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Effect of Blended Learning Strategy on Students' Interest and Cognitive Performance in Geography among Secondary Schools in Dutsin-Ma Educational Quality Assurance Zone, Katsina State

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Abstract

This study investigated the impact of a blended learning strategy on secondary school students' interest and cognitive performance in Geography within the Dutsin-Ma Educational Quality Assurance Zone, Katsina State. A quasi-experimental research design using a pre-test, post-test non-equivalent control group approach was adopted. The population consisted of 1,792 Senior Secondary II (SS II) Geography students, from which a sample of 135 students was purposively selected from two schools based on available ICT infrastructure. The experimental group (N=64) was exposed to a Customized Geography E-Learning Platform (CGELP), while the control group (N=71) was taught using the traditional lecture method. Three instruments were used for data collection: the CGELP software, a 50-item Geography Cognitive Performance Test (GCPT), and a Geography Interest Inventory (GII). Data were analyzed using Mean, Standard Deviation, Analysis of Covariance (ANCOVA), and Independent Samples t-tests at a 0.05 level of significance. Findings revealed that students taught using the blended learning strategy achieved significantly higher mean cognitive performance scores ($F=379.42$, $p<.001$) and higher interest levels ($F=802.62$, $p<.001$) compared to those taught with traditional methods. Furthermore, the study found no significant difference in cognitive performance ($p=.264$) or interest ($p=.989$) between male and female students in the experimental group, indicating that the intervention is gender-neutral. The study concludes that blended learning effectively addresses instructional gaps

in Geography and recommends the formal integration of localized digital platforms into the secondary school curriculum in Katsina State.

Keywords: Blended Learning, Geography Education, Cognitive Performance, Student Interest, Gender Parity, Educational Technology.

Introduction

The criteria for teaching challenging subjects, such as geography, have been redefined by the global trend toward digital pedagogy. Due to its special role as a link between the social and physical sciences, geography requires students to become proficient in environmental analysis, data synthesis, and spatial visualization. However, geography is frequently reduced to a rote memorizing exercise in many Nigerian secondary schools, especially those in the Dutsin-Ma Educational Quality Assurance Zone. The distance between abstract textbook explanations and the dynamic reality of geographic phenomena is sometimes unbridgeable by traditional, teacher-centered approaches (Obi, 2019). A "cognitive ceiling," where pupils can remember knowledge but are unable to apply geographic concepts to real-world situations, is frequently the result of this pedagogical gap.

Technology integration through a Blended Learning Strategy (BLS) has become a revolutionary requirement to get beyond these restrictions. In order to promote intrinsic interest and higher-order cognitive performance, blended learning is a deliberate educational framework that maximizes the advantages of both online and in-person instruction (Bonk & Graham, 2020). A more individualized, self-paced learning experience is made possible by educators using specialized digital platforms to offer interactive simulations and multimedia content that accommodate a variety of learning styles (Alqahtani & Rajkhan, 2020). The alignment of digital technologies with local curriculum requirements and student characteristics is crucial for the success of such e-learning projects in the African context (Mtebe & Raphael, 2018).

Notwithstanding the theoretical benefits, North-Western Nigeria confronts particular systemic obstacles to the practical use of blended learning, such as inadequate infrastructure and teacher reluctance to the digital shift (Nwosu & Chukwu, 2020). Research that assesses technology's overall effectiveness as well as its particular effects on students' cognitive results in settings with limited resources is desperately needed. The creation and assessment of a personalized blended learning framework are the main objectives of this study. In addition to addressing the persistent gender-performance discrepancies in the Dutsin-Ma educational landscape, it aims to present empirical data on how such interventions might increase students' engagement and cognitive competence.

Statement of the Problem

In the secondary schools of the Dutsin-Ma Educational Quality Assurance Zone, geography instruction is currently beset by two crises: stagnant academic accomplishment and dwindling student participation. Due to traditional "talk and chalk" teaching techniques that provide limited opportunity for interactive exploration, many students view geography as an abstract and excessively challenging topic (Adeyemi & Ukonu, 2020). Deep learning is psychologically hampered by this loss of engagement, which is directly correlated with a noticeable drop in student interest. Students' ability to remember and apply difficult geographic ideas, such as climatology or map reading, is greatly reduced when they lack intrinsic motivation (Garrison & Vaughan, 2021). Additionally, there is an ongoing disparity in cognitive performance. The majority

of students find it difficult to advance beyond Bloom's Taxonomy's "remembering" and "understanding" stages, falling short of the "application" and "analysis" levels necessary for success in senior secondary exams (Yusuf & Balogun, 2021). The visual scaffolding required to grasp spatial concepts is largely absent from traditional lecture-based methods (Kintu, Zhu, & Kagambe, 2017). Furthermore, there is still a dearth of studies in this particular area about the influence of gender in technology-mediated learning. It's unknown if male and female students' cognitive development is impacted differently by the existing digital divide.

The zone's geography education will continue to struggle with low student motivation and subpar cognitive results in the absence of a systematic, evidence-based remedy that makes use of specialized digital resources. Moving past general teaching methods and toward a "Quality Assurance" structure that incorporates interactive modules and digital dashboards is necessary. In order to better understand how a blended learning approach might stimulate students' interest and improve their cognitive abilities, this study explicitly looks at how gender interacts in this technologically advanced setting.

Research Objectives

The main objective of this study is to investigate the effect of a blended learning strategy on students' interest and cognitive performance in Geography in secondary schools within the Dutsin-Ma Educational Quality Assurance Zone. Specifically, the study seeks to:

1. Compare the cognitive performance of students taught Geography using a blended learning strategy and those taught using the traditional lecture method.
2. Determine the difference in the level of interest in Geography between students exposed to blended learning and those exposed to traditional instruction.
3. Examine the effect of blended learning on the cognitive performance of male and female students.
4. Assess the difference in the interest of male and female students toward Geography when taught using a blended learning strategy

Research Questions

The following research questions will guide the study:

1. What is the difference in the mean cognitive performance scores of students taught Geography using a blended learning strategy and those taught using the traditional method?
2. What is the difference in the mean interest scores of students exposed to the blended learning strategy and those taught via the traditional method?
3. What is the difference in the mean cognitive performance scores of male and female students taught Geography using a blended learning strategy?
4. What is the difference in the mean **i**nte**rest** scores of male and female students taught Geography using a blended learning strategy?

Research Hypotheses

The following null hypotheses will be tested at a 0.05 level of significance:

HO_1: There is no significant difference in the mean cognitive performance scores of secondary school students taught Geography using a blended learning strategy and those taught using the traditional method.

HO_2: There is no significant difference in the mean interest scores of students exposed to a blended learning strategy and those exposed to traditional teaching methods in Geography.

HO_3: There is no significant difference in the mean cognitive performance scores of male and female students taught Geography using a blended learning strategy.
HO_4: There is no significant difference in the mean interest scores of male and female students taught Geography using a blended learning strategy.

Research Methodology

The study adopted a quasi-experimental research design utilizing the pre-test and post-test non-equivalent control group approach to measure shifts in students' cognitive performance and interest. The population comprised 1,792 SS II Geography students across 15 public co-educational Senior Secondary Schools in the Dutsin-Ma Zonal Education Quality Assurance area. Using a purposive sampling technique, two schools were selected based on their ICT infrastructure, resulting in a sample of 135 students: 64 in the experimental group (GSSS Birchi) and 71 in the control group (GSSS Karofi). The research utilized three distinct instruments: a Customized Geography E-Learning Platform (CGELP) featuring interactive modules, a 50-item Geography Cognitive Performance Test (GCPT) validated for higher-order thinking skills, and a Geography Interest Inventory (GII) to measure intrinsic motivation.

Data Collection and Analysis

Data collection was conducted in three phases, beginning with a pre-test to establish baseline levels, followed by a six-week treatment period where the experimental group utilized the digital platform, and concluding with a post-test assessment. The data were analyzed using the Statistical Package for the Social Sciences (SPSS), starting with a Shapiro-Wilk Normality Test, which confirmed the data were normally distributed. Descriptive statistics (Mean and Standard Deviation) were used to answer the research questions, while Analysis of Covariance (ANCOVA) was employed to test the hypotheses by using pre-test scores as covariates to control for initial differences. Additionally, an Independent Samples t-test was performed to determine the significance of differences between male and female students within the experimental group, with all hypotheses tested at a 0.05 level of significance.

Results and Discussion

This section presents the empirical findings of the study. The analysis is structured to answer the research questions and test the null hypotheses using the data obtained from the Geography Cognitive Performance Test (GCPT) and the Geography Interest Inventory (GII).

Analysis of Research Questions

Research Question 1: What is the difference in the mean cognitive performance scores of students taught Geography using a blended learning strategy and those taught using the traditional method?

Table 1

Mean and Standard Deviation of the Difference in the Mean Cognitive Performance Scores Between the Experimental and Control Groups

Group	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Epermental	67	42.49	4.402	.538	**11.15**
Control	68	31.34	1.990	.241	

As shown in Table 1, the experimental group (N=67) achieved a post-test mean cognitive performance score of 42.49 (SD = 4.40), while the control group (N=68) recorded a mean score of 31.34 (SD = 1.99).

This results in a mean difference of 11.15 in favor of the blended learning group, suggesting that the intervention enhanced students' ability to apply and analyze geographic concepts significantly more than the conventional lecture method.

Research Question 2: What is the difference in the mean interest scores of students exposed to the blended learning strategy and those taught via the traditional method?

Table 2

Mean and Standard Deviation of the Difference in the Mean Interest Between the Experimental and Control Groups

Group	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Epermental	67	43.25	2.070	.253	11.69
Control	68	31.56	2.576	.312	

Data from **Table 2** also reveals that the experimental group attained a mean interest score of 43.25 (SD = 2.07), whereas the control group attained a mean score of 31.56 SD = 2.58). The mean difference indicates that students' intrinsic motivation and engagement with Geography were substantially higher when digital interactive modules were integrated into the instruction.

Research Question 3: What is the difference in the mean cognitive performance scores of male and female students taught Geography using a blended learning strategy?

Table 3

Mean and Standard Deviation of the Difference in the Mean Cognitive Performance Scores Between male and female students in the Experimental Group

Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Male	35	41.91	4.203	.711	1.22
Female	32	43.13	4.591	.812	

As presented in Table 3, male students in the experimental group achieved a mean score of 41.91 (SD = 4.20), while female students achieved a mean score of 43.13 (SD = 4.59). The slight mean difference of 1.22 suggests that female students performed marginally better than their male counterparts when exposed to blended learning, though both groups showed high performance levels.

Research Question 4: What is the difference in the mean interest scores of male and female students taught Geography using a blended learning strategy?

Table 4

Mean and Standard Deviation of the Difference in the Mean Interest Scores Between male and female students in the Experimental Group

Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Male	35	43.26	1.915	.324	0.01
Female	32	43.25	2.258	.399	

Table 4 shows that male students recorded a mean interest score of 43.26 (SD = 1.92), and female students recorded a mean score of 43.25 (SD = 2.26). The negligible mean difference of 0.01 suggests that the blended learning platform stimulated interest equally across both genders.

Testing of Hypotheses

Hypothesis 1 ($H0_1$): There is no significant difference in the mean cognitive performance scores of students taught Geography using a blended learning strategy and those taught using the traditional method.

Table 5

ANCAVA Analyses of the Difference in the Mean Cognitive Performance Scores Between the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4290.810[a]	2	2145.405	195.030	.000	.747
Intercept	2993.416	1	2993.416	272.119	.000	.673
PretestGCPT	91.917	1	91.917	8.356	.004	.060
Group	4173.781	1	4173.781	379.422	.000	.742
Error	1452.049	132	11.000			
Total	189302.000	135				
Corrected Total	5742.859	134				

The result of the ANCOVA in Table 5 shows a significant main effect of the treatment on students' cognitive performance, $F(1, 132) = 379.42$, $p < .001$. The partial eta squared $\eta 2 = .742$) indicates that the blended learning strategy accounted for 74.2% of the variance in the post-test scores. Since the p-value (.000) is less than the alpha level (.05), $H0_1$ is rejected. This implies that students taught Geography using a blended learning strategy significantly performed better than those taught using the traditional method in cognitive performance scores.

Hypothesis 2 ($H0_2$): There is no significant difference in the mean interest scores of students exposed to a blended learning strategy and those exposed to traditional teaching methods.

Table 6

ANCAVA Analyses of the Difference in the Mean Interest Between the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4615.895[a]	2	2307.947	418.865	.000	.864
Intercept	2043.464	1	2043.464	370.865	.000	.738
PretestGII	.131	1	.131	.024	.878	.000
Group	4422.420	1	4422.420	802.617	.000	.859
Error	727.320	132	5.510			
Total	193802.000	135				
Corrected Total	5343.215	134				

The ANCOVA result in Table 6 indicates a highly significant difference in interest levels between the two groups, $F(1, 132) = 802.62$, $p < .001$, with a very large effect size $\eta 2 = .859$). Consequently, $H0_2$ is rejected, confirming that the blended learning strategy is superior to traditional methods in fostering student interest.

Hypothesis 3 ($H0_3$): There is no significant difference in the mean cognitive performance scores of male and female students taught Geography using a blended learning strategy.

Table 7

t-test Analyses of the Difference in the Mean Cognitive Performance Scores Between Male and Female Students in the Experimental Group

Gender	Mean	Std. Deviation	t-value	df	p-value	Decision
Male	41.91	4.203	-1.127	65	.264	Not sig.
Female	43.13	4.591				

As presented in Table 7, male students in the experimental group achieved a mean score of 41.91 (SD = 4.20), while female students achieved a mean score of 43.13 (SD = 4.59). The slight mean difference of 1.22 suggests that female students performed marginally better than their male counterparts when exposed to blended learning, though both groups showed high performance levels.

Hypothesis 4 ($H0_4$): There is no significant difference in the mean interest scores of male and female students taught Geography using a blended learning strategy.

Table 7

t-test Analyses of the Difference in the Mean Interest Scores Between Male and Female Students in the Experimental Group

Gender	Mean	Std. Deviation	t-value	df	p-value	Decision
Male	43.26	1.915	.014	65	.989	Not sig.
Female	43.25	2.258				

The t-test result in Table 8 for interest levels yielded $t(65) = 0.014$, $p = .989$. Since $p > .05$, the null hypothesis is retained. This confirms that the interest stimulated by the blended learning intervention is consistent across both genders.

Discussion of Findings

The primary objective of this study was to evaluate the impact of a blended learning strategy on the cognitive performance and interest of Geography students. The findings derived from the analysis of Research Questions 1 and 2, and the subsequent rejection of Null Hypotheses 1 and 2, demonstrate that students exposed to the blended learning strategy achieved significantly higher mean scores in both cognitive performance and interest compared to those taught through traditional methods.

The significant improvement in cognitive performance ($F = 379.42$; $p < .05$) suggests that the integration of digital interactive modules provided the necessary visual scaffolding for students to master complex spatial concepts. This result aligns with the findings of Bonk and Graham (2020), who asserted that blended learning environments optimize the strengths of both face-to-face and online instruction to enhance mental processing. Similarly, the study supports the work of Kintu, Zhu, and Kagambe (2017), which highlighted that specifically designed features in blended learning platforms are directly correlated with improved learning outcomes in science-based subjects.

Regarding student interest**,** the results showed a substantial shift ($F = 802.62$; $p < .05$) in the experimental group. This suggests that the use of simulations and multimedia content within the Geography E-Learning Platform transformed a subject often perceived as abstract and "dry" into an engaging, interactive experience. This finding is consistent with Alqahtani and Rajkhan (2020), who

found that digital tools increase intrinsic motivation by allowing students to explore real-world applications of theoretical concepts. It also reinforces the observations of Olawale and Egbokhare (2022), who noted that digital tools significantly boost student engagement in Nigerian secondary schools by catering to the digital sensibilities of modern learners.

A pivotal contribution of this study is found in the results of Research Questions 3 and 4 and the retention of Hypotheses 3 and 4, which addressed the gender dimension. The data indicated no statistically significant difference between male and female students in terms of cognitive gains ($p = .264$) or interest levels ($p = .989$) when using the blended learning platform. This finding is of high strategic importance for the Dutsin-Ma Educational Quality Assurance Zone, as it suggests that the developed intervention is "gender-neutral." This contradicts older studies that suggested a digital divide favoring males in STEM-related subjects (Adeyemi, 2006) and instead aligns with the more contemporary findings of Mtebe and Raphael (2018), who argued that well-designed e-learning platforms in African contexts provide equitable learning opportunities regardless of gender.

In conclusion, the findings suggest that the crisis of low performance and disinterest in Geography in Katsina State is not a result of student inability, but rather a consequence of instructional mismatch. The transition from traditional "talk and chalk" methods to a customized blended learning framework, as supported by this IBR project, provides a scalable model for improving educational quality and gender equity in secondary education.

Conclusion

This study set out to evaluate the efficacy of a customized blended learning framework on the cognitive performance and interest of geography students in the Dutsin-Ma Educational Quality Assurance Zone. The empirical evidence generated through this research leads to several significant conclusions.

Firstly, the substantial gain in cognitive performance scores among the experimental group proves that traditional lecture-based methods are insufficient for mastering the spatial and analytical complexities of Geography. The integration of digital interactive modules provides the necessary visual scaffolding to move students from rote memorization to higher-order cognitive mastery.

Secondly, the study concludes that the "crisis of interest" in Geography is not an inherent student deficit but a pedagogical one. The blended learning strategy successfully catalyzed intrinsic interest, suggesting that when technology is localized and interactive, it aligns with the digital sensibilities of modern learners.

Finally, and perhaps most importantly for educational quality assurance, the study concludes that gender does not moderate the effectiveness of blended learning**.** The absence of significant differences in cognitive and affective outcomes between male and female students indicates that the Customized Geography E-Learning Platform (CGELP) is an equitable instructional tool. Therefore, blended learning represents a viable pathway for improving academic standards and ensuring gender parity in North-Western Nigeria’s secondary education sector.

Recommendations

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

1. The Katsina State Ministry of Education and the Zonal Quality Assurance Units should move beyond traditional methods and formally integrate blended learning frameworks into the secondary school Geography curriculum to enhance cognitive outcomes.

2. Rather than relying on generic educational videos, institutions should invest in the development and deployment of customized e-learning platforms similar to the one evaluated in this study that align specifically with the Nigerian Educational Research and Development Council (NERDC) syllabus.
3. Policymakers should adopt blended learning as a strategic tool for closing the gender gap in STEM and Geography education, as this study demonstrates its effectiveness in providing equitable learning opportunities for both male and female students.
4. There should be a systematic training program for Geography teachers on digital literacy and the management of blended classrooms. This will ensure that the transition from teacher-centered to student-centered technology-aided instruction is sustainable.
5. To fully realize the benefits of blended learning, there is an urgent need for the government and private stakeholders to improve the ICT infrastructure (internet connectivity and power supply) in rural and semi-urban secondary schools.

Recommendation and Appreciation of Tetfund Research Support

To:

The Executive Secretary,
Tertiary Education Trust Fund (TETFund),
Abuja, Nigeria.

I, Aminu Ango, of the Department of Science Education, Federal University Dutsin-Ma, Katsina State, wish to express my profound appreciation to the Tertiary Education Trust Fund (TETFund) for its invaluable support towards research and academic development in Nigerian tertiary institutions.

I applied for the TETFund Research Projects Intervention, and I am pleased to have been granted the opportunity to benefit from this important intervention. The support provided by TETFund has greatly enhanced my capacity to undertake meaningful research that contributes to the advancement of knowledge and addresses relevant educational and societal challenges.

The intervention has provided an enabling environment for me to conduct my research effectively and to generate findings that can contribute to educational development and evidence-based decision-making. This demonstrates TETFund's continued commitment to promoting research, innovation, academic excellence, and capacity building among researchers in Nigerian universities.

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I therefore respectfully recommend the continued support and strengthening of the TETFund Research Projects Intervention, particularly sponsorship for the presentation and publication of research papers arising from approved TETFund-funded research projects. Such support will further enhance the visibility, impact, and contribution of Nigerian research to national and international academic communities.

I remain sincerely grateful to TETFund for the support and opportunity provided to me and other researchers across Nigerian tertiary institutions.

Yours faithfully,



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