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Blended Learning Models and Approaches in North Central Colleges of Education, Nigeria: Implementation and Perceived Effectiveness

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Highlights:

Examines across technology access, readiness, model suitability, perceived effectiveness and implementation challenges using blended learning

Respondents reported moderate technology access and high readiness for blended learning.

Observes connectivity, ICT infrastructure, training, institutional support and investment remained as the major challenges.

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Abstract: Blended learning combines face-to-face instruction with digitally mediated learning and has become increasingly relevant to teacher education. This study investigated blended learning models and approaches in selected Colleges of Education in North Central Nigeria, focusing on technology access and internet connectivity, readiness of lecturers and students, suitability of blended learning models, perceived effectiveness, and implementation challenges. A descriptive survey design was adopted. The population comprised 1,200 lecturers and students in 11 selected Colleges of Education, from which 300 respondents were selected through purposive selection of institutions and proportionate random sampling. Data were collected using a 25-item Blended Learning Models and Approaches Questionnaire (BLMAQ), validated by experts in Educational Technology, Measurement and Evaluation, and Teacher Education. The reported overall Cronbach's alpha coefficient was .94. Data were analysed using mean, standard deviation and one-way analysis of variance. Respondents reported moderate technology access and connectivity (M = 3.46), high readiness (M = 3.97), favourable ratings for blended learning models (provisional cluster M = 4.05), high perceived effectiveness (M = 4.08), and substantial implementation challenges (M = 4.13). Flipped classrooms, online discussions, multimedia-based instruction, Learning Management Systems and integrated face-to-face/online instruction were generally rated suitable. The reported ANOVA showed no statistically significant difference in overall perceptions across participating institutions, $F(10, 289) = 1.214$, $p = .281$. The study concludes that blended learning is favourably perceived in the participating institutions, but sustainable implementation requires stronger digital infrastructure, reliable connectivity, continuous professional development and institutional support.

Keywords: Blended learning; teacher education; Colleges of Education; digital learning; ICT infrastructure; perceived effectiveness.

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Introduction

The rapid development of digital technologies has reshaped educational practice and increased the need for flexible instructional arrangements that combine classroom interaction with digitally mediated learning. Blended learning integrates face-to-face teaching with online or technology-mediated learning activities and provides opportunities for interaction, flexibility, self-directed learning, collaborative learning and access to instructional resources beyond scheduled classroom periods. However, the educational value of blended learning depends not simply on the presence of technology but on the quality of instructional design, learner engagement, technological conditions and institutional support (De Bruijn-Smolders & Prinsen, 2024; Istenič, 2024).

Teacher education institutions occupy a strategic position in preparing teachers who are expected to function effectively in technology-rich school environments. Colleges of Education in Nigeria therefore require learning environments that develop both pedagogical competence and practical digital skills. The expansion of technology-supported teaching following the COVID-19 disruption has further increased the need for flexible learning arrangements in teacher education. Nevertheless, the availability of digital devices or online platforms does not automatically translate into effective blended-learning implementation. Successful implementation requires appropriate instructional models, lecturer and student readiness, reliable connectivity, technical support, professional development and institutional commitment (Agim et al., 2025; Ganiyu & Olasedidun, 2024). Recent Nigerian evidence reinforces the importance of these conditions. Ganiyu and Olasedidun (2024) examined lecturers' competency and readiness for blended learning in Colleges of Education and highlighted the importance of lecturers' preparedness for effective implementation. Similarly, Agim et al. (2025) reported that personnel training and appropriate facilities were important for improving instructional delivery through blended learning among College of Education lecturers. Evidence from other Nigerian teacher-education settings has also identified infrastructure, connectivity, technical support and training as continuing concerns. For example, Ishola and Ogunrinbokun (2025) reported technical-support deficits, time constraints and related challenges affecting blended-learning adoption among pre-service teachers in a College of Education in Lagos State. These findings suggest that the implementation of blended learning requires attention to both human capacity and institutional conditions. Blended learning is also increasingly relevant because different models and approaches provide different possibilities for organising teaching and learning.

The flipped classroom, online discussions, multimedia-supported instruction, Learning Management Systems (LMS) and integrated face-to-face/online instruction can support different combinations of content delivery, interaction, collaboration, assessment and independent learning. Evidence from Nigerian Colleges of Education suggests that the suitability and outcomes of blended-learning approaches may depend on instructional design, learner characteristics, subject area and available institutional resources (Agim et al., 2025; Ganiyu & Olasedidun, 2024). More specifically, Okoronkwo et al. (2026), in a study involving pre-service mathematics teachers in Colleges of Education in North-Central Nigeria, reported differences in learning outcomes across rotational, flex and enriched-virtual blended-learning models. This reinforces the need to examine blended-learning models and approaches rather than treating blended learning as a single and uniform instructional strategy.

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Although blended learning has attracted increasing attention in Nigerian higher education and teacher education, the available evidence is not evenly distributed across institutions, geographical locations and dimensions of implementation. Existing studies have examined issues such as lecturer readiness, institutional preparedness, adoption, instructional outcomes and implementation challenges, but these dimensions are often investigated separately (Agim et al., 2025; Ganiyu & Olasedidun, 2024; Ishola & Ogunrinbokun, 2025; Okoronkwo et al., 2026).

Consequently, there is a need for a more integrated examination of the conditions under which blended learning is implemented in Colleges of Education, particularly in North Central Nigeria. Such evidence is important because Colleges of Education are central to teacher preparation, and the digital learning experiences provided during teacher education can contribute to the development of future teachers' competence and confidence in technology-supported instruction. Against this background, the present study examined technology access and internet connectivity, lecturer and student readiness, the suitability of blended-learning models and approaches, perceived effectiveness, and implementation challenges in selected Colleges of Education in North Central Nigeria. By examining these dimensions together, the study provides a broader picture of the institutional and user-related conditions surrounding blended-learning implementation in the selected institutions. The study is descriptive and perception-based; therefore, its findings concerning effectiveness are interpreted as respondents' perceptions of instructional effectiveness rather than causal evidence that blended learning improves academic achievement. Despite the growing adoption of technology-supported learning, the effective implementation of blended learning in many Colleges of Education may be constrained by inadequate ICT facilities, unreliable internet connectivity, insufficient technical support, limited professional development and uneven digital readiness among lecturers and students (Agim et al., 2025; Ishola & Ogunrinbokun, 2025; Olayiwola & Alimi, 2015). These conditions can make it difficult for institutions to move from occasional use of digital tools to systematic integration of face-to-face and online learning. Moreover, the existence of different blended-learning models raises questions about which approaches are considered suitable within particular institutional contexts and whether lecturers and students possess the readiness required to use them effectively (Ganiyu & Olasedidun, 2024; Okoronkwo et al., 2026).

The problem is therefore not merely whether blended learning is being used, but whether the technological infrastructure, human readiness, instructional models and institutional support required for meaningful implementation are available and adequate. Although Nigerian studies have provided useful evidence on selected aspects of blended learning, much of the evidence has focused on individual issues such as readiness, adoption, instructional outcomes or implementation challenges. Evidence that simultaneously considers technology access and connectivity, lecturer and student readiness, suitability of blended-learning models, perceived effectiveness and implementation challenges within Colleges of Education in North Central Nigeria remains comparatively limited. This creates an information gap for institutional managers and policymakers who require multidimensional evidence to identify priority areas for intervention.

Concept of Blended Learning

Blended learning refers to the purposeful integration of face-to-face teaching and digitally mediated learning rather than simply adding technology to conventional instruction. The

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central concern is the pedagogical relationship between the physical and digital components. Effective blended learning requires deliberate decisions about when activities should occur online, when they should occur face to face, how learners interact with content and peers, and how learning is assessed. Recent reviews emphasise that design quality, engagement, technology and institutional conditions jointly influence outcomes (De Bruijn-Smolders & Prinsen, 2024; Istenic, 2024).

Blended Learning Models and Approaches

Blended learning is not a single instructional method but an arrangement in which face-to-face teaching is deliberately combined with technology-mediated learning activities. Common blended-learning models and approaches include the flipped classroom, online discussions, multimedia-supported instruction, Learning Management Systems (LMS), and integrated face-to-face/online instruction. In the flipped classroom, selected instructional content is made available to learners before classroom sessions, allowing classroom time to be devoted more extensively to application, discussion, collaboration and problem-solving. Online discussions provide opportunities for synchronous or asynchronous interaction, while multimedia-supported instruction uses combinations of text, audio, video, animation, graphics and interactive resources to present learning content. Learning Management Systems provide an organised digital environment for distributing learning resources, communicating with learners, submitting assignments and supporting assessment. Integrated face-to-face/online instruction, on the other hand, deliberately connects physical classroom activities with online learning experiences to provide continuity between the two environments (Agim et al., 2025; Ganiyu & Olasedidun, 2024). Nigerian evidence suggests that these approaches are increasingly relevant to teacher education. Agim et al. (2025) found that lecturers in Colleges of Education considered personnel training and the provision of appropriate facilities necessary for improving instructional delivery through blended learning. Similarly, Ganiyu and Olasedidun (2024) examined lecturers' competency and blended learning in Colleges of Education and emphasised the importance of lecturers' preparedness for effective implementation. Earlier evidence from Colleges of Education in Southwestern Nigeria also showed that institutional preparedness for blended learning was closely related to the availability and adequacy of ICT facilities and infrastructure (Olayiwola & Alimi, 2015). These findings indicate that the selection of a blended-learning model cannot be separated from the technological and institutional conditions within which the model is implemented.

Recent Nigerian experimental evidence further demonstrates that different blended-learning models may produce different learning outcomes depending on the instructional design, subject area and learner characteristics. For instance, Okoronkwo et al. (2026) compared rotational, flex and enriched-virtual blended-learning models among pre-service mathematics teachers in Colleges of Education in North-Central Nigeria and reported differences in learning outcomes across the models. This finding reinforces the need to examine blended-learning approaches individually rather than treating blended learning as a single, homogeneous instructional strategy. It also suggests that the suitability of a particular model

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should be considered in relation to the content, learners, lecturers, available technologies and institutional context.

Readiness for Blended Learning

Readiness for blended learning refers to the extent to which lecturers, students and institutions possess the knowledge, skills, confidence, willingness and resources required to participate effectively in technology-supported learning. At the lecturer level, readiness encompasses digital competence, technological confidence, pedagogical knowledge and the ability to design and facilitate online and face-to-face learning activities. Student readiness includes digital literacy, confidence in using learning technologies, willingness to participate in online activities and the ability to manage learning tasks with a reasonable degree of independence. Institutional readiness involves the availability of ICT infrastructure, internet connectivity, technical support, professional development opportunities, policies and administrative commitment (Ganiyu & Olasedidun, 2024; Olayiwola & Alimi, 2015).

Nigerian studies have demonstrated that readiness is an important consideration in the implementation of blended learning in Colleges of Education. Ganiyu and Olasedidun (2024) specifically investigated lecturers' competency and readiness for blended learning in Colleges of Education and highlighted the importance of lecturers possessing the required knowledge and skills to function effectively within blended instructional environments. Similarly, Agim et al. (2025) reported that training of personnel was necessary for the effective use of blended learning for instructional delivery among College of Education lecturers. The implication is that the introduction of digital platforms without corresponding investment in human capacity may not produce sustainable changes in instructional practice. Institutional readiness is equally important. Olayiwola and Alimi (2015) found that Colleges of Education in Southwestern Nigeria were inadequately prepared for blended learning because the ICT facilities and infrastructure available in the institutions did not meet the required standards. Although the study predates more recent developments in educational technology, its findings remain relevant because infrastructure constitutes a foundational requirement for effective blended-learning implementation. Thus, readiness should be understood as a multidimensional construct involving not only the willingness of lecturers and students but also the capacity of institutions to provide the technological and organisational conditions necessary for implementation.

Perceived Effectiveness of Blended Learning

Perceived effectiveness refers to respondents judgement that blended learning contributes positively to teaching and learning processes and outcomes, including learner engagement, interaction, collaboration, satisfaction, independent learning and perceived academic performance. In survey research, perceived effectiveness provides information about how lecturers and students evaluate an instructional approach based on their experiences and observations (De Bruijn-Smolders & Prinsen, 2024; Istenič, 2024). However, perceived effectiveness should be distinguished from objectively measured effectiveness. A questionnaire can establish respondents' perceptions of the usefulness or effectiveness of blended learning, but such perceptions alone cannot establish that blended learning caused an improvement in students' academic

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achievement. Nigerian evidence provides support for the perceived instructional value of blended learning in teacher education. Agim et al. (2025) reported that lecturers perceived blended learning as useful for improving instructional delivery while emphasising the importance of appropriate training and facilities. Similarly, Okoronkwo et al. (2026) reported differences in learning outcomes across different blended-learning models among pre-service mathematics teachers in Colleges of Education in North-Central Nigeria. These findings suggest that the outcomes associated with blended learning may depend on the model and manner of implementation rather than merely on the presence of technology. Experimental evidence also provides relevant support. Zechariah and Chinda (2024) reported significant differences in achievement and retention among Colleges of Education students exposed to a blended instructional strategy compared with those exposed to a traditional instructional strategy in Electronics Technology. Although such findings demonstrate the potential instructional value of blended learning, they should not be conflated with perception-based evidence. The present study therefore uses the term perceived effectiveness because its evidence is based on respondents' ratings rather than on a controlled experimental comparison of academic achievement.

Implementation Challenges of Blended Learning

The implementation of blended learning can be constrained by inadequate internet connectivity, insufficient ICT devices and infrastructure, unreliable electricity supply, limited digital competence, inadequate professional development, weak technical support and insufficient institutional or government funding. These challenges can interact with one another. For example, lecturers may possess the necessary digital skills but still experience difficulties implementing online activities where internet connectivity is unreliable or where appropriate learning platforms and technical support are unavailable. Consequently, successful blended learning requires simultaneous attention to technological, human and institutional factors.

Nigerian evidence consistently identifies infrastructure and capacity development as important implementation concerns. Olayiwola and Alimi (2015) found that Colleges of Education in Southwestern Nigeria were inadequately prepared for blended learning because available ICT facilities and infrastructure were insufficient. More recently, Ishola and Ogunrinbokun (2025) identified technical-support deficits, time constraints and other challenges affecting blended-learning adoption among pre-service teachers in a College of Education in Lagos State. The authors recommended increased technical support and capacity-building programmes to facilitate effective adoption. Evidence from lecturers also points to the importance of training and facilities. Agim et al. (2025) found that adequate personnel training and provision of appropriate facilities were necessary for improving instructional delivery through blended learning in Colleges of Education. These findings suggest that the challenges of blended learning in Nigeria extend beyond the provision of digital platforms; institutions must also ensure that lecturers and students have the skills, connectivity, technical assistance and institutional support required to use those platforms effectively. The challenges are particularly significant in teacher-education

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institutions because Colleges of Education are responsible for preparing future teachers. Where student-teachers experience poorly supported blended learning environments, they may acquire limited practical experience of technology-mediated pedagogy. Conversely, well-supported blended-learning environments can provide student-teachers with opportunities to experience and practise the types of digital instructional strategies they may later use in schools. It is therefore necessary for Colleges of Education to address infrastructure, connectivity, training, technical support and institutional policy simultaneously rather than treating them as isolated problems. The present study therefore examined blended-learning models and approaches in selected Colleges of Education in North Central Nigeria, with particular attention to technology access and connectivity, lecturer and student readiness, model suitability, perceived effectiveness and implementation challenges. The study was designed to provide contextual evidence that can support institutional planning, capacity development and decisions concerning the implementation of blended learning in teacher-education institutions.

Research Questions

1. What is the current state of technology access and internet connectivity in the selected Colleges of Education?
2. To what extent are lecturers and students prepared to adopt blended learning approaches?
3. Which blended learning models and approaches are perceived as most suitable for implementation?
4. What is the perceived effectiveness of blended learning for teaching and learning?
5. What challenges affect the implementation of blended learning in the selected Colleges of Education?

Null Hypothesis

H0: There is no significant difference in respondents' overall blended-learning perception scores across the participating Colleges of Education at the 0.05 level of significance.

Materials and Methods

Research Design

A descriptive survey design was adopted because the study sought to obtain respondents' perceptions of existing blended-learning conditions without manipulating the study variables.

Study Area and Population

The study was conducted in selected Colleges of Education in Benue, Kogi, Kwara, Nasarawa, Niger and Plateau States and the Federal Capital Territory. The manuscript reports a working population of 1,200 lecturers and students across 11 selected institutions. In the final submission, the author should replace the provisional population statement with the verified institutional records and academic session used for sampling.

Sample and Sampling Procedure

A sample of 300 respondents was determined from the reported population of 1,200 using Yamane's formula at a 5% level of precision. The institutions were purposively selected and respondents were subsequently selected proportionately and randomly. The actual lecturer/student composition should be inserted from the original sampling records if available.

Yamane's formula: $n = N/[1 + N(e^2)] = 1,200/[1 + 1,200(.05^2)] = 300$.

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Table 1: *Population Distribution and Proportional Sample Allocation*

S/N	Selected Institution	Population	Sample
1	College of Education, Katsina-Ala, Benue State	108	27
2	College of Education, Oju, Benue State	96	24
3	Federal College of Education, Okene, Kogi State	150	38
4	College of Education, Ankpa, Kogi State	102	26
5	College of Education (Technical), Kabba, Kogi State	84	21
6	College of Education, Oro, Kwara State	90	23
7	College of Education (Technical), Lafiagi, Kwara State	120	30
8	College of Education, Akwanga, Nasarawa State	126	32
9	Federal College of Education (Technical), Kontagora, Niger State	108	27
10	Federal College of Education, Pankshin, Plateau State	102	25
11	Federal College of Education, Zuba, FCT	114	27
	Total	1,200	300

Instrument

Data were collected using the researcher-developed 25-item Blended Learning Models and Approaches Questionnaire (BLMAQ). It used a five-point Likert response format from Strongly Agree (5) to Strongly Disagree (1) and covered five constructs: technology access and connectivity, readiness, models and approaches, perceived effectiveness, and implementation challenges.

Validity and Reliability

The instrument was subjected to face and content validation by experts in Educational Technology, Measurement and Evaluation, and Teacher Education. The reported overall Cronbach's alpha coefficient was .94. If the pilot study produced separate alpha coefficients for the five sections, these should be reported in the final version; they should not be reconstructed without the original pilot output.

Data Collection and Analysis

The questionnaire was administered by the researcher with trained research assistants after institutional approval. Respondents were informed about the study and assured of confidentiality. Data were analysed using mean and standard deviation for the research questions and one-way ANOVA for the null hypothesis. A criterion mean of 3.00 was used: $M \geq 3.00$ indicated agreement and $M < 3.00$ indicated disagreement. Effectiveness results were interpreted as perceptions rather than causal effects.

Results

Research Question One: What is the current state of technology access and internet connectivity in the selected Colleges of Education?

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Table 2: ***Mean and Standard Deviation on Technology Access and Internet Connectivity***

Item	M	SD	Decision
My institution provides adequate access to computers and digital learning devices.	3.37	1.10	Agree
Reliable internet connectivity is available.	3.45	1.12	Agree
Digital learning facilities are sufficient.	3.47	1.12	Agree
Easy access to online learning platforms is available.	3.51	1.09	Agree
Technical support is readily available.	3.49	1.08	Agree
Cluster Mean	3.46	1.10	Agree

The results indicate moderate perceived availability of technology and connectivity. The cluster mean of 3.46 is above the criterion mean, but it also indicates that access is not uniformly strong and that further infrastructure improvement is necessary.

Research Question Two: To what extent are lecturers and students prepared to adopt blended learning approaches?

Table 3: ***Readiness of Lecturers and Students for Blended Learning***

Item	M	SD	Decision
Lecturers possess adequate digital skills.	3.98	0.91	Agree
Students possess adequate digital literacy.	3.94	0.92	Agree
Lecturers and students are willing to participate in blended learning.	3.96	0.90	Agree
Respondents are confident in online learning.	4.01	0.88	Agree
Institutions are adequately prepared for blended learning implementation.	3.95	0.90	Agree
Cluster Mean	3.97	0.90	Agree

Respondents reported high readiness, with a cluster mean of 3.97. Confidence in online learning received the highest item mean (4.01), while student digital literacy received the lowest (3.94), although both were above the criterion mean.

Research Question Three: Which blended learning models and approaches are perceived as most suitable for implementation?

Table 4: ***Provisional Mean and Standard Deviation on the Suitability of Blended Learning Models and Approaches***

Model/Approach	M	SD	Decision
Flipped classroom	4.03	0.84	Agree
Online discussions	4.09	0.82	Agree
Multimedia-based instruction	4.15	0.78	Agree

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Learning Management System	3.86	0.91	Agree
Integrated face-to-face/online instruction	4.12	0.80	Agree
Cluster Mean	4.05	0.83	Agree

Results indicate that all five identified approaches were perceived as suitable. Multimedia-based instruction recorded the highest provisional mean (4.15), followed by integrated face-to-face/online instruction (4.12). The Learning Management System recorded the lowest provisional mean (3.86), although it remained above the criterion mean. These values should be treated as a working reconstruction, not as verified empirical results.

Research Question Four

What is the perceived effectiveness of blended learning for teaching and learning?

Table 5: ***Perceived Effectiveness of Blended Learning***

Item	M	SD	Decision
Student engagement	4.10	0.82	Agree
Academic performance	4.08	0.81	Agree
Lecturer–student collaboration	4.06	0.84	Agree
Student satisfaction	4.05	0.83	Agree
Independent learning	4.09	0.80	Agree
Cluster Mean	4.08	0.82	Agree

Respondents perceived blended learning as effective across the five measured outcomes. The cluster mean of 4.08 indicates a favourable perception; however, the finding should not be interpreted as causal evidence that blended learning increased academic performance.

Research Question Five

What challenges affect the implementation of blended learning in the selected Colleges of Education?

Table 6: ***Challenges Affecting Blended Learning Implementation***

Item	M	SD	Decision
Poor internet connectivity	4.15	0.80	Agree
Inadequate ICT infrastructure	4.13	0.82	Agree
Lack of professional training	4.11	0.83	Agree
Inadequate institutional support	4.08	0.84	Agree
Insufficient government investment	4.16	0.79	Agree
Cluster Mean	4.13	0.82	Agree

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All five listed challenges were rated above the criterion mean, with insufficient government investment recording the highest mean (4.16). The cluster mean of 4.13 indicates that implementation barriers were strongly perceived.

Hypothesis Testing

Table 7: ***One-Way ANOVA Showing Difference in Overall Blended-Learning Perception by Institution***

Source	*SS*	*df*	*MS*	*F*	*p*
Between Groups	1.287	10	0.129	1.214	0.281
Within Groups	30.713	289	0.106		
Total	32.000	299			

Since p = .281 is greater than .05, the null hypothesis was not rejected. There was no statistically significant difference in the reported overall perception score across the participating institutions, F(10, 289) = 1.214, p = .281. This does not mean that the institutions were identical; it means that the analysed perception score did not differ significantly at the stated significance level.

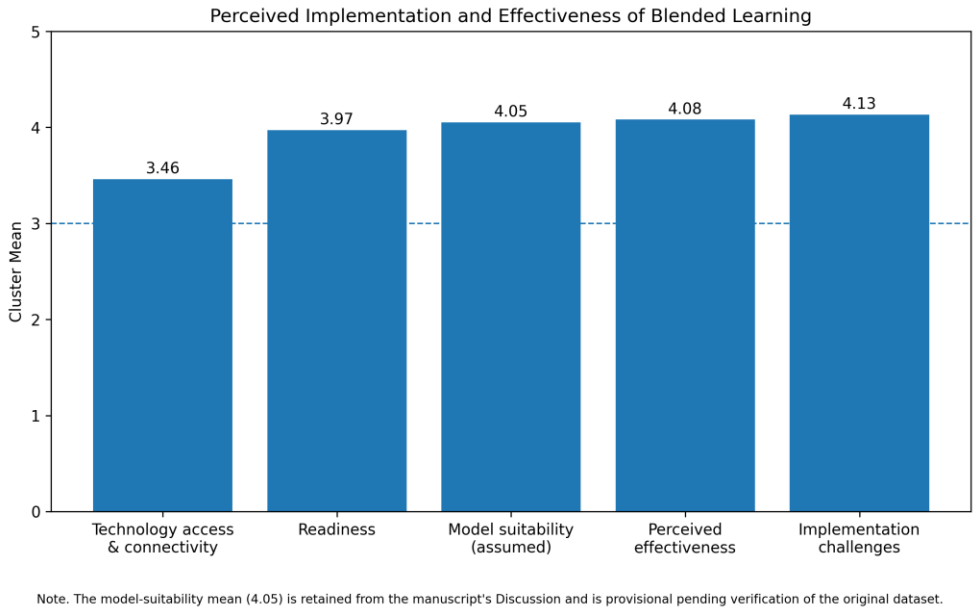


Figure 1. Cluster means for the major blended-learning constructs.

Discussion

The moderate technology-access and connectivity mean of 3.46 suggests that respondents recognised the presence of digital facilities but did not perceive the infrastructure as fully adequate. This finding is important because blended learning requires dependable access to devices, online platforms, connectivity

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and technical assistance. Recent Nigerian studies continue to identify these conditions as central implementation issues. Research involving Colleges of Education has reported challenges relating to technical support, infrastructure and adoption, while recent northern Nigerian evidence has demonstrated both the potential of blended learning and the constraints created by infrastructure and access conditions.

The readiness cluster mean of 3.97 indicates favourable perceptions of lecturer and student preparedness. This finding is consistent with recent Nigerian interest in lecturers' competency and readiness for blended learning in Colleges of Education. Ganiyu and Olasedidun (2024) specifically investigated Colleges of Education lecturers' readiness, highlighting the importance of competency in the transition towards blended learning.

The model-suitability results indicate broad acceptance of the five approaches considered in the study. Multimedia-based instruction and integrated face-to-face/online instruction were the highest-rated approaches in the provisional reconstruction. This interpretation is conceptually reasonable because these approaches can provide learners with multiple ways of accessing content while retaining opportunities for classroom interaction. However, the numerical ordering in Table 4 must be checked against the original dataset before publication. Recent research in North-Central Colleges of Education has also shown that different blended-learning models can produce different outcomes, reinforcing the importance of deliberate model selection.

The perceived-effectiveness cluster mean of 4.08 indicates that respondents associated blended learning with engagement, academic performance, collaboration, satisfaction and independent learning. This finding should be read alongside experimental evidence from Nigerian Colleges of Education. For example, a 2024 study in North-East Nigeria reported significant achievement and retention advantages for students taught with a blended instructional strategy compared with a traditional instructional strategy. Such evidence provides useful contextual support, but it does not convert the present survey's perception data into causal evidence. Implementation challenges produced the highest cluster mean among the study constructs (4.13), indicating that respondents perceived substantial barriers. Poor connectivity, inadequate ICT infrastructure, limited training, weak institutional support and insufficient investment are not isolated problems; they interact. A lecturer may possess digital competence but still be unable to implement a stable blended course where connectivity and technical support are inadequate. Recent Nigerian work on sustaining blended learning similarly identifies connectivity, device costs, electricity, LMS availability, lecturer training, technical support and funding as major issues.

The ANOVA result showed no significant institutional difference in the overall perception score. The implication is not that all institutions have identical digital environments. Rather, the available evidence did not demonstrate a statistically significant difference in the composite perception score. Future research could strengthen the institutional comparison by examining objective infrastructure indicators, digital-resource availability and actual LMS-use data alongside respondents' perceptions.

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Conclusion

The study indicates that respondents in the selected Colleges of Education perceived technology access and connectivity as moderately adequate and reported high readiness for blended learning. The five identified models and approaches were favourably perceived, while blended learning was also viewed as beneficial to engagement, collaboration, satisfaction, independent learning and academic performance. At the same time, connectivity, ICT infrastructure, professional training, institutional support and investment were identified as major barriers. The findings therefore suggest that blended learning has strong perceived potential in teacher education, but that its sustainability depends on coordinated technological, human and institutional support.

The study does not establish that blended learning causes improved academic achievement because the design was descriptive and perception-based. The evidence instead demonstrates a favourable perception of blended learning alongside significant implementation constraints. Institutional decision makers should therefore focus on creating the conditions under which blended learning can be implemented consistently and pedagogically effectively.

Recommendations

1. Government and institutional authorities should prioritise reliable electricity, broadband connectivity, computer laboratories, smart classrooms and other digital-learning facilities in Colleges of Education.
2. College management should provide continuous, practice-oriented professional development in blended-learning pedagogy, LMS management, digital-content development and online assessment.
3. Institutions should establish clear blended-learning policies covering platform provision, technical support, staff development, student orientation, online assessment and quality assurance.
4. Colleges should negotiate affordable and reliable internet services and establish technical-support structures for staff and students.
5. Teacher-education curricula should strengthen digital pedagogy, educational technology, digital assessment, cybersecurity awareness and responsible use of emerging technologies.

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Data Availability. The underlying dataset should be made available by the author upon reasonable request, subject to institutional and ethical requirements.

Conflict of Interest. The author declares no financial or non-financial conflict of interest.

Author Contributions. Shaibu, Ibrahim Ibore conceptualised the study, designed the methodology, collected and analysed the data, interpreted the findings and prepared the manuscript.

AI Disclosure. Generative AI was used to assist with language refinement, and formatting during manuscript revision. The author remains responsible for the research data, analysis, interpretation and final manuscript.

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