.00 = very high.

Table 1 shows that male students obtained a mean anxiety score of 2.52 (SD = 0.57) during PBT and 2.37 (SD = 0.45) during CBT, while female students obtained 2.51 (SD = 0.59) during PBT and 2.26 (SD = 0.47) during CBT. Based on the decision rule, both male and female students experienced a high level of anxiety during PBT and a low level during CBT. Because the PBT means lie just above the 2.50 boundary, the anxiety in PBT is better characterised as moderate. The anxiety of male and female students during PBT was almost identical, whereas female students reported somewhat lower anxiety than male students during CBT.

4.3 Hypotheses One and Two

H01: There is no significant difference in the level of examination anxiety experienced by male Mathematics Education students between Paper-Based Testing and Computer-Based Testing.

H02: There is no significant difference in the level of examination anxiety experienced by female Mathematics Education students between Paper-Based Testing and Computer-Based Testing.

Table 2:**Paired Samples t-Test of Examination Anxiety of Male and Female Mathematics Education Students between PBT and CBT**

Group	Mean Diff.	SD	SE	LL	UL	t	df	p	d
Male (PBT minus CBT)	0.15	0.73	0.07	0.01	0.29	2.07	106	.041	0.20
Female (PBT minus CBT)	0.25	0.74	0.15	-0.05	0.56	1.70	24	.102	0.34

Note. LL and UL = lower and upper limits of the 95% confidence interval of the difference; d = Cohen's effect size for paired samples.

Table 2 shows that male students experienced significantly higher anxiety during PBT than during CBT, t(106) = 2.07, p = .041, 95% CI [0.01, 0.29], with a small effect size (d = 0.20). The first null hypothesis was therefore rejected. For female students, the difference was not statistically significant, t(24) = 1.70, p = .102, 95% CI [-0.05, 0.56], and the second null hypothesis was not rejected. However, the mean difference and effect size for female students (0.25; d = 0.34) were larger than those of male students (0.15; d = 0.20).

5.0 Discussion of Findings

The first finding showed that male Mathematics Education students experienced significantly higher examination anxiety during PBT than during CBT. This contrasts with studies that associated CBT with greater anxiety, such as Usman and Olaleye (2022) and Abanobi et al. (2024), who attributed anxiety in CBT to technical difficulties, time pressure and unfamiliar interfaces. It is, however, consistent with Fegha and Daomi (2021), who found positive attitudes towards Mathematics CBT among undergraduates, and with Awofala et al. (2019), whose finding that male pre-service teachers had more computer confidence implies that they would be less threatened by a computer-based examination. Within the framework of Attentional Control Theory, the sources of threat in PBT, including pressure to write quickly, comparison with peers who appear to be

writing faster and fear of irreversible mistakes on answer sheets, may have been more salient for male final-year students than the technological threats of a CBT platform they had used in earlier courses.

The second finding showed that female students also experienced higher anxiety during PBT than during CBT, but the difference was not statistically significant. This finding partly agrees with the general direction of the male result, but it differs from studies which reported that female students experience higher anxiety than males, such as Franco-Buriticá (2023), Horsfall and Wordu (2023) and Adeyemi (2018). In the present study, female students did not report more anxiety than male students in either mode, and their CBT anxiety was in fact the lowest of the four group means. This suggests that the expectation that female students would be particularly anxious in CBT, based on lower computer self-efficacy (Campos & Scherer, 2024), did not hold in this cohort of final-year students.

The pattern of significance must be interpreted with caution. The effect size for female students ($d = 0.34$) was larger than that for male students ($d = 0.20$), so the non-significant female result is better explained by the small female group ($n = 25$), which produced a wide confidence interval, than by the absence of a mode effect. Both genders therefore appear to have experienced somewhat more anxiety in PBT. The variation between these findings and earlier studies may be attributed to differences in participants' educational level, prior exposure to CBT, computer competence and institutional testing environments. As Adeyemi (2018) observed, gender differences in anxiety tend to diminish when students receive deliberate exposure and practice, and final-year students at Joseph Sarwuan Tarka University may have accumulated enough CBT experience for the expected female disadvantage to disappear.

6.0 Conclusion

The study concluded that both male and female Mathematics Education students at Joseph Sarwuan Tarka University, Makurdi experienced higher examination anxiety during Paper-Based Testing than during Computer-Based Testing. The difference was statistically significant for male students but not for female students, a pattern attributable to the small female group, since the female effect was of comparable or larger size. Female students did not report more anxiety than male students in either mode. Examination anxiety in this cohort therefore appears to be shaped more by the demands of the testing mode and students' familiarity with it than by gender alone.

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