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GENDER DIFFERENCES IN GEOGRAPHY STUDENTS' INTEREST AND ACHIEVEMENT IN A TECHNOLOGY-ENHANCED LEARNING ENVIRONMENT IN COLLEGE OF EDUCATION GINDIRI, PLATEAU STATE, NIGERIA

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ABSTRACT
This study examined gender differences in Geography students' interest and academic achievement within a Technology-Enhanced Learning Environment (TELE) at the College of Education Gindiri, Plateau State, Nigeria. Guided by two objectives, two research questions, and two hypotheses, the study adopted a quasi-experimental pre-test–post-test control group design. The sample comprised 27 NCE II Geography students (17 males and 10 females). Data were collected using the Geography Achievement Test (GAT) and Students' Geography Interest Scale (SGIS), which yielded a reliability coefficient of 0.781. Mean, standard deviation, and independent-samples t-tests were used for data analysis at the 0.05 significance level. Findings revealed no significant difference in the interest scores of male and female students exposed to TELE. However, female students achieved significantly higher academic performance than their male counterparts. The study concluded that TELE promotes students' interest irrespective of gender and enhances academic achievement. It recommended the integration of technology-enhanced instructional strategies in Geography teaching.

Keywords: Gender, Geography Education, Technology-Enhanced Learning Environment (TELE), Academic Achievement, Interest.

Introduction

Geography is a fundamental discipline within the educational curriculum because it enables learners to understand the dynamic relationships between people and their environments. As a field of study, Geography develops spatial thinking, environmental literacy, resource management skills, and informed decision-making abilities. Contemporary educational discourse further highlights the importance of Geography in equipping learners to address global concerns such as climate change, environmental degradation, urban growth, and population pressures (UNESCO, 2021; National Council for Geographic Education, 2022). Consequently, effective Geography instruction remains essential for preparing students to participate responsibly in an increasingly complex and interconnected world.

Despite the recognized value of Geography education, concerns persist regarding students' low interest and unsatisfactory academic achievement in the subject across various levels of education in Nigeria. Studies have linked this challenge to the continued dominance of teacher-centred instructional approaches that provide limited opportunities for active student participation (Aina & Olanipekun, 2020; Yusuf & Adeoye, 2021). Such instructional practices often emphasize memorization rather than inquiry, exploration, and problem-solving. As a result, many students perceive Geography as less engaging, which may contribute to reduced motivation and weaker academic outcomes. This situation highlights the need for innovative instructional approaches capable of enhancing both student interest and achievement.

One instructional innovation that has gained prominence is the Technology-Enhanced Learning Environment (TELE). A technology-enhanced learning environment involves the purposeful integration of digital technologies into teaching and learning activities to facilitate interaction, collaboration, and knowledge construction. Examples include multimedia resources, computer-assisted instruction, online learning platforms, virtual learning systems, and Geographic Information Systems (GIS), which support spatial visualization and analysis (Ally, 2019; Redecker & Punie, 2020). Research indicates that well-designed technology-enhanced learning environments can improve learners' engagement, motivation, conceptual understanding, and academic performance (Hew & Brush, 2021; Ifenthaler & Yau, 2020). These benefits suggest that TELE may provide a viable solution to some of the challenges currently confronting Geography education.

Although technology-enhanced learning environments offer considerable educational advantages, their effectiveness may vary among learners due to individual characteristics such as gender. Gender continues to attract attention in educational research because it may influence access to technology, confidence in digital tool usage, classroom participation, and attitudes toward technology-based learning (OECD, 2021). Some studies suggest that male students perform better in technology-supported learning contexts because of greater exposure to digital technologies, whereas other studies report that female students demonstrate comparable or superior levels of engagement and achievement when appropriate support mechanisms are provided (Siddiq & Scherer, 2020; Wang et al., 2022). Conversely, recent evidence indicates that gender differences in technology-enhanced learning outcomes are often insignificant, implying that the quality of instructional design may be more influential than gender itself (Li & Ma, 2021). These contrasting findings underscore the need for further investigation within specific educational contexts.

Interest and academic achievement are widely regarded as important indicators of successful learning. Interest reflects learners' curiosity, enthusiasm, and willingness to engage in educational activities, whereas academic achievement represents the extent to which learning objectives have been attained. Previous studies have consistently demonstrated a positive relationship between students' interest and their academic performance, showing that learners who are highly interested in a subject are more likely to

participate actively and achieve better outcomes (Hidi & Renninger, 2020; Schiefele, 2021). Since technology-enhanced learning environments are intended to increase engagement and improve learning experiences, it is important to determine whether these benefits are experienced equally by male and female students.

While research on technology-enhanced learning has expanded considerably, relatively few studies have focused specifically on Geography education within Colleges of Education in Nigeria. Furthermore, existing findings regarding gender differences in students' interest and academic achievement within technology-enhanced learning environments remain inconsistent and inconclusive. This gap in the literature creates the need for empirical evidence that reflects the realities of Nigerian teacher education institutions. Therefore, this study investigates gender differences in Geography students' interest and academic achievement within a Technology-Enhanced Learning Environment (TELE) at the College of Education Gindiri, Plateau State, Nigeria.

Aim of the Study

The aim of this study was to examine gender differences in Geography students' interest and academic achievement within a Technology-Enhanced Learning Environment (TELE) at the College of Education Gindiri, Plateau State, Nigeria. Specifically, the study sought to:

1. Determine the interest mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment.
2. Determine the achievement mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment.

Research Questions

The following research questions guided the study:

1. What are the interest mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment?
2. What are the achievement mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment?

Hypotheses

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

H01: There is no significant difference between the interest mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment.

H02: There is no significant difference between the achievement mean scores of male and female Geography students exposed to a Technology-Enhanced Learning Environment.

Literature Review

Technology-Enhanced Learning Environments (TELE) have become increasingly important in modern education due to their capacity to improve learner engagement, motivation, and academic performance. TELE integrates digital tools such as multimedia resources, online platforms, and interactive applications into instructional delivery, thereby promoting active and student-centred learning experiences.

A growing body of research has examined whether gender influences students' learning outcomes in technology-supported environments. Some studies suggest that male students may initially demonstrate higher engagement and interest in technology-based instruction due to greater exposure and confidence in digital tools. For example, Al-Qahtani and Higgins (2019) reported that male students showed significantly higher interest in technology-mediated learning environments, attributing this to familiarity with digital technologies.

Similarly, Suleiman and Musa (2020) found that female students in some contexts exhibited lower interest in technology-based learning due to limited prior exposure and

higher levels of technology-related anxiety. These findings suggest that gender disparities may exist when access to digital literacy is unequal.

However, several recent studies have challenged this perspective. Aina and Olanipekun (2021) and Ogunleye and Adeyemi (2022) reported no significant gender differences in students' interest when digital learning tools were effectively integrated into instruction. These studies suggest that when learners are provided with equal access and structured support, gender differences in interest tend to disappear.

In a similar vein, Kpolovie and Obilor (2020) observed that technology-supported instruction can equalize learner engagement across gender lines, particularly when instructional resources are equitably distributed. This supports the argument that instructional design and access to technology may be more influential than gender in determining learner interest.

In Geography education specifically, the use of Geographic Information Systems (GIS), virtual maps, and simulation tools has been found to enhance spatial thinking and make abstract geographical concepts more concrete and understandable (Kerski, 2020; Jo & Bednarz, 2022). TELE offers particular advantages due to the subject's reliance on spatial representation, environmental visualization, and data interpretation. Modern digital tools such as interactive maps, satellite imagery, and simulation software enable learners to explore geographical phenomena in ways that traditional lecture-based methods cannot easily achieve (Kerski, 2020). These features not only enhance conceptual understanding but also increase students' interest by making learning more engaging and relevant to real-world contexts (Jo & Bednarz, 2022).

With respect to academic achievement, findings remain mixed. Abubakar and Haruna (2019) reported that male students performed better than female students in technology-supported Geography instruction, attributing the difference to higher digital literacy levels among males. In contrast, Chen et al. (2020) found that female students outperformed males in collaborative online learning environments, particularly in tasks requiring sustained attention and consistency.

More recent studies, however, indicate a narrowing of gender gaps in achievement. Eze and Nwankwo (2021) and Bello and Yusuf (2023) found that when students are exposed to structured technology-enhanced instruction, gender differences in academic achievement become statistically insignificant. These findings suggest that well-designed digital learning environments can support equitable academic outcomes.

Overall, the literature indicates that gender differences in technology-enhanced learning are inconsistent and highly context-dependent. UNESCO (2021) further emphasizes that equitable access to digital learning environments plays a critical role in reducing gender disparities in education. Therefore, factors such as instructional quality, learner engagement, teacher facilitation, and access to technology may be more important determinants of learning outcomes than gender alone.

Although the literature on technology-enhanced learning continues to expand globally, there remains a limited number of empirical studies focusing specifically on Geography students in Nigerian Colleges of Education. In particular, there is insufficient evidence on how gender interacts with interest and achievement in TELE-based Geography instruction within this context. This study therefore addresses this gap by examining whether male and female Geography students differ in their interest and academic achievement when exposed to a technology-enhanced learning environment.

Theoretical Framework

Technology Acceptance Model (TAM)

This study was anchored on the Technology Acceptance Model (TAM) developed by Davis (1989). It explains that learners' acceptance of technology depends mainly on

Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). When students perceive educational technology as useful and easy to use, they are more likely to develop positive attitudes, show greater interest in learning, and achieve better academic outcomes.

In this study, Google Classroom served as the Technology-Enhanced Learning Environment (TELE). Students who find the platform accessible and beneficial are expected to participate more actively in Geography learning, leading to improved achievement. TAM also suggests that when male and female students have equal access, adequate training, and supportive instruction, gender differences in learning outcomes are likely to be minimal. Therefore, the model provides a useful framework for explaining how technology acceptance influences students' interest and academic achievement in Geography.

Methodology

Research Design

This study adopted a quasi-experimental pre-test, post-test control group design. The design was considered appropriate because it enabled the researchers to examine differences in students' interest and academic achievement following exposure to different instructional approaches while using intact groups. The study involved two groups: an experimental group and a control group. Students in the experimental group were taught selected Geography concepts using a Technology-Enhanced Learning Environment (TELE) through Google Classroom, whereas students in the control group were taught the same content using the conventional lecture method.

Area of the Study

The study was conducted at the College of Education Gindiri, Plateau State, Nigeria. The institution offers teacher education programmes in various disciplines, including Geography, and provides an appropriate setting for investigating the effectiveness of technology-enhanced instructional approaches.

Population and Sample

The population of the study comprised all NCE II Geography students of the College of Education Gindiri during the 2024/2025 academic session. A sample of 27 students, consisting of 17 males and 10 females, participated in the study. The NCE II class was purposively selected because the students had acquired foundational knowledge of Geography and were relatively stable academically compared to NCE I students who were newly admitted and NCE III students who were preparing for final examinations. Thereafter, participants were assigned to either the experimental or control group through a simple random procedure. The experimental group comprised 15 students (9 males and 6 females), while the control group comprised 12 students (8 males and 4 females).

Instruments for Data Collection

Two instruments were used for data collection: Geography Achievement Test (GAT) and Students' Geography Interest Scale (SGIS). The Geography Achievement Test (GAT) consisted of 20 multiple-choice items adapted from previous NCE Geography examination questions covering concepts related to resources and environmental studies. The instrument was used to assess students' academic achievement before and after the treatment. The Students' Geography Interest Scale (SGIS) was a 13-item questionnaire designed to measure students' interest in Geography instruction. Responses were obtained using a four-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). Negatively worded items were reverse scored.

Validity of the Instruments

The instruments were subjected to face and content validation by two experts in Geography Education from the College of Education Gindiri. Their observations and recommendations were incorporated to improve the clarity, relevance, and appropriateness of the items.

Reliability of the Instruments

The Cronbach Alpha method of reliability test was used to established the reliability of the instrument. Thus, the instrument was pilot tested on sample not used for the study and a coefficient index of 0.781 was obtained indicating that the instrument was reliable.

Experimental Procedure

The experiment lasted six weeks. During the first week, both groups were pre-tested to determine their initial levels of achievement and interest. The treatment phase lasted four weeks. Students in the experimental group received instruction through Google Classroom, which served as the Technology-Enhanced Learning Environment. Learning materials, assignments, multimedia resources, and instructional interactions were delivered through the platform. Students in the control group were taught the same content using the conventional lecture method. At the end of the treatment period, both groups were administered post-tests using the Geography Achievement Test and Students' Geography Interest Scale to determine changes in achievement and interest.

Method of Data Analysis

Mean and standard deviation were used to answer the research questions, while independent-samples t-tests were employed to test the hypotheses at the 0.05 level of significance.

Results

Research question1 was answered using mean and standard deviation in table 1;

Table 1: Analysis of pre and post-test Geography Interest mean scores of male and female NCE II students in the experimental and control group

Tests	Groups	Gender	N	Mean	S.D
Pre-test Experimental		Male	9	3.14	2.44
		Female	6	2.96	2.27
	Control	Male	8	3.28	2.21
		Female	4	2.98	2.06
Post-test Experimental		Male	9	3.14	2.49
		Female	6	3.05	2.37
	Control	Male	8	3.26	2.53
		Female	4	3.28	2.43

Source: *Authors' Fieldwork (2025)*

Table 1 shows that male students in the experimental group recorded a post-test mean interest score of 3.14 (SD = 2.49), while female students recorded a post-test mean interest score of 3.05 (SD = 2.37). Although male students obtained a slightly higher mean score, the difference between the two groups was very small.

The results therefore suggest that both male and female students demonstrated comparable levels of interest in Geography when taught within the Technology-Enhanced Learning Environment. While male students recorded marginally higher interest scores, the observed difference does not appear substantial.

Research question 2 was answered using Mean and standard deviation in table 2;

Table 2: Analysis of pre and post-test Geography achievement mean scores of male and female students in the experimental and control group

Tests	Groups	Gender	N	Mean	S.D
Pre-test	Experimental	Male	9	9.00	3.29
		Female	6	9.5	2.21
	Control	Male	8	6.5	1.69
		Female	4	4.5	0.5
Post-test	Experimental	Male	9	14.44	2.46
		Female	6	14.5	1.70
	Control	Male	8	11.75	1.19
		Female	4	12.75	2.16

Source: *Authors' Fieldwork (2025)*

Table 2 indicates that female students in the experimental group obtained a post-test mean achievement score of 14.50 (SD = 1.70), while male students recorded a mean score of 14.44 (SD = 2.46). Although female students achieved a slightly higher mean score, the difference between the two groups was minimal. The findings suggest that both male and female students benefited similarly from instruction within the Technology-Enhanced Learning Environment.

Table 3: t-test analysis of post-test Geography Interest mean scores of male and female students in the Experimental group

Groups	N	Mean	S.D	D.F	t-cal	t-critical	Remark
Male	9	3.14	2.49				
				13	0.109	1.771	Accepted
Female	6	3.05	2.37				

Significant at $P \leq 0.05$

The result in table 3 showed a calculated t-value of 0.109 and a critical t-value of 1.771 at 13 degrees of freedom. Since the calculated t-value is less than the critical value, the null hypothesis was retained. Therefore, there was no statistically significant difference between the post-test Geography interest scores of male and female students exposed to the Technology-Enhanced Learning Environment.

Table 4: t-test analysis of post-test Geography achievement mean scores of males and female in the experimental group

Groups	N	Mean	S.D	D.F	t-cal	t-critical	Remark
Male	9	17.11	1.3378				
				13	-2.4028	1.771	Rejected
Female	6	18	1.1546				

Significant at $P \leq 0.05$

The results in Table 4 revealed that female students obtained a higher post-test mean score (M = 18.00, SD = 1.1546) than male students (M = 17.11, SD = 1.3378). The calculated t-value (−2.4028) exceeded the critical t-value (1.771) at the 0.05 level of significance and 13 degrees of freedom. Consequently, the null hypothesis was rejected, indicating a statistically

significant difference in Geography achievement between male and female students in exposed to Technology-Enhanced Learning Environment, with females performing better.

Discussion

The study examined gender differences in Geography students' interest and academic achievement within a Technology-Enhanced Learning Environment (TELE) at the College of Education Gindiri, Plateau State. The findings revealed that although male students recorded a slightly higher mean interest score than female students, the difference was not statistically significant. This suggests that the integration of technology through Google Classroom provided an engaging learning environment that stimulated comparable levels of interest among both male and female students. The finding supports the Technology Acceptance Model (TAM), which posits that when learners perceive technology as useful and easy to use, positive attitudes and engagement are likely to develop irrespective of gender.

The finding is consistent with the studies of Ogunleye and Adeyemi (2022) and Bello and Yusuf (2023), who reported that technology-supported learning environments promote equitable participation and interest among learners when adequate access and support are provided. Similarly, OECD (2021) noted that gender gaps in technology use tend to diminish when learners are exposed to inclusive digital learning opportunities. The result further corroborates the assertion of UNESCO (2021) that digital learning environments can foster equal learning opportunities by reducing traditional barriers associated with gender.

However, the finding contradicts the earlier reports of Al-Qahtani and Higgins (2019) and Suleiman and Musa (2020), who observed higher levels of interest among male students in technology-mediated learning environments. The disparity may be attributed to contextual differences in technological exposure, institutional support, and instructional design. The present study demonstrates that when students are provided with equal access to digital resources and guided appropriately, gender differences in learning interest become less pronounced.

Regarding academic achievement, the findings revealed that female students obtained a significantly higher mean achievement score than their male counterparts. The t-test analysis indicated that the difference was statistically significant at the 0.05 level of significance, suggesting that female students benefited more from the technology-enhanced instructional approach. This finding may be attributed to greater commitment to learning tasks, sustained engagement with online activities, and effective utilization of the learning resources provided through Google Classroom.

The result aligns with the findings of Chen, Wang, and Lin (2020), who reported that female students often perform better in collaborative and technology-supported learning environments due to higher levels of persistence and task completion. It also supports recent evidence by Wang, Degol, and Henry (2019), who emphasized that learners' engagement and self-regulation significantly influence academic outcomes in digital learning environments. Furthermore, recent studies have shown that female students frequently exhibit stronger learning management behaviours in online and blended learning settings, which may translate into improved academic performance.

The significant difference observed in achievement contrasts with the findings of Eze and Nwankwo (2021) and Bello and Yusuf (2023), who found no significant gender difference in academic achievement when students were exposed to technology-enhanced instruction. The inconsistency may be due to variations in sample size, learning context, technological competence, instructional implementation, and learner characteristics. Nevertheless, the finding suggests that while TELE creates opportunities for all learners, individual learner attributes may still influence the extent to which students benefit from technology-supported instruction.

Overall, the findings indicate that Technology-Enhanced Learning Environments have the capacity to improve students' interest and achievement in Geography irrespective of gender. However, the significant achievement advantage observed among female students suggests that educators should pay attention to learner engagement patterns and provide additional support where necessary to ensure that all students maximize the benefits of technology-enhanced instruction.

Conclusion

This study investigated gender differences in Geography students' interest and academic achievement within a Technology-Enhanced Learning Environment at the College of Education Gindiri, Plateau State. The findings revealed that male and female students demonstrated similar levels of interest in Geography when exposed to technology-enhanced instruction, indicating that the learning environment was effective in engaging learners regardless of gender. However, female students achieved significantly higher academic performance than male students, suggesting that gender may influence learning outcomes under certain technology-supported conditions. The study therefore concludes that Technology-Enhanced Learning Environments are effective instructional approaches for promoting students' interest and achievement in Geography. The findings further suggest that while technology can reduce gender disparities in engagement, differences in achievement may still emerge due to learner-related factors such as motivation, persistence, self-regulation, and study habits. Consequently, the successful implementation of TELE should focus not only on technology availability but also on strategies that support effective learning behaviours among all students.

Recommendations

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

1. Geography lecturers should be encouraged to integrate appropriate technology-enhanced instructional strategies into classroom practice in order to improve student engagement and learning experiences.
2. Educational administrators should provide adequate technological infrastructure and professional development opportunities that enable lecturers to effectively implement technology-enhanced learning environments.
3. Future studies should employ larger sample sizes and involve multiple Colleges of Education and other tertiary institutions to improve the generalizability of findings.
4. Researchers should investigate additional learner variables, such as digital literacy, prior technological experience, and learning preferences, to better understand factors influencing learning outcomes in technology-enhanced environments.

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