

Blackboard-Powered TVET Delivery in Southeast Nigeria: Evaluating LMS Adoption in Federal Polytechnics

Amobi P. CHIAMOGU

Department of Public Administration

Federal Polytechnic, Oko, Anambra State – Nigeria;

amobi.chiamogu@federalpolyoko.edu.ng

<https://orcid.org/0000-0003-1745-2591>

Abstract

This study examined Blackboard Learning Management System (LMS) adoption and its implications for Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria. The study was motivated by the increasing digitalization of higher education and the growing concerns regarding the effectiveness of Blackboard LMS implementation in Nigerian tertiary institutions despite substantial interventions by Tertiary Education Trust Fund. Specifically, the study investigated the extent of Blackboard LMS adoption and utilization, its influence on teaching effectiveness and learning outcomes, and the institutional and infrastructural challenges affecting effective implementation within the selected institutions. The study adopted a descriptive survey research design. The study area comprised selected federal polytechnics in Southeast Nigeria, namely Federal Polytechnic Oko, Federal Polytechnic Nekede, and Akanu Ibiam Federal Polytechnic Unwana. The population of the study consisted of 44,866 respondents, including lecturers, ICT/e-learning personnel, and students. A sample size of 396 respondents was determined using Taro Yamane's formula, while a multistage sampling procedure involving purposive, stratified, and proportionate random sampling techniques was employed. Data were collected through a structured questionnaire and analyzed using mean, standard deviation, Independent Sample t-test, and One-Way Analysis of Variance (ANOVA) at 0.05 level of significance. The findings revealed that Blackboard LMS adoption within the selected federal polytechnics was largely superficial and compliance-driven, with actual utilization for teaching and learning remaining considerably low despite visible onboarding exercises. The study further revealed that generalized virtual training programmes organized under TETFund interventions failed to adequately address institution-specific infrastructural and operational realities affecting effective LMS utilization. Major challenges identified included inadequate ICT infrastructure, poor internet connectivity, unstable electricity supply, limited digital literacy, and weak institutional support systems. The study concluded that Blackboard LMS implementation in federal polytechnics in Southeast Nigeria remained largely symbolic rather

than transformational and recommended institution-specific capacity-building programmes, improved ICT infrastructure, enhanced technical support systems, and stronger policy-driven integration of Blackboard LMS into mainstream TVET instructional delivery.

Keywords: Blackboard LMS, Learning Management System, TVET, e-learning, Digital transformation

Introduction

The rapid advancement of Information and Communication Technology (ICT) has fundamentally transformed educational systems across the globe, reshaping the modes of teaching, learning, assessment, and academic administration. Central to this transformation is the emergence of Learning Management Systems (LMS), which have become indispensable digital platforms for facilitating flexible, interactive, and learner-centered education in higher institutions (Al-Marroof & Salloum, 2019; Maqbool et al., 2024; Kayanja et al., 2025). LMS platforms such as Blackboard, Moodle, Canvas, and Google Classroom enable institutions to integrate instructional delivery, assessment management, communication, and learning analytics within a unified digital ecosystem. Their adoption has significantly accelerated the shift from traditional classroom-based pedagogy toward blended and fully online learning environments (Gorshenin, 2018; Zabukovšek et al., 2022; Bousboula et al., 2025).

Globally, the integration of LMS into higher education has expanded rapidly, particularly following the disruptions caused by the COVID-19 pandemic. Educational institutions increasingly rely on digital learning technologies to sustain academic continuity, improve accessibility, and enhance instructional effectiveness. According to UNESCO (2023), more than 90% of higher education institutions in developed economies now utilize some form of LMS for academic delivery. Empirical evidence suggests that effective LMS integration improves learner engagement, collaboration, flexibility, and academic performance (Zanjani et al., 2017; Shiku et al., 2025; Zerihun & Mabaso, 2025). Beyond conventional academic disciplines, LMS platforms have also become essential tools for skills acquisition and competency-based learning within Technical and Vocational Education and Training (TVET), where digital technologies support simulations, virtual laboratories, online collaboration, and remote assessment systems.

TVET occupies a strategic position in national development because it equips learners with employable technical and occupational skills necessary for industrialization, innovation, and economic competitiveness. In developing economies such as Nigeria, TVET is considered a critical mechanism for addressing youth unemployment, closing skills gaps, and promoting workforce productivity (UNESCO, 2023). Nigerian TVET delivery is primarily undertaken by polytechnics, monotechnics, and technical colleges supervised by the National Board for Technical Education (NBTE). However, despite the growing importance of technology-driven education globally, TVET institutions in Nigeria continue to face serious challenges associated with inadequate infrastructure, weak ICT integration, insufficient funding, unstable electricity supply, and limited digital competencies among both staff and students (Oye et al., 2014; Bello & Muhammad, 2021; Usman et al., 2025).

Among the various LMS platforms utilized in higher education, Blackboard remains one of the most widely recognized and commercially established systems globally. Blackboard supports virtual

classrooms, online assessments, collaborative learning, content management, and learning analytics, thereby enabling institutions to improve instructional efficiency and learner participation (Dobre, 2015; Al-Hawari et al., 2021). Although Blackboard has achieved widespread adoption in Europe, North America, and parts of Asia, its utilization within African higher education institutions remains uneven due to infrastructural and institutional limitations. In Nigeria, Blackboard adoption has largely emerged through institutional ICT reforms, donor interventions, and TETFund-supported digitalization initiatives. Nevertheless, many institutions still operate at the level of partial implementation, where LMS use is largely restricted to uploading lecture materials and basic communication rather than comprehensive instructional integration (Chigozie-Okwum et al., 2018; Sulaiman & Abubakar, 2024; Orji et al., 2025). The adoption of LMS in Nigerian higher education has increased steadily over the last decade, especially after the COVID-19 pandemic exposed the vulnerability of traditional face-to-face instructional systems. Studies have shown that perceived usefulness, ease of use, and institutional support significantly influence LMS acceptance among students and academic staff in Nigerian universities (Yakubu et al., 2020; Itasanmi & Mampane, 2025; Shittu et al., 2025). However, the existing body of literature indicates that LMS implementation in Nigeria remains at an early or moderate stage due to persistent infrastructural deficits, inadequate internet access, poor policy enforcement, and low levels of digital literacy. More importantly, most extant studies on LMS adoption in Nigeria focus predominantly on universities, leaving a major empirical gap regarding federal polytechnics and TVET institutions where practical and technology-driven instruction is critically required.

In Southeast Nigeria, federal polytechnics are increasingly attempting to integrate digital learning systems into their academic operations in line with broader national objectives for ICT-driven education. Institutions such as Federal Polytechnic Oko, Federal Polytechnic Nekede, and Akanu Ibiam Federal Polytechnic Unwana have initiated varying levels of ICT integration and LMS deployment. However, the extent to which Blackboard LMS has influenced TVET delivery effectiveness within these institutions remains insufficiently explored in empirical literature. Existing evidence suggests that where LMS platforms exist, their utilization often remains superficial, characterized by minimal integration into practical instruction, learner engagement, and assessment innovation. Consequently, the transformative potential of Blackboard-powered TVET delivery has not been fully realized within Nigerian polytechnics. Against this backdrop, this study examines Blackboard-powered TVET delivery in selected federal polytechnics in Southeast Nigeria, with emphasis on evaluating the extent of LMS adoption, utilization patterns, instructional effectiveness, and implementation challenges. The study seeks to provide empirical evidence capable of informing educational policy, strengthening ICT integration, and promoting technology-driven transformation within Nigeria's TVET sector. By focusing specifically on federal polytechnics in Southeast Nigeria, the study contributes to the growing discourse on digital transformation in higher education while addressing the persistent research gap on LMS adoption within the Nigerian polytechnic and TVET context.

Statement of the Problem

The increasing global transition toward digital and technology-driven education has positioned Learning Management Systems (LMS) as critical tools for improving instructional delivery, learner engagement, academic flexibility, and institutional efficiency in higher education. In Technical and Vocational Education and Training (TVET), LMS platforms are particularly important because they support

competency-based instruction, collaborative learning, digital assessment, and flexible access to technical knowledge required in modern labour markets. Despite these advantages, the integration of LMS into TVET delivery within many Nigerian federal polytechnics remains limited and inconsistent.

In several federal polytechnics in Southeast Nigeria, Blackboard Learning Management System (LMS) has been introduced as part of institutional ICT reforms and digital learning initiatives. However, evidence from practice suggests that the platform is not being optimally utilized for comprehensive instructional delivery. In many cases, Blackboard usage appears restricted to basic functions such as uploading lecture notes and disseminating information, while critical features such as interactive learning, online assessment, virtual collaboration, learner analytics, and blended instructional delivery remain underutilized. This situation raises concerns regarding the actual effectiveness of Blackboard-powered TVET delivery in enhancing teaching quality, practical learning experiences, and student engagement within the polytechnic system.

The persistence of infrastructural deficits, unstable internet connectivity, inadequate ICT facilities, irregular electricity supply, weak institutional policy enforcement, and limited digital competencies among lecturers and students further complicates effective LMS implementation in Nigerian polytechnics. Consequently, despite substantial investments in ICT integration and digital education initiatives by stakeholders such as the Federal Government, TETFund, and institutional managements, the expected transformation in TVET delivery has not been fully achieved.

More importantly, there remains limited empirical evidence on the extent of Blackboard LMS adoption and its implications for TVET delivery within federal polytechnics in Southeast Nigeria. Existing studies on LMS adoption in Nigeria have largely focused on conventional universities, with minimal attention given to polytechnics and the specialized nature of TVET instruction. Furthermore, many available studies emphasize intention to adopt LMS rather than actual utilization patterns, instructional effectiveness, and implementation challenges within real institutional contexts. This creates a significant knowledge gap in understanding how Blackboard LMS is influencing teaching and learning outcomes in federal polytechnics.

It is against this background that this study seeks to evaluate Blackboard-powered TVET delivery in selected federal polytechnics in Southeast Nigeria by examining the extent of LMS adoption, assessing its influence on teaching and learning effectiveness, and identifying the institutional and technological challenges affecting its effective utilization. The study is therefore necessary to generate empirical evidence capable of informing educational policy, strengthening ICT integration strategies, and enhancing digital transformation within Nigeria's TVET system.

Objectives of the Study

The main objective of this study is to evaluate Blackboard-powered Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria.

Specifically, the study seeks to:

1. examine the extent of Blackboard Learning Management System (LMS) adoption and utilization in selected federal polytechnics in Southeast Nigeria;
2. assess the influence of Blackboard LMS on teaching effectiveness and learning outcomes in TVET programmes within the selected institutions; and

3. identify the infrastructural, technological, and institutional challenges affecting effective Blackboard LMS implementation in the selected federal polytechnics.

Research Hypotheses

The following alternate hypotheses guided the study and were tested at 0.05 level of significance:

1. **H₁:** There was a significant relationship between Blackboard Learning Management System (LMS) adoption and effective Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria.
2. **H₂:** Blackboard LMS utilization significantly influenced teaching effectiveness and learning outcomes in TVET programmes within the selected federal polytechnics.
3. **H₃:** Infrastructural, technological, and institutional challenges significantly affected effective Blackboard LMS implementation in selected federal polytechnics in Southeast Nigeria.

Review of Related Literature

Conceptual Clarifications

Learning Management Systems (LMS)

Learning Management Systems (LMS) are web-based digital platforms designed to facilitate the planning, delivery, management, monitoring, and evaluation of teaching and learning activities within educational institutions. LMS platforms integrate instructional content, communication channels, assessment tools, and academic analytics into a centralized virtual environment that enhances educational administration and instructional efficiency (Al-Marroof & Salloum, 2019; Deku et al., 2024). Common LMS platforms include Blackboard, Moodle, Canvas, Google Classroom, and Schoology, all of which support blended and online learning models.

Conceptually, LMS represents a paradigm shift from conventional teacher-centered instructional approaches toward learner-centered and technology-driven education. According to Educational Technology scholars, LMS facilitates flexible learning, asynchronous communication, collaborative engagement, and self-paced instruction, thereby expanding educational accessibility and participation. Gorshenin (2018) further conceptualizes LMS as evolving digital ecosystems that transcend ordinary course management functions by supporting adaptive learning, institutional coordination, learning analytics, and data-driven academic decision-making.

The significance of LMS became more pronounced during the COVID-19 pandemic when educational institutions globally adopted virtual learning systems to sustain academic continuity. Consequently, LMS has become central to digital transformation policies in higher education institutions worldwide. Effective LMS integration has been associated with improved learner engagement, enhanced instructional flexibility, efficient assessment management, and stronger academic collaboration (Zanjani et al., 2017).

Technical and Vocational Education and Training (TVET)

Technical and Vocational Education and Training (TVET) refers to educational programmes designed to equip learners with practical, technical, entrepreneurial, and occupational skills necessary for employment, innovation, and national development. UNESCO (2023) defines TVET as a comprehensive educational process that combines theoretical knowledge with practical competencies required for effective participation in the labour market.

TVET plays a strategic role in industrial development, poverty reduction, youth empowerment, and economic transformation, particularly in developing economies. In Nigeria, TVET is delivered primarily

through polytechnics, monotechnics, technical colleges, and vocational training institutions supervised by the National Board for Technical Education (NBTE). The primary objective of TVET is to produce technically competent manpower capable of supporting industrial productivity and technological advancement.

Despite its developmental relevance, TVET delivery in Nigeria continues to face major challenges including inadequate infrastructure, obsolete instructional facilities, insufficient funding, poor industry linkage, and weak integration of digital technologies into instructional processes. These challenges have negatively affected instructional quality, practical learning experiences, and graduate employability within the Nigerian TVET sector.

Blackboard Learning Management System

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Blackboard is one of the most widely adopted commercial LMS platforms globally. Developed to support online and blended learning environments, Blackboard provides integrated tools for virtual classrooms, content management, communication, collaborative learning, online assessment, grading, and learner analytics (Dobre, 2015). Blackboard enables institutions to organize instructional materials, facilitate lecturer-student interaction, monitor academic participation, and manage digital assessment processes within a centralized system.

Globally, Blackboard has achieved widespread acceptance in universities and higher education institutions across Europe, North America, and Asia due to its advanced instructional capabilities and institutional management features. However, its adoption within African higher education institutions remains relatively uneven because of infrastructural deficits, limited institutional readiness, and inadequate ICT support systems.

In Nigeria, Blackboard LMS adoption has largely emerged through institutional digitalization initiatives, TETFund-supported ICT interventions, and post-COVID educational reforms. Nevertheless, many institutions still utilize Blackboard at a surface level, mainly for uploading lecture materials and disseminating announcements rather than fully integrating the system into instructional delivery and competency-based learning processes.

Thematic Review of Literature

Global Trends in LMS Adoption and Digital Transformation in Education

The global educational landscape has witnessed increasing digital transformation driven by rapid advancements in ICT and internet technologies. LMS platforms have become central instruments for facilitating blended learning, online instruction, and digital collaboration in higher education institutions. According to UNESCO (2023), over 90% of universities in developed countries currently operate some form of LMS to support academic delivery, assessment, and institutional management.

The COVID-19 pandemic significantly accelerated the adoption of LMS across educational institutions globally. During the pandemic, universities and colleges rapidly transitioned from traditional face-to-face instruction to virtual learning systems to ensure academic continuity. This transformation reinforced the importance of LMS in enhancing instructional flexibility, learner accessibility, and educational resilience. Zanjani et al. (2017) argue that effective LMS implementation improves learner engagement, collaborative learning, and academic performance by promoting interactive and student-centered instruction. Similarly, Al-Marouf and Salloum (2019) observed that perceived usefulness, ease of use, and institutional support significantly influence continuous LMS utilization among students and lecturers.

Despite the increasing global adoption of LMS, several challenges remain evident. Digital inequality, limited digital literacy, user resistance, cybersecurity concerns, and technological fatigue continue to affect effective LMS implementation even in advanced educational systems. These concerns demonstrate that digital transformation in education requires not only technological infrastructure but also institutional readiness, continuous training, and sustainable policy support.

LMS Adoption in Developing Countries

In developing countries, LMS adoption remains uneven and highly dependent on infrastructural readiness, internet accessibility, institutional funding, and government support. Although many developing nations have embraced digital education reforms, implementation challenges continue to undermine effective LMS integration.

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Gorshenin (2018) contends that many institutions in developing contexts remain at the “implementation without integration” stage, where LMS platforms exist but are not effectively embedded into mainstream instructional processes. In many African countries, LMS deployment is often constrained by inadequate electricity supply, poor internet connectivity, insufficient ICT facilities, and limited technical support systems.

UNESCO-UNEVOC (2023) emphasizes that digital transformation within Sub-Saharan African education systems remains slow because of infrastructural limitations and weak institutional preparedness. The report further notes that many institutions lack sustainable ICT policies and sufficient funding for continuous LMS maintenance and staff training.

Furthermore, digital literacy gaps among lecturers and students continue to affect effective utilization of LMS in developing countries. In many institutions, users lack adequate competencies required for interactive online instruction, digital assessment, and collaborative learning. Consequently, LMS usage often remains restricted to basic administrative and communication functions rather than comprehensive pedagogical integration.

LMS Adoption in Nigerian Higher Education

The adoption of LMS within Nigerian higher education institutions has increased significantly over the last decade, particularly following the COVID-19 pandemic. Nigerian universities and polytechnics increasingly recognize the importance of digital learning technologies for sustaining academic activities and improving instructional delivery.

However, empirical evidence indicates that LMS adoption in Nigeria remains largely moderate and inconsistent across institutions. Yakubu et al. (2020) found that perceived usefulness, ease of use, institutional support, and technological accessibility significantly influence LMS adoption among Nigerian university students. Nevertheless, the study revealed that poor internet access, inadequate ICT infrastructure, and insufficient training continue to hinder effective LMS utilization.

Similarly, Oye et al. (2014) observed that Nigerian tertiary institutions experience significant challenges in integrating ICT into teaching and learning because of infrastructural inadequacies and limited digital competencies among lecturers. These limitations have contributed to low institutional readiness for sustainable LMS implementation.

Within Nigerian polytechnics, LMS integration appears even more limited despite increasing emphasis on digital transformation in TVET delivery. Many polytechnics still rely predominantly on traditional instructional approaches characterized by face-to-face lectures, manual assessment systems, and limited

use of digital instructional technologies. Where LMS platforms exist, utilization often remains superficial and inconsistent.

The uneven adoption of LMS across Nigerian tertiary institutions reflects broader structural problems within the country's educational system, including inadequate funding, unstable electricity supply, weak ICT policy implementation, and insufficient staff development programmes.

Blackboard LMS and TVET Delivery

The integration of Blackboard LMS into TVET delivery has significant implications for competency-based education, practical learning, and workforce development. TVET programmes require interactive, practice-oriented, and technology-driven instructional approaches capable of preparing students for modern industrial and digital work environments.

Blackboard LMS supports TVET delivery through virtual demonstrations, digital simulations, collaborative learning, online assessment, and remote instructional access. These features enhance instructional flexibility and improve opportunities for continuous learning beyond conventional classroom environments.

According to UNESCO (2023), digital technologies are essential for modernizing TVET systems and aligning technical education with contemporary labour market demands. LMS platforms facilitate competency-based assessment, industry collaboration, and technology-driven instructional innovation necessary for effective TVET transformation.

Despite these potentials, Nigerian polytechnics continue to experience challenges in integrating Blackboard LMS into technical instruction. Oye et al. (2014) argue that poor infrastructure, inadequate training, and weak ICT support systems limit effective technology integration in Nigerian technical education institutions.

Sulaiman and Abubakar (2024) found that LMS utilization positively influences teaching effectiveness, learner engagement, and academic communication within Nigerian tertiary institutions. However, the study observed that many institutions utilize LMS primarily for uploading lecture notes and sharing announcements rather than for comprehensive instructional innovation and learner-centered engagement. The persistence of these limitations suggests that Blackboard-powered TVET delivery in Nigeria has not yet achieved its transformative potential despite increasing institutional investments in ICT integration.

Empirical Review

Several empirical studies have examined LMS adoption and digital learning within higher education institutions globally and in Nigeria.

Yakubu et al. (2020) conducted a survey study on factors influencing students' acceptance of e-learning systems in Nigerian universities. The study found that perceived usefulness, ease of use, and institutional support significantly determine LMS adoption among students. However, the study focused exclusively on universities and did not examine federal polytechnics or TVET institutions.

Sulaiman and Abubakar (2024) employed a mixed-methods approach to investigate LMS and teaching effectiveness in Nigerian tertiary institutions. Their findings revealed that LMS utilization improves instructional delivery, academic communication, and learner participation. Nevertheless, the study did not specifically examine Blackboard LMS or TVET-focused instructional delivery.

Oye et al. (2014) examined ICT integration challenges in Nigerian tertiary institutions using survey methodology. The study found that inadequate ICT infrastructure, poor internet access, and insufficient

training significantly hinder digital learning adoption. However, the study concentrated broadly on ICT usage without focusing specifically on Blackboard LMS implementation.

At the global level, UNESCO-UNEVOC (2023) conducted policy-based analysis on digital transformation in TVET systems. The report concluded that digital learning technologies significantly improve instructional accessibility and workforce readiness. However, the report lacked empirical data from Nigerian polytechnics and did not address Blackboard-specific implementation challenges.

Gorshenin (2018) conceptualized LMS as digital ecosystems within higher education institutions and emphasized their role in enhancing institutional efficiency and adaptive learning. While the study provided important theoretical insights, it did not sufficiently examine African educational contexts or TVET institutions.

The reviewed empirical studies collectively demonstrate that LMS adoption positively influences educational delivery when effectively implemented. However, the studies also reveal persistent challenges related to infrastructure, digital competencies, institutional support, and policy implementation. More importantly, the existing body of literature shows that empirical studies focusing specifically on Blackboard LMS adoption within Nigerian federal polytechnics and TVET environments remain highly limited.

Summary of Literature and Gap in Literature

The reviewed literature demonstrates that Learning Management Systems have become central to digital transformation within global higher education systems. LMS platforms such as Blackboard enhance instructional flexibility, learner engagement, assessment management, and collaborative learning. The literature further reveals that TVET institutions globally are increasingly integrating digital technologies into instructional delivery to improve workforce readiness and competency-based education.

Thematic and empirical evidence indicates that LMS adoption within Nigerian higher education institutions remains moderate and uneven because of infrastructural deficits, weak institutional support, inadequate digital competencies, and limited policy implementation. Existing studies consistently show that effective LMS utilization improves teaching effectiveness and learner participation. However, most studies focus predominantly on universities, leaving federal polytechnics and TVET institutions relatively underexplored.

The literature also reveals that Blackboard LMS remains under-researched within the Nigerian educational context compared to open-source platforms such as Moodle and Google Classroom. Furthermore, existing studies largely emphasize LMS adoption intention rather than actual utilization patterns, instructional effectiveness, and implementation challenges within real institutional environments.

Another major gap identified in the literature is the absence of sufficient empirical studies focusing specifically on Blackboard-powered TVET delivery in federal polytechnics in Southeast Nigeria. Existing studies have not adequately examined how Blackboard LMS influences teaching effectiveness, learner engagement, and competency-based instruction within Nigerian TVET institutions.

Therefore, this current study becomes significant because it seeks to fill these identified gaps by providing empirical evidence on Blackboard LMS adoption, utilization, instructional effectiveness, and implementation challenges within selected federal polytechnics in Southeast Nigeria. The study will contribute to knowledge by expanding the literature on digital transformation in TVET education while also providing evidence-based recommendations for policymakers, institutional administrators, Tertiary

Education Trust Fund, the National Board for Technical Education, and the Federal Ministry of Education on strengthening ICT integration and sustainable LMS implementation within Nigerian polytechnics.

Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM) developed by Fred Davis in 1989. The Technology Acceptance Model is one of the most widely used theoretical frameworks for explaining users' acceptance, adoption, and utilization of information technologies within organizational and educational environments. The theory was originally developed to explain how users come to accept and use technological systems based on their perceptions of usefulness and ease of use.

According to Davis (1989), two primary determinants influence an individual's intention to adopt and utilize a technological innovation:

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1. **Perceived Usefulness (PU)** – the degree to which a person believes that using a particular technology will enhance job performance or learning outcomes.
2. **Perceived Ease of Use (PEOU)** – the degree to which a person believes that using the technology will be free from difficulty or excessive effort.

The theory posits that when users perceive a technology as useful and easy to use, they are more likely to develop positive attitudes toward it, leading to actual adoption and continuous utilization. Over the years, TAM has been extensively applied in studies relating to e-learning systems, digital education, online learning environments, and Learning Management Systems (LMS) adoption in higher education institutions.

The relevance of TAM to this study lies in its ability to explain the factors influencing Blackboard Learning Management System (LMS) adoption and utilization within Technical and Vocational Education and Training (TVET) institutions. In the context of selected federal polytechnics in Southeast Nigeria, lecturers, students, and ICT personnel are more likely to utilize Blackboard LMS effectively if they perceive the system as beneficial to teaching effectiveness, learner engagement, assessment efficiency, and instructional flexibility. Similarly, if users perceive Blackboard as easy to operate and compatible with their digital competencies, the likelihood of sustained utilization increases significantly.

Empirical studies have demonstrated the applicability of TAM in educational technology research. Yakubu et al. (2020) found that perceived usefulness, ease of use, and institutional support significantly influence e-learning acceptance among Nigerian university students. Similarly, Al-Marroof and Salloum (2019) observed that users' perceptions regarding usefulness and ease of use strongly determine continuous LMS usage in higher education environments. These findings support the argument that technology acceptance variables remain central to understanding LMS adoption patterns in Nigerian tertiary institutions.

The theory is particularly relevant to this study because the identified challenges affecting Blackboard LMS implementation in Nigerian polytechnics, such as inadequate ICT infrastructure, poor internet connectivity, insufficient digital skills, and weak institutional support, directly influence users' perceptions of usefulness and ease of use. For instance, when internet access is unstable or institutional support is weak, users may perceive Blackboard LMS as difficult to use or ineffective for instructional delivery, thereby reducing adoption and utilization levels.

Furthermore, TAM provides a suitable framework for explaining variations in Blackboard LMS utilization among lecturers, students, and ICT personnel within the selected federal polytechnics. The theory helps

to establish the relationship between institutional conditions, user perceptions, and actual LMS usage behavior in TVET delivery.

The adoption of TAM therefore provides this study with a strong theoretical basis for examining the extent of Blackboard LMS adoption, its influence on teaching and learning effectiveness, and the institutional factors affecting its utilization in federal polytechnics in Southeast Nigeria. The theory also offers an analytical framework for understanding how technology acceptance influences digital transformation within the Nigerian TVET sector.

Methodology

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This study adopted a descriptive survey research design to examine Blackboard Learning Management System (LMS) adoption and its implications for Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria. The design was considered appropriate because it enabled the researcher to collect and analyze quantitative data relating to respondents' perceptions, utilization patterns, instructional effectiveness, and implementation challenges without manipulating the study variables. According to Creswell and Creswell (2018), descriptive survey design is suitable for studies involving attitudes, practices, and trends within a defined population.

The study was conducted in Southeast Nigeria, which comprises Abia, Anambra, Ebonyi, Enugu, and Imo States. Although each state has a federal polytechnic, the researcher purposively selected Federal Polytechnic Oko, Federal Polytechnic Nekede, and Akanu Ibiam Federal Polytechnic Unwana because they are older, more established institutions with relatively advanced ICT integration and Blackboard LMS implementation structures. The newly established Federal Polytechnic Ngodo Isuochi and Federal Polytechnic Ohodo were excluded because they may not yet provide adequate institutional and infrastructural grounds for the study.

The population of the study comprised 44,866 respondents, consisting of 3,275 lecturers, 71 ICT/e-learning personnel, and 41,520 students across the selected institutions. A sample size of 396 respondents was determined using Taro Yamane's (1967) formula at 0.05 level of significance:

$$n = \frac{N}{(1 + N(e))^2}$$

A multistage sampling procedure involving purposive, stratified, and proportionate random sampling techniques was employed to ensure adequate representation of lecturers, ICT personnel, and students.

Data for the study were obtained from both primary and secondary sources. Primary data were collected using a structured questionnaire titled *Blackboard Learning Management System Adoption and TVET Delivery Questionnaire (BLMSATVETQ)*, while secondary data were sourced from scholarly journals, textbooks, institutional documents, conference papers, and publications from relevant educational agencies such as UNESCO and the National Board for Technical Education.

The instrument was validated by experts in Educational Technology, Measurement and Evaluation, and TVET/ICT integration. Reliability was established through a pilot study using Cronbach's Alpha reliability technique, with a coefficient threshold of 0.70 considered acceptable in line with Nunnally (1978).

Data were collected through direct administration of questionnaires with the assistance of trained research assistants. Retrieved data were coded and analyzed using Statistical Package for Social Sciences (SPSS)

version 25. Descriptive statistics such as mean and standard deviation were used to answer the research questions, while Independent Sample t-test and One-Way Analysis of Variance (ANOVA) were used to test the hypotheses at 0.05 level of significance.

Data Presentation and Discussion of Findings

This section presents the analysis and interpretation of data collected from respondents on Blackboard Learning Management System (LMS) adoption and Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria. The data were analyzed using mean and standard deviation to answer the research questions, while the hypotheses were tested using Independent Sample t-test and One-Way Analysis of Variance (ANOVA) at 0.05 level of significance.

A criterion mean of 2.50 was adopted for decision-making. Any item with a mean score of 2.50 and above was accepted, while items below 2.50 were rejected.

Response Rate

Out of the 396 copies of questionnaire administered, 371 copies were successfully retrieved and found valid for analysis, representing a response rate of 93.7%. The response rate was considered adequate and reliable for statistical analysis and generalization of findings.

However, during the field survey, many respondents, particularly ICT Directors, librarians, and ICT support personnel, expressed apprehension that their responses could be linked to institutional access to Tertiary Education Trust Fund ICT intervention allocations and Blackboard LMS intervention assessments. This concern created a tendency toward cautious and institutionally protective responses among some categories of respondents. To minimize this limitation, anonymity and confidentiality were emphasized throughout the data collection process.

Analysis of Research Question One: What is the extent of Blackboard LMS adoption and utilization in selected federal polytechnics in Southeast Nigeria?

S/N	Items	Mean	SD	Decision
1	Blackboard LMS platform is available in my institution	3.42	0.71	Accepted
2	Staff and students have been onboarded on the Blackboard LMS platform	3.16	0.79	Accepted
3	Lecturers regularly utilize Blackboard LMS for instructional delivery	2.47	0.88	Rejected
4	Students regularly access Blackboard LMS for learning activities	2.31	0.94	Rejected
5	Blackboard LMS is effectively integrated into TVET instructional activities	2.18	0.96	Rejected
6	Blackboard LMS is frequently used for online assessments and collaborative learning	2.22	0.91	Rejected
7	Grand Mean	2.63	0.87	Accepted

The findings in Table 1 revealed a grand mean score of 2.63, indicating the apparent existence of Blackboard LMS adoption within the selected federal polytechnics. However, a critical analysis of the item-by-item responses showed that actual utilization remained very low despite institutional onboarding exercises and formal adoption structures.

While respondents agreed that Blackboard LMS platforms existed within the institutions and that staff and students had been onboarded, respondents disagreed that lecturers and students regularly utilized the platforms for teaching, learning, assessment, and collaborative instructional activities. This indicates that Blackboard LMS adoption within the selected institutions was largely nominal and administrative rather than functional and pedagogically integrated.

Discussion of Findings

The findings revealed a major disconnect between institutional adoption and actual utilization of Blackboard LMS in the selected federal polytechnics. Although Blackboard LMS infrastructure and onboarding exercises existed in most institutions due to interventions supported by Tertiary Education Trust Fund, the system was not effectively integrated into teaching and learning processes.

Field observations and responses obtained during the study showed that many institutions prioritized compliance-driven onboarding of staff and students mainly to satisfy institutional requirements for ICT intervention access rather than ensuring effective pedagogical integration and utilization. In many cases, ICT Directors and librarians onboarded staff and students who lacked the digital competencies, institutional orientation, internet access, or technical support required for effective LMS utilization.

The findings further revealed that many students who were officially onboarded into Blackboard LMS platforms did not possess functional access credentials, internet-enabled devices, or regular internet connectivity necessary for sustained engagement with the system. Consequently, the institutions demonstrated what may be described as “symbolic adoption” rather than effective utilization.

The findings also indicated that the Blackboard LMS training programmes sponsored through TETFund interventions had not produced the desired outcomes because the trainings were largely conducted through generalized virtual sessions without adequate consideration of institution-specific infrastructural realities, digital literacy levels, technical capacities, and operational challenges. As a result, many lecturers and students remained unable to effectively utilize the platform beyond basic login activities and uploading of lecture materials.

These findings corroborate Gorshenin (2018), who argued that many institutions in developing countries remain at the “implementation without integration” stage where LMS platforms exist but are not effectively embedded into mainstream instructional delivery. The findings also support Oye et al. (2014), who identified inadequate infrastructure, poor internet access, and insufficient digital competencies as major barriers to technology integration within Nigerian tertiary institutions. Similarly, the findings align with UNESCO-UNEVOC (2023), which emphasized that weak institutional preparedness and infrastructural limitations continue to hinder digital transformation in African educational systems.

Research Question Two

What is the influence of Blackboard LMS on teaching effectiveness and learning outcomes in TVET programmes?

S/N	Items	Mean	SD	Decision
1	Blackboard LMS has improved access to instructional materials	3.08	0.77	Accepted
2	Blackboard LMS enhances flexibility in teaching and learning	2.91	0.82	Accepted
3	Blackboard LMS improves communication between lecturers and students	2.74	0.88	Accepted

S/N	Items	Mean	SD	Decision
4	Blackboard LMS enhances practical and collaborative learning in TVET programmes	2.36	0.93	Rejected
5	Blackboard LMS significantly improves learner engagement and participation	2.41	0.91	Rejected
6	Blackboard LMS has significantly transformed instructional delivery in my institution	2.19	0.96	Rejected
7	Grand Mean	2.62	0.88	Accepted

The findings in Table 2 revealed a grand mean score of 2.62, indicating that Blackboard LMS had moderate positive influence on teaching effectiveness and learning outcomes. However, the findings also showed that the transformative potential of the system had not been fully realized within the selected federal polytechnics.

Respondents agreed that Blackboard LMS improved access to instructional materials and enhanced communication and flexibility in learning. However, respondents disagreed that the system had significantly transformed instructional delivery, practical learning, learner engagement, or collaborative learning activities within TVET programmes.

Discussion of Findings

The findings suggest that Blackboard LMS contributed modestly to instructional flexibility and access to learning resources, particularly during periods requiring blended or remote learning support. However, the system had not significantly transformed competency-based TVET instruction within the selected institutions.

The study revealed that most lecturers utilized Blackboard LMS mainly for uploading lecture notes, announcements, and assignments rather than for practical simulations, virtual demonstrations, collaborative learning, competency-based assessment, or interactive instructional engagement expected within modern TVET systems.

This limitation was strongly associated with inadequate ICT infrastructure, unstable electricity supply, weak internet connectivity, poor institutional support, and insufficient digital literacy among lecturers and students. The findings therefore suggest that Blackboard LMS implementation within the selected institutions remained largely administrative rather than transformational.

These findings corroborate Sulaiman and Abubakar (2024), who found that LMS utilization in Nigerian tertiary institutions positively influenced academic communication and instructional delivery but remained limited in achieving comprehensive instructional transformation. The findings also support UNESCO (2023), which emphasized that digital technologies can only effectively transform TVET systems where adequate institutional support, infrastructure, and user competencies exist.

Furthermore, the findings validate the assumptions of the Technology Acceptance Model developed by Fred Davis (1989), which posits that perceived usefulness and perceived ease of use significantly influence technology adoption and utilization. Where users encounter infrastructural barriers and operational difficulties, sustained utilization becomes limited.

Research Question Three

What are the challenges affecting effective Blackboard LMS implementation in selected federal polytechnics in Southeast Nigeria?

S/N	Items	Mean	SD	Decision
1	Inadequate ICT infrastructure affects Blackboard LMS implementation	3.56	0.61	Accepted
2	Poor internet connectivity limits effective LMS utilization	3.61	0.58	Accepted
3	Irregular electricity supply affects LMS access and usage	3.49	0.67	Accepted
4	Generalized virtual training programmes are inadequate for institution-specific LMS implementation	3.38	0.73	Accepted
5	Many staff and students lack adequate digital literacy for effective LMS utilization	3.27	0.76	Accepted
6	Institutional onboarding exercises often prioritize compliance over effective utilization	3.14	0.81	Accepted
7	Grand Mean	3.41	0.69	Accepted

The findings in Table 3 revealed a grand mean score of 3.41, indicating that infrastructural, institutional, and operational challenges significantly affected effective Blackboard LMS implementation within the selected federal polytechnics.

Discussion of Findings

The findings revealed that inadequate ICT infrastructure, poor internet connectivity, unstable electricity supply, limited digital literacy, and ineffective training models constituted major barriers to Blackboard LMS implementation in the selected institutions.

Respondents strongly indicated that the virtual training programmes organized under TETFund-supported Blackboard LMS interventions were too generalized and failed to address institution-specific realities such as bandwidth limitations, device accessibility, operational culture, technical support gaps, and varying levels of digital readiness across institutions.

The findings further revealed that many institutions focused more on demonstrating visible adoption structures for compliance and intervention purposes than on ensuring actual instructional utilization and sustainability. Consequently, Blackboard LMS implementation remained weak, fragmented, and poorly institutionalized across many federal polytechnics in Southeast Nigeria.

The findings support Oye et al. (2014), who identified infrastructural inadequacies and insufficient ICT competencies as major obstacles to technology integration in Nigerian tertiary institutions. The findings also align with UNESCO-UNEVOC (2023), which reported that digital transformation within African TVET institutions continues to be undermined by infrastructural deficits, inadequate institutional preparedness, and weak policy implementation mechanisms.

Test of Hypotheses

Hypothesis One

There is a significant relationship between Blackboard LMS adoption and effective TVET delivery in selected federal polytechnics in Southeast Nigeria.

Variables	N	r-value	p-value	Decision
Blackboard LMS Adoption and TVET Delivery	371	0.593	0.001	Significant

The result revealed a significant relationship between Blackboard LMS adoption and effective TVET delivery ($r = 0.593$, $p < 0.05$). Therefore, the hypothesis was accepted.

Hypothesis Two

Blackboard LMS utilization significantly influences teaching effectiveness and learning outcomes in TVET programmes.

Variables	N	t-value	p-value	Decision
Blackboard LMS Utilization and Teaching Effectiveness	371	4.216	0.003	Significant

The result indicated that Blackboard LMS utilization significantly influenced teaching effectiveness and learning outcomes in TVET programmes. Therefore, the hypothesis was accepted.

Hypothesis Three

Infrastructural, technological, and institutional challenges significantly affect effective Blackboard LMS implementation.

Variables	N	F-value	p-value	Decision
Implementation Challenges and Blackboard LMS Effectiveness	371	5.972	0.001	Significant

The result showed that infrastructural, technological, and institutional challenges significantly affected effective Blackboard LMS implementation within the selected federal polytechnics. Therefore, the hypothesis was accepted.

Summary of Findings

The study revealed that Blackboard LMS adoption in selected federal polytechnics in Southeast Nigeria was largely apparent rather than functionally institutionalized. Although Blackboard LMS platforms existed and onboarding exercises had been conducted across institutions, actual utilization for teaching, learning, assessment, and collaborative engagement remained low.

The findings further showed that TETFund-supported Blackboard LMS training programmes had not delivered the desired outcomes because the trainings were largely generalized and virtual without adequate consideration of institution-specific infrastructural and operational challenges. Many lecturers and students who were officially onboarded lacked the technical capacity, internet access, and operational support required for effective LMS utilization.

The study also established that Blackboard LMS moderately improved access to instructional materials and communication within institutions but had not significantly transformed practical TVET instructional delivery. Major challenges identified included inadequate ICT infrastructure, poor internet connectivity, unstable electricity supply, weak institutional preparedness, insufficient digital literacy, and compliance-driven implementation culture.

Overall, the findings suggest that Blackboard LMS implementation within federal polytechnics in Southeast Nigeria remains at a transitional and largely symbolic stage requiring stronger institutional commitment, infrastructure development, localized capacity-building programmes, and sustainable implementation strategies for meaningful digital transformation in TVET delivery.

Conclusion

This study investigated Blackboard Learning Management System (LMS) adoption and its implications for Technical and Vocational Education and Training (TVET) delivery in selected federal polytechnics in Southeast Nigeria. The study established that although Blackboard LMS platforms have been introduced across many federal polytechnics through interventions supported by Tertiary Education Trust Fund, actual utilization across the institutions remains considerably low despite visible onboarding exercises and institutional claims of adoption.

The findings revealed that Blackboard LMS implementation within the selected institutions is largely characterized by superficial or compliance-driven adoption rather than meaningful instructional integration. While many lecturers and students were officially onboarded onto the platforms, a significant number lacked the digital competencies, internet access, technical support, and operational understanding required for effective utilization. Consequently, Blackboard LMS usage remained largely restricted to basic administrative functions such as uploading lecture notes and assignments rather than supporting practical, collaborative, and competency-based TVET instruction.

The study further established that the virtual Blackboard LMS training programmes facilitated through TETFund interventions did not adequately address institution-specific infrastructural realities, operational limitations, and digital readiness gaps within the institutions. The generalized nature of the trainings limited their effectiveness, particularly in institutions facing severe challenges relating to internet connectivity, electricity supply, ICT infrastructure, and technical support services.

The findings also showed that Blackboard LMS possesses significant potential for improving access to instructional materials, enhancing communication between lecturers and students, and promoting flexible learning opportunities within TVET programmes. However, these potentials have not been fully realized because of persistent infrastructural deficiencies, weak institutional preparedness, inadequate funding, and poor digital literacy among users.

The study therefore concluded that Blackboard LMS adoption within federal polytechnics in Southeast Nigeria remains largely transitional and symbolic, with institutional presence existing without corresponding pedagogical effectiveness and sustainable utilization. Meaningful digital transformation in TVET delivery will require a shift from mere onboarding and compliance-based implementation toward context-sensitive, infrastructure-driven, and user-centered LMS integration capable of addressing the peculiar realities of Nigerian polytechnic education.

Recommendations

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

1. Tertiary Education Trust Fund should redesign its Blackboard LMS intervention and training programmes to accommodate institution-specific realities, infrastructural conditions, and varying levels of digital readiness within federal polytechnics. Training programmes should move beyond generalized virtual sessions to include practical, hands-on, and institution-based capacity-building workshops.
2. Management of federal polytechnics should prioritize the provision of adequate ICT infrastructure, including stable internet connectivity, functional computer laboratories, campus-wide broadband access, alternative power supply systems, and accessible digital learning facilities necessary for effective Blackboard LMS implementation.

3. Polytechnic administrations should establish sustainable technical support and digital help-desk units within their ICT directorates to provide continuous assistance, troubleshooting services, and operational guidance to lecturers and students utilizing Blackboard LMS platforms.
4. Lecturers, ICT personnel, librarians, and students should undergo continuous digital literacy and e-learning competency training to improve their capacity for effective Blackboard LMS utilization in teaching, learning, assessment, and collaborative instructional activities.
5. Blackboard LMS onboarding exercises should emphasize practical utilization and user competence rather than mere institutional compliance or access to intervention funds. Institutions should develop monitoring and evaluation mechanisms to assess actual utilization levels and instructional effectiveness of the LMS platforms.
6. Federal polytechnics should integrate Blackboard LMS into mainstream instructional delivery through institutional policies that encourage blended learning, digital assessment, online collaboration, and competency-based TVET instruction across departments and programmes.
7. The National Board for Technical Education should develop clear policy guidelines and implementation benchmarks for LMS-driven TVET delivery in Nigerian polytechnics to ensure standardization, accountability, and sustainability in digital learning initiatives.
8. Government and relevant educational stakeholders should increase funding for digital education infrastructure and institutional ICT development to support effective implementation of Blackboard LMS and other e-learning systems within Nigerian tertiary institutions.
9. Future LMS intervention programmes should incorporate periodic institutional needs assessments to identify peculiar operational challenges affecting implementation within individual polytechnics before deployment of digital learning initiatives.
10. Students should be adequately supported through subsidized internet access schemes, device support initiatives, and user orientation programmes to enhance meaningful participation and sustained engagement with Blackboard LMS platforms within the polytechnic system.

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