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# EFFECT OF DIGITAL LEARNING STRATEGIES ON STUDENTS' ACADEMIC PERFORMANCE AND RETENTION OF SELECTED EDUCATIONAL TECHNOLOGY CONCEPTS

**Mohammed Jibril**[1]
[1]University of Ilorin, Ilorin, Nigeria
9jibrilmohammed@gmail.com

**Abstract**

Digital learning strategies, such as Moodle and hybrid learning, are increasingly utilized to enhance academic performance and retention. However, there is limited evidence of their specific effect on Educational Technology courses in Kwara State Colleges of Education. This study addresses this gap by determining the effectiveness of these strategies on students' academic performance and retention. A purposive sampling technique was employed to select the intact class of 200-level computer science education students from two randomly selected colleges. 127 students participated, 65 in the Moodle group and 62 in the hybrid learning group. A quasi-experimental design with pre-test and post-test was adopted, using ANCOVA for the analysis of performance and retention, and independent samples t-test for gender-based comparisons. Kuder-Richardson (KR-20) reliability values of 0.73 for multiple-choice items and a Split-half reliability coefficient of 0.78 for completion tests were obtained. Findings revealed a significant difference in performance ($F(1, 124) = 30.10$, $p < .05$), and retention ($F(1, 124) = 22.41$, $p < .05$) between students taught with Moodle and those using hybrid learning. Gender had no significant impact on students' academic performance in either learning group. The study concluded that Moodle-based learning improved students' performance and retention more effectively than hybrid learning. It is recommended that Kwara State Colleges of Education adopt Moodle-based learning strategies while continuing to incorporate hybrid approaches for enhanced educational outcomes. Further studies should explore the long-term impacts of these learning strategies across various educational levels.

**Keywords:** Educational Technology, Hybrid Learning, Moodle-Based Learning, Retention, Student Performance

## INTRODUCTION

Educational technology in Nigerian higher institutions, particularly in Kwara State Colleges of Education, has become an essential tool for improving

the instructional process. The integration of technology into the educational system aims to modernize the instructional process and provide students with the skills necessary to succeed in a technology-driven world. Kwara State Colleges of Education have started to embrace various educational technological tools to complement traditional teaching methods which is aimed at improving student engagement and learning efficiency. With the rapid growth of digital technologies, educators are increasingly turning to technological resources to improve student interaction with course content and promote active learning (Daramola, 2023).

The role of educational technology in Kwara State Colleges of Education is particularly significant in enhancing students' performance. This involves the use of tools such as multimedia presentations, computer-assisted learning, and digital learning strategies that help modernize how students engage with and retain knowledge (Haleem et al., 2022). Learning strategies are essential in determining how effectively students grasp and retain knowledge in their academics (Alenezi, 2023). One of the most significant advancements in this transformation is the incorporation of digital platforms such as Moodle and hybrid learning approaches.

The introduction of digital learning environments, like Moodle, has revolutionized the way students interact with content and engage with educational materials. Moodle is a widely used Learning Management System (LMS) that offers a virtual space where students can access course materials, interact with peers and instructors, and track their learning progress (Arifin et al., 2023). The integration of Moodle has been shown to enhance educational experiences that provide flexible and accessible learning environments (Olugbade, 2023). Research has shown that online learning strategies, such as those facilitated by Moodle, enhance higher levels of student autonomy, engagement, and collaboration (Al-Naabi, 2023). Furthermore, Moodle's adaptive features, including quizzes, discussion boards, and assignment submission portals, offer opportunities for students to engage with course

content at their own pace, which can result in an enhanced understanding of course content (Mustapha et al., 2023). These digital environments support personalized learning experiences that cater to various student needs which offers a potential advantage over traditional methods.

On the other hand, hybrid learning combines both traditional face-to-face classroom instruction with digital tools which offer a more blended approach that caters to diverse learning needs (Niyomves et al., 2024). One common challenge of this strategy is the ability of the instructor to carefully blend face-to-face instruction with the flexibility and accessibility of online learning within the specific instructional hour. The debate surrounding which learning strategy between Moodle-based or hybrid learning yields better academic outcomes remains relevant, especially in educational settings where student engagement and performance are primary goals. According to studies, hybrid learning has the potential to increase student engagement due to its flexibility and the varied ways in which content is delivered (Obinna et al., 2024). Hybrid learning encourages active participation which provides opportunities for students to revisit online content at their convenience. As students move between physical classrooms and digital platforms, they benefit from diverse learning modalities, which can lead to enhanced academic performance.

Academic performance is the most important measure when assessing the impact of different learning strategies. Academic performance refers to the ability of students to meet the learning objectives of a course, typically assessed through exams, assignments, and participation (Mentzer et al., 2024). Research on Moodle-based learning has consistently shown that students who engage with digital platforms perform well academically due to the increased accessibility to resources, continuous feedback, and opportunities for self-paced learning (Peramunugamage et al., 2024). The interactivity and multimedia capabilities of Moodle also enhance cognitive engagement which leads to better academic performance ((Nasiru, 2024; Mustafa & Ali, 2023).

Consequently, students taught through Moodle may have an advantage in terms of academic performance, as they have access to a more flexible and interactive learning environment.

Hybrid learning, however, offers a unique combination of benefits that may affect students' academic performance. Hybrid learning strategies allow students to engage with content in diverse ways. For example, while in-person classes promote direct interaction with instructors, online components of hybrid learning offer the flexibility of self-directed learning (Edem, 2023). Studies have shown that hybrid learning can improve student performance by enabling more tailored learning experiences, where students can access additional resources and receive personalized feedback outside of traditional class hours (Benjamin-Ohwodede et al., 2024; Hermita et al., 2023; Olumorin et al., 2023). The combination of these instructional strategies may result in higher academic performance and retention in educational technology courses, where practical applications and theoretical concepts must be mastered.

Retention is another important variable when evaluating the effectiveness of different learning strategies. Retention refers to the extent to which students remember and apply learned concepts over time, which is essential in ensuring long-term success in education (Ibrahim, 2023). Moodle's ability to provide continuous, spaced-out learning opportunities through quizzes, assignments, and interactive features can support improved retention by reinforcing learning over time (Abusalem, 2024). The use of regular assessments and reminders ensures that students remain engaged with the material, which enhances long-term memory retention. Additionally, Moodle's tools that facilitate peer interaction and collaborative learning can help students retain concepts by allowing them to apply knowledge in social interaction and real-world scenarios (Eze et al., 2023).

Similarly, the hybrid learning approach also impacts retention by offering varied instructional formats. Face-to-face instruction facilitates real-

time interaction and immediate clarification of complex concepts, which aids in initial learning (Olatunde-Aiyedun & Adams, 2022). Meanwhile, online components provide opportunities for revision and reinforcement, allowing students to review content at their own pace, leading to better retention. A study by Tukur et al. (2023) found that students in hybrid learning environments demonstrated improved retention of material compared to those in traditional classroom settings, due to the opportunities for revisiting content and applying knowledge in practical settings.

Gender, another important variable, has been shown to influence students' academic performance. Research suggests that gender differences in academic performance may arise from various factors, including social, cultural, and psychological influences (Angwaomaodoko, 2023; Pajares & Valiante, 2021). Some studies have found that male students tend to perform better in technology-driven courses, possibly due to higher levels of comfort and familiarity with digital tools (Anggrawan, & Nuraini, 2021). However, other research indicates that when digital learning platforms like Moodle are used, female students show increased engagement and performance, particularly when the platform offers collaborative learning opportunities (Vellu & Maat, 2021). Thus, understanding the role of gender in digital learning strategies is crucial for assessing how Moodle and hybrid learning approaches may differentially impact male and female students' academic performance.

Digital learning strategies, including Moodle and hybrid learning, are essential components of contemporary education that offer flexibility and diverse learning opportunities. The effects of these learning strategies on students' academic performance and retention are of significant interest in educational technology. The ability of Moodle to provide personalized learning experiences and the dynamic nature of hybrid learning both have the potential to enhance students' understanding and long-term retention of concepts. Additionally, considering gender differences in performance allows for a better understanding of how digital platforms may benefit various student

populations. This study aims to contribute to the ongoing discourse on the effectiveness of digital learning strategies and their impact on student performance in educational technology concepts.

The rapid adoption of digital learning strategies, such as Learning Management Systems (LMS) like Moodle and hybrid learning, has revolutionized education globally. These strategies offer flexible learning environments that allow students to engage with course content in ways that were previously not possible with only traditional face-to-face instruction (Suad et al., 2023). Despite the use of these digital strategies, there is a significant gap in understanding how these methods impact students' performance and retention in educational technology courses at Kwara State Colleges of Education.

Studies have explored the effect of Moodle and hybrid learning globally, but fewer have specifically focused on their effectiveness in Colleges of Education (Oguguo et al., 2021; Yüksel, 2022). Additionally, digital platforms have shown promise in improving engagement, performance, and retention, it is unclear whether these benefits apply equally to male and female students in Kwara State Colleges of Education in educational technology courses. This lack of focused research creates uncertainty around the best strategies for enhancing learning outcomes in these settings.

To address this gap, the present study examined the effects of Moodle and hybrid learning on students' academic performance and retention in educational technology courses at Kwara State Colleges of Education. This research also investigated the role of gender in moderating the effects of these digital learning strategies. This study identifies which strategy is more effective in promoting student performance. The results of this study provide empirical evidence which contributes to the development of evidence-based practices that enhance teaching and learning in educational technology courses at Kwara State Colleges of Education.

## METHOD

This research utilized a quasi-experimental design, incorporating pre-tests, post-tests, and a delayed retention test with two experimental groups. The study included two levels of treatment: Moodle-based Learning and Hybrid Learning. The independent variable in this study is the teaching methods. The dependent variables are students' performance on the post-test and their retention, as measured by the delayed post-test. Gender is the moderating variable in this study, as it may affect student performance within the two treatment groups.

**Table 1.** Research Design Structure

| Groups | Pre-test | Treatment | Post-test | Delayed Post-test (Retention) |
|---|---|---|---|---|
| Experimental Group 1 | $O_1$ | $X_1$ (Moodle-based learning) | $O_2$ | $O_3$ |
| Experimental Group 2 | $O_2$ | $X_2$ (Hybrid Learning: Moodle group and conventional classroom) | $O_5$ | $O_6$ |

Table 1 shows the outlines of the variables used in the study. The pre-test was administered to both experimental groups before the treatment began as seen in $O_1$ and $O_2$. In the first experimental group, students were taught educational technology concepts using the Moodle-based learning approach $X_1$. In the second experimental group, students received instruction via a hybrid learning approach, which combines both Moodle and conventional classroom-based methods $X_2$. After the treatment period of four weeks, a post-test was administered to assess the students' immediate performance as seen in $O_3$ and $O_4$. To assess retention, a delayed post-test was conducted two weeks after the initial post-test as seen in $O_5$ and $O_6$. This delayed post-test aimed to measure the students' retention of the educational technology concepts taught during the treatment period. Gender was treated as a moderating variable

throughout the study, and its potential effects on student performance were analyzed.

The population for this study comprises all students enrolled in Colleges of Education across Kwara State. The specific target population includes all 200-level students from two of the three public Colleges of Education in Kwara State, who were randomly assigned to the experimental groups. The sample consists of intact classes of 200-level computer science students enrolled in educational technology courses at these two Colleges of Education, selected through purposive sampling. 127 students participated, 65 in the Moodle group and 62 in the hybrid learning group.

The researcher used four instruments to collect data for this study: (1) lesson plan, (2) Moodle, (3) hybrid learning, and (4) a students' performance test on educational technology concepts.

The lesson plan and performance test were validated by a lecturer from the College of Education and three educational technology experts from a university. A pilot study with 15 computer science education students in Oyo State tested for reliability, yielding a KR-20 coefficient of 0.73 for the multiple-choice section and split-half of 0.78 for the completion test. Given these reliability coefficients, the instrument was deemed both reliable and consistent for the study.

The data collection for this study followed a structured process to ensure consistency and reliability. A pre-test was first administered to assess students' prior knowledge of educational technology concepts and ensure both groups started with similar levels of understanding. The treatments were delivered over four weeks: the Moodle-based group accessed materials and assignments online, while the hybrid group had a mix of face-to-face lectures and online Moodle instruction. Group I (Moodle-based) received two hours of online learning per week, while Group II (hybrid) received one hour of face-to-face learning and one hour online. After the four-week treatment, a post-test was given to measure immediate understanding, followed by a delayed post-

test two weeks later to assess retention. The researcher ensured that all ethical guidelines were followed, with informed consent obtained from the participants. The study adhered to ethical standards for research, ensuring accurate and honest reporting of findings.

Research questions one and two were answered with Mean and Standard Deviation using the Statistical Product for Service Solutions (SPSS). For hypothesis testing, ANCOVA was used to test hypotheses one and two, while independent t-tests were used for hypotheses three and four. All hypotheses were tested at a 0.05 significance level.

## RESULTS AND DISCUSSION

Table 2 shows the demographic information of the participants based on the groups in the study. Experimental Group I, which received Moodle-based learning, consisted of 65 participants, accounting for 51.2% of the total sample.

**Table 2.** Demographic Information of Participants by Group

| Group | Frequency | Percentage | Cumulative Percent |
|---|---|---|---|
| Experimental Group I (Moodle-based Learning) | 65 | 51.2% | 51.2% |
| Experimental Group II (Hybrid Learning) | 62 | 48.8% | 100.0% |
| Total | 127 | 100.0% | 100.0% |

Experimental Group II, which participated in hybrid learning, had 62 participants, making up 48.8% of the total. The cumulative percentage column shows that the total sample size of 127 participants was fully accounted for, with 51.2% in the Moodle-based learning group and 100% in the hybrid learning group.

**Table 3.** Demographic Information of Participants by Gender

| Gender | Frequency | Percentage | Cumulative Percent |
|---|---|---|---|
| Male | 70 | 55.1% | 55.1% |
| Female | 57 | 44.9% | 100.0% |
| Total | 127 | 100.0% | 100.0% |

Table 3 shows the demographic distribution of participants based on gender. Of the 127 participants in the study, 70 were male, making up 55.1% of the total sample, while 57 were female, accounting for 44.9%. The cumulative percentage column reflects that the total sample consists of 55.1% male participants and 100% when both male and female participants are combined.

**Table 4.** Demographic Information of Participants Based on Gender Distribution in Each Group

| Group | Gender | Frequency | Percentage within Group | Cumulative Percent |
|---|---|---|---|---|
| Moodle-based Learning | Male | 36 | 55.4% | 28.3% |
| | Female | 29 | 44.6% | 51.2% |
| Hybrid Learning | Male | 34 | 54.8% | 78.0% |
| | Female | 28 | 45.2% | 100.0% |
| Total | | 127 | 100.0% | 100.0% |

Table 4 presents the gender distribution of participants within each experimental group. In Experimental Group I (Moodle-based learning), 36 of the participants were male, representing 55.4% of that group, while 29 were female, making up 44.6%. For Experimental Group II (Hybrid learning), 34 participants were male (54.8%), and 28 were female (45.2%). The cumulative percentages reflect the total sample distribution, with males comprising 55.1% and females 44.9% across both groups, resulting in a combined total of 127 participants.

Hypotheses One: An Analysis of Covariance (ANCOVA) was conducted to determine if there was a significant difference in the post-test mean scores between the two experimental groups, with pre-test scores used as the covariate, as presented in Table 5.

**Table 5.** ANCOVA Result of the Difference Between Students' Performance Taught Using Moodle-based Learning and the Students Taught Using Hybrid Learning

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 2720.25 | 2 | 1360.12 | 15.16 | .000 | .197 |
| Intercept | 21727.70 | 1 | 21727.70 | 242.22 | .000 | .661 |
| Pretest | 18.76 | 1 | 18.76 | 0.21 | .648 | .002 |
| Group | 2699.68 | 1 | 2699.68 | 30.10 | .000 | .195 |
| Error | 11123.20 | 124 | 89.70 | | | |
| Total | 620977.00 | 127 | | | | |
| Corrected Total | 13843.45 | 126 | | | | |

Table 5 shows that there is a significant effect on the posttest scores, $F$ (*1*, *124*) = *30.10*, $p<.005$. Since the p-value is less than 0.05, we reject the null hypothesis (H01), indicating that there is a significant difference in post-test performance between the two groups. Additionally, the pretest scores did not significantly affect posttest performance (p = .648) confirming that prior knowledge had no significant impact on the results. To identify the direction of this difference, mean and standard deviation calculations were conducted for Research Question 1 to determine the mean gain score between groups.

Research Question 1: How does students' performance differ between those taught using Moodle and those taught with hybrid learning in educational technology concepts?

**Table 6**. Difference Between the Two Experimental Groups

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| Moodle | 73.65 | 7.61 | 65 |
| Hybrid | 64.42 | 11.04 | 62 |
| Total | 69.14 | 10.48 | 127 |

Table 6 presents the mean posttest scores, standard deviations, and sample sizes for the two experimental groups: Moodle-based learning and Hybrid learning. The Moodle-based learning group had a mean score of 73.65 (SD = 7.61), while the Hybrid learning group had a mean score of 64.42 (SD = 11.04). The overall mean for both groups combined was 69.14 (SD = 10.48). This indicates that students who were taught using the Moodle-based learning approach performed better on the post-test compared to those taught using the Hybrid learning method. The difference in performance suggests that Moodle-based learning may have a more positive impact on students' understanding of educational technology concepts. The standard deviation values show that there was more variability in the posttest scores within the Hybrid learning group (SD = 11.04) compared to the Moodle group (SD = 7.61), indicating that the performance of students in the Hybrid group was more spread out around the mean. This result reveals that the two methods are effective in teaching the selected educational technology concepts. However, using Moodle is more effective.

Hypotheses Two: To determine if a significant difference existed in the post-test mean scores between the two experimental groups, an Analysis of Covariance (ANCOVA) was conducted as shown in Table 7.

**Table 7.** ANCOVA Result of the Difference Between Students' Retention Taught Using Moodle-based Learning and the Students Taught Using Hybrid Learning

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 2338.40 | 2 | 1169.20 | 29.06 | .000 | .319 |
| Intercept | 8909.37 | 1 | 8909.37 | 221.43 | .000 | .641 |
| Posttest | 430.22 | 1 | 430.22 | 10.69 | .001 | .079 |
| Group | 901.60 | 1 | 901.60 | 22.41 | .000 | .153 |
| Error | 4989.32 | 124 | 40.24 | | | |
| Total | 739968.00 | 127 | | | | |
| Corrected Total | 7327.72 | 126 | | | | |

The ANCOVA results in Table 7 show a significant difference in the retention of educational technology concepts between students taught using Moodle-based learning and those taught through hybrid learning methods $F(1,124) = 22.41$, $p < .005$. Therefore, the null hypothesis is rejected, suggesting that there is a significant difference in retention between the two groups. Mean and standard deviation analyses for Research Question 2 were conducted to establish the mean gain score. This was done to establish the direction of the difference.

Research Question 2: What is the difference in students' retention of educational technology concepts when taught using Moodle and those taught using hybrid learning in educational technology concepts?

**Table 8.** Difference Between the Two Experimental Groups

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| Moodle | 73.65 | 7.61 | 65 |
| Hybrid | 64.42 | 11.04 | 62 |
| Total | 69.14 | 10.48 | 127 |

Table 8 shows the mean retention scores for students in the Moodle and Hybrid learning groups. The Moodle-based learning group had a mean retention score of 79.74 (SD = 5.47), while the Hybrid learning group had a mean score of 71.98 (SD = 7.58). This descriptive data suggests that students in the Moodle-based learning group retained educational technology concepts better than those in the Hybrid learning group.

Hypotheses Three: An independent samples t-test was conducted to examine if there were differences in performance between male and female students in the first experimental group (Moodle-based learning), as shown in Table 9.

**Table 9.** Comparison of Post-Test Scores Between Male and Female Students in the First Experimental Group (Moodle-Based Learning)

| Variable (Posttest Scores) | N | Mean | Standard Deviation | df | T | Sig. (p) | Remark |
|---|---|---|---|---|---|---|---|
| Male | 36 | 74.53 | 7.44 | 63 | 1.042 | 0.302 | Not Significant |
| Female | 29 | 72.55 | 7.80 | | | | |

Table 9 compares the post-test scores of male and female students in the Moodle-based learning group. The male group (N = 36) had an average score of 74.53 with a standard deviation of 7.44, while the female group (N = 29) had

an average score of 72.55 with a standard deviation of 7.80. An independent samples t-test was conducted to compare the two groups, and the results showed no significant difference between them (df = 63; t = 1.042; p = 0.302), as the p-value exceeded the 0.05 significance level. Thus, Hypothesis 3 is not rejected, indicating that gender does not significantly influence students' performance in the post-test on educational technology concepts.

Hypotheses Four: An independent samples t-test was conducted to determine if there was a significant difference in performance between male and female students in the second experimental group (Hybrid learning), as presented in Table 10.

**Table 10.** Comparison of Post-Test Scores Between Male and Female Students in the Hybrid Learning Group

| Variable (Posttest Scores) | N | Mean | Standard Deviation | df | t | Sig. (p) | Remark |
|---|---|---|---|---|---|---|---|
| Male | 34 | 65.71 | 11.10 | 60 | 1.011 | 0.316 | Not Significant |
| Female | 28 | 62.86 | 10.97 | | | | |

Table 10 presents a comparison of post-test scores between male and female students in the hybrid learning group. The male group (N = 34) achieved a mean score of 65.71 with a standard deviation of 11.10, while the female group (N = 28) had a mean score of 62.86 with a standard deviation of 10.97. An independent samples t-test was conducted to evaluate the difference between the two gender groups, revealing no statistically significant difference (df = 60; t = 1.011; p = 0.316), as the p-value exceeded the 0.05 threshold. Consequently, Hypothesis 4 is not rejected, indicating that gender does not significantly impact students' post-test performance in educational technology concepts in hybrid learning.

The findings from this study demonstrate a significant difference in academic performance between students taught using Moodle-based learning and those using hybrid learning. This result reveals that using Moodle is more effective in teaching educational technology courses. Studies by Arifin et al. (2023) and Al-Naabi (2023) support this result, indicating that Moodle's structured learning environment and adaptive features help to improve student performance. This is in line with research by Mustapha et al. (2023), which shows that the self-paced, accessible nature of Moodle enhances students' grasp of complex concepts. However, contrasting views like those from Obinna et al. (2024) argue that hybrid learning, with its flexible and diversified instruction, could increase student engagement and academic outcomes, especially when in-person guidance is needed. Despite this, the result from this current study shows that Moodle may be more effective in enhancing students' performance in educational technology courses.

In terms of retention, the findings indicate that students in the Moodle group retained concepts better than those in the hybrid group. This aligns with research from Abusalem (2024) and Eze et al. (2023). Moodle's frequent quizzes, collaborative activities, and reminders reinforce learning over time, supporting long-term retention of educational technology concepts. Although hybrid learning also offers retention benefits through varied instructional formats, as observed by Olatunde-Aiyedun & Adams (2022) and Tukur et al. (2023), the findings of this current study show that Moodle's consistent, interactive elements may provide an edge in reinforcing and retaining learned materials.

Gender did not have a significant impact on academic performance within the Moodle or hybrid learning groups, a finding consistent with Angwaomaodoko (2023), who suggested that gender differences in performance may be less pronounced in structured digital learning environments. Nevertheless, some research indicates male students may generally be more comfortable with digital tools (Anggrawan & Nuraini, 2021),

while Vellu & Maat (2021) found that female students engage better in collaborative learning settings typical of platforms like Moodle. Findings from this current study show that both male and female students perform similarly in these digital environments, suggesting that gender-related differences may be minimal in Moodle-based and hybrid learning approaches.

## CONCLUSION

The study examined the effect of digital learning strategies on student academic performance and retention in selected educational technology concepts. The findings suggest that the structured, interactive, and self-paced nature of Moodle, supported by regular assessments and collaborative tools, fosters greater engagement, understanding, and long-term retention of course material. Although hybrid learning also offers flexibility and diverse instructional strategies, Moodle's digital environment appears to be more effective in improving students' academic outcomes. Furthermore, gender did not significantly influence performance in either learning method, suggesting that digital learning platforms can be effective across diverse student populations. These results contribute to the growing body of research advocating for the integration of technology in education, particularly in enhancing instructional delivery and ensuring the retention of knowledge in Nigerian higher institutions. The study provides empirical evidence for educators and policymakers seeking to optimize learning strategies in educational technology which emphasizes the importance of adopting well-structured digital platforms like Moodle to improve student performance and retention.

The following recommendations were made based on the major findings of this study: 1) Based on the positive impact of Moodle on academic performance and retention, it is recommended that Kwara State Colleges of Education and other Nigerian higher institutions increase the adoption of Moodle-based learning environments. This can be achieved by providing

comprehensive training for instructors on effectively using Moodle's features to engage students and enhance learning outcomes; 2) Institutions should consider incorporating hybrid learning strategies in conjunction with Moodle which allows students to benefit from both in-person and online learning experiences; 3) Given that Moodle supports personalized learning, educators should create tailored learning paths for students, taking advantage of Moodle's adaptive learning features. This can help address the diverse learning needs of students; and 4) Since gender did not significantly influence the learning outcomes in this study, educational institutions should focus on creating inclusive digital learning environments that cater to all students.

Although gender did not show significant differences in this study, further research could explore how specific digital learning strategies impact male and female students differently, with a focus on creating gender-responsive learning environments that enhance engagement and performance for all students.

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