International Journal of Sub-Saharan African Research (IJSSAR)
Vol. 4, Issue 1, pp. 438-453, March 2026, ISSN: 3043-4467 (Online), 3043-4459 (Print)
doi:10.5281/zenodo.18077527

Institutional Readiness for Implementing the 4-in-1 Teacher Training Model in Pre-Service Teacher Education in Selected Colleges of Education in Nigeria

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ABSTRACT

Background: Pre-service teacher education remains central to improving teaching quality in Nigeria, yet implementation gaps persist across institutional infrastructure, technology, and administrative systems. While innovative pedagogical reforms such as the 4-in-1 teaching model, integrating Jigsaw, problem-based learning, microteaching, and Technological Pedagogical and Content Knowledge (TPACK), offer promise, successful adoption depends on institutional readiness. Empirical evidence on the infrastructural preparedness of Colleges of Education (CoEs) across Nigeria's geopolitical zones remains limited.
Objective: This study assessed the readiness and capacity of six selected publicly funded Colleges of Education across Nigeria's six geopolitical zones for implementing the 4-in-1 teacher training model.
Method: A quantitative cross-sectional institutional assessment was conducted using a 62-item structured observational checklist covering five domains: general institutional information, classroom infrastructure, technology and equipment, library and learning resources, and administrative support. Data were analysed using descriptive statistics (frequencies and proportions) in Microsoft Excel.
Results: Female students predominated across institutions, 54(89%), whereas academic staff were largely male, 52(77%). All colleges had classrooms, IT laboratories, microteaching facilities, and primary/secondary power supply. However, major gaps were identified, including limited classroom projectors (67% lacking), inadequate internet connectivity (33% lacking reliable access), absence of Learning Management Systems (100%), and limited educational software (67%). Security vulnerabilities (50% without structured security measures) and environmental risks such as flooding (reported in several institutions) threaten continuity of training activities.

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Conclusion: Although basic instructional and technological infrastructure exists across the selected CoEs, critical digital, environmental, and security gaps may constrain effective implementation of the 4-in-1 pedagogical reform. Targeted investments in digital systems, connectivity, visual teaching aids, and institutional resilience are necessary for sustainable teacher education reform.
Unique Contribution: This study provides multi-regional, institution-level baseline evidence on infrastructural readiness for implementing an integrated pedagogical model within Nigeria's public Colleges of Education.
Key Recommendations: Strengthen digital infrastructure through the introduction of Learning Management Systems and educational software; improve internet connectivity and classroom visual aids; reinforce institutional security and environmental safeguards; and promote balanced gender representation in staff recruitment and student enrolment policies.

Keywords: Pre-service teacher training, Colleges of Education, Pedagogy, 4-in-1 model.

INTRODUCTION

Education is the systemic and intentional process of acquiring knowledge, skills, values and attitudes required to manoeuvre the world, form relationships, and build society through different learning channels in both formal and informal institutions. Education is a crucial instrument for personal growth and development, Societal development and economic growth (Doharey et al., 2023). Teachers serve a dual role: they are both custodians of subject knowledge and skilled facilitators of learning. Beyond possessing content expertise, teachers must be capable of effectively transmitting that knowledge to learners. This competence is commonly referred to as pedagogical skill (Ekpiken & Aniefiok, 2018). To develop, strengthen and improve this skill, teachers must undergo training and continuous retraining (Ibrahim, 2023).

Teacher education is the professional education required to equip upcoming teachers with the knowledge, attitude, behaviour, and skills they need to be effective in their work in the classroom, school, and community (Acheampomaa, 2019). It represents the multifaceted, holistic preparation of individuals for professional teaching roles by equipping them with the competencies needed to fulfil these duties. Teacher education is divided into two main categories: initial teacher training (pre-service training) and teacher development (in-service training (Acheampomaa, 2019).

Globally, major development partners like the World Bank recognise pre-service teacher education as essential yet challenging. As a result, greater emphasis has been placed on in-service training to address systemic shortcomings. Of the 110 World Bank projects supporting teacher professional development across 67 countries, between FY13 and FY18, 68 focused exclusively on in-service training, while only two focused on pre-service training. The remaining projects addressed political and resource constraints in reforming initial training institutions (World Bank, 2019). In 2018, the World Bank launched the Global Platform for Successful Teachers to ensure all children are taught by effective educators supported by robust systems, underscoring the need for better-designed pre-service programs despite limited scalable evidence on best practices (World Bank, 2019).

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Nigeria has demonstrated a sustained commitment to bolstering teacher quality through legislative reforms, dedicated agencies, and innovative programs (Lawal & Braimoh, 2018). In Nigeria, Colleges of Education (COEs) are responsible for the nurturing of future educators and award the National Certificate of Education (NCE) while upholding the highest standards of teacher quality (Oluwatosin & Bolanle, 2024).

Thus far, the National Commission for Colleges of Education (NCCE), the regulatory body for Nigeria's 108 COEs, has introduced pivotal reforms, including updating the Minimum Standards for General Education to emphasise practical skills, digital integration, and pedagogical innovation. Despite these efforts so far by the government, there exist some challenges in the pre-service teacher education in Nigeria. These challenges include inadequate duration and depth of teaching practice (Garba, 2017), curriculum gaps and over-theoretical orientation, limited integration and access to educational technology (Bolaji & Ahmed, 2025), quality of entrants and professional motivation, and weak institutional supervision and limited real-world experience (Lawal & Braimoh, 2018).

There is a growing body of research on teacher education and professional development in Nigeria (Mohammad & Mahadi, 2025; Anthony & Ali, 2025). However, most studies have focused on isolated pedagogical interventions or mainly on the professional development of in-service teachers with limited attention to integrated interventions for pre-service teachers (Bankole et al., 2019; Abdulhamid et al., 2023).

Existing studies have examined curriculum structure, teaching practice duration, and institutional challenges within Colleges of Education (Garba, 2017; Lawal & Braimoh, 2018), providing insights into systemic constraints. While microteaching, Jigsaw, problem-based learning (PBL), and TPACK have each shown positive effects on teaching skills, engagement, critical thinking, and technology integration, their implementation has been conducted independently and without nationally representative evidence of effectiveness (Bankole et al., 2019; Abdulhamid et al., 2023; Okeke, A. U., & Dikeocha, 2024). Challenges such as inadequate infrastructure, limited lecturer training, differences in technology competence, and regional disparities constrain effectiveness. This highlights a critical gap: little empirical evidence exists regarding the development, adoption, and effectiveness of an integrated pedagogical model that combines collaborative learning, problem-solving, microteaching, and technology integration. Research addressing this gap is essential to strengthen pedagogical competence, practical teaching skills, and technological readiness among pre-service teachers in Nigeria.

To address some of these challenges in Nigeria’s pre-service teacher education, we have designed a comprehensive 4-in-1 model integrating Jigsaw, problem-based learning, Microteaching and Technological Pedagogical and Content Knowledge (TPACK) frameworks. The 4-in-1 model aims to enhance teaching quality through improved pedagogy, technology, and curriculum delivery. Successful rollout, however, demands a rigorous landscape evaluation to assess the institutional readiness of the selected six (6) colleges of education across the six (6) geopolitical zones.

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OBJECTIVES OF THE STUDY

The general goal of this study is to assess the readiness and suitability of the six (6) selected Colleges of Education for the implementation of the 4-in-1 model. The specific objectives include:

i. To evaluate the institutional readiness of selected COEs against predefined benchmarks such as infrastructure adequacy, faculty qualifications, and institutional capacity to support the implementation of the model.

ii. To identify specific resource gaps in ICT facilities, library resources and institutional materials that may hinder model implementation.

LITERATURE REVIEW

Pre-service Teacher Education

Pre-service teacher education is the training a teacher receives prior to becoming a full teacher and entering the classroom. The training can be classified into two models. In the first model, a teacher may first obtain a qualification at a university, college, or vocational institution, and then study further to gain additional knowledge in teaching. The second model uses a pedagogical approach, in which the student studies an academic subject as well as the ways of teaching it (Acheampomaa, 2019).

Theoretical framework

This study uses Bronfenbrenner's Bioecological Systems Theory. The BST framework was used to inquire into the interplay between persons and their environment relative to the environment (Bronfenbrenner, 2005). The interconnection between process, individuals, context, and time, which influences human development, spans across five subsystems: Microsystem, Mesosystem, Exosystem, Macrosystem, and Chronosystem (Adigun, 2021). Persons refers to the characteristics pre-service teachers bring into training, including age, gender, educational experience, zeal, and beliefs for teaching. Process explains the day-to-day interactions and experience between lecturers, mentors, colleagues, and students/pupils during teaching practicum, which are pivotal to growth. Process exists in a stratified context. The microsystem consists of the trainee teacher classroom, teaching practice school, and age group, while the mesosystem consists of the interplay between these settings, such as the partnership between the teacher's training college and practicum schools or supervisors and mentee teachers. The exosystem refers to institutional structures that implicitly influence preparation, such as regulatory policies, funding schemes, and administrative choices within the training colleges. The macrosystem involves wider societal beliefs on teaching, national education precedence, cultural beliefs on teachers' roles, and economic factors affecting educational investment (Adigun, 2021). The chronosystems comprise time, how it views teachers' preparation across academic semesters, new policies, changes in technology, and social/historical events that influence education delivery (Tong & An, 2024).

This framework provides an extensive view of how pre-service teachers' knowledge, attitude, and insight are shaped by individual, institutional, cultural, structural, and temporal influences (Adigun, 2021).

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Institutional Readiness themes

Inclusivity and Gender Representation: Unterhalter et al. (2015) reported that more male students were enrolled in colleges of education across five states (Lagos, Rivers, Sokoto, Kano, and Jigawa) than female students, underscoring the need to balance male and female student teachers to improve inclusivity, equal opportunity, and gender representation.

Classroom infrastructure: Findings from Wogboroma & Emmanuel (2025) show a lack of ergonomic furniture, electricity supply, water supply, heating, ventilation, and sanitation of facilities suitable for learning across the Colleges of Education in Nigeria.

Technology and equipment: Etesike et al. (2024) found varying access to digital technologies across institutions in Nigeria. Many institutions lack reliable internet access, computers, and other necessary digital tools. Even when these facilities are available, some educators lack the digital literacy to use these tools for teaching.

Library and Learning Resources: Bello & Musa (2025) reports the availability of facilities such as electronic information resources at an institution in Northern Nigeria, but access is hampered by insufficient subscriptions, frequent power outages, unstable internet access, and a lack of computers.

Administrative support: Fasanya (2025) found that administrative support for teacher education is influenced by a wide range of systemic challenges, including inadequate funding, institutional corruption, weak administrators, and brain drain. Inadequate funding undermines institutional planning capacity. Institutional corruption weakens resource allocation and governance structure, while weak school administrators limit professional mentorship and organisational leadership. Brain drain reduces the level of expertise available for academic support and management, leading to varying degrees of administrative support received by colleges of education and departments.

General facilities and security: Jiya & Osuji (2025) found that a college of education has hostels with basic amenities such as toilets, water supply, good ventilation, and lighting, but some of the amenities are inadequate, with facilities like toilets requiring improved maintenance and hygiene, rooms needing more bed spaces, reduction in overcrowding, and the environment requiring improved sanitation. The study reported the presence of security agents within the campus. Egwu (2025) reported that institutions have physical security amenities such as CCTV cameras, Perimeter fencing, security posts, and security checkpoints at entry and exit points, but they lack partnerships between security agents and the institution, compulsory identity verification, biometric access to buildings, and portable security devices to address threats effectively.

Challenges affecting pre-service training

Although pre-service teacher training is crucial to improve teaching, it is still plagued by challenges in curriculum structure, practicum experiences, and teacher, educator/institutional capacity (Napanoy et al., 2021). Curricular issues arise because pre-teachers require content knowledge, pedagogical knowledge, and practical knowledge; however, LMICs often prioritise content knowledge at the expense of practical and pedagogical knowledge (Zuilkowski et al.,

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2023). Contributing factors include poor instructional methods, a shortage of teaching materials, and outdated courses (Anthony & Ali, 2025).

Practicum challenges undermine training, with poor learning environments and a low level of school engagement limiting pre-service teachers' development (Zuilkowski et al., 2023).
In Nigeria, insufficient government funding has resulted in deteriorating facilities, overcrowded classrooms and staff rooms, inadequate laboratories, and generally poor learning environments, all of which reduce the quality of teacher training (Mohammad & Mahadi, 2025; Anthony & Ali, 2025).

METHODOLOGY

Study Design
This study adopted a quantitative cross-sectional institutional assessment design to evaluate the readiness of six (6) selected Colleges of Education (CoEs) in Nigeria for implementing a 4-in-1 teacher training model.

Study Setting and Sampling Procedure
Nigeria is administratively divided into six geopolitical regions (GPRs): North-Central, North-East, North-West, South-East, South-South, and South-West. To ensure national representativeness, one College of Education (CoE) was selected from each geopolitical region using purposive sampling. The six CoEs selected across the GPRs are FCT College of Education, Zuba (North-Central); College of Education, Zing (North-East); Federal College of Education, Kano (North-West); Akwa Ibom State College of Education, Afaha Nsit (South-South); Enugu State College of Education (Technical) (South-East); and Federal College of Education (Special), Oyo (South-West).

CoEs in Nigeria operate under either public (federal or state government–funded) or private ownership structures. Privately funded CoEs were excluded due to comparatively low enrolment rates and anticipated recruitment constraints that could compromise implementation fidelity. Consequently, only publicly funded CoEs (federal or state) were considered eligible for inclusion.

To ensure institutional diversity and inclusiveness, selection further accounted for the three operational models of CoEs in Nigeria: conventional/normal colleges, technical colleges, and special colleges (serving students with special needs).

Instrument for Institutional Assessment
Data were collected using a structured observational checklist developed based on predefined institutional readiness criteria relevant to the implementation requirements of the 4-in-1 teacher training model. The checklist titled "Colleges of Education Readiness and Suitability Assessment Tool containing 62 questions, was designed to assess General Information on institutional security, staff and student distribution, infrastructural adequacy, technological capacity, library and learning resources, and administrative support systems necessary for effective deployment of blended and collaborative pedagogical strategies. The instrument also aimed to identify resource gaps that may require strengthening prior to full implementation of the training model. The

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instrument was validated by a research scientist at the Sydani Institute of Research and Innovation (SIRI), Abuja, using face and content validity protocols. The instrument was validated by a research scientist at the Sydani Institute of Research and Innovation (SIRI) using a face and content validity protocol. The instrument's content validity was assessed by ensuring that the items developed reflect the variables under investigation. The face validity ensured the appropriateness of the total number of items in the questionnaires.

Structure of the Checklist

The checklist comprised five major domains:

1. **General Institutional Information:**

This section assessed 13 questions on contextual and demographic characteristics, including campus safety (security concerns, flooding risks), availability of student accommodation for 300-level students, and gender distribution among students and staff.

2. **Classroom Infrastructure:**

This domain evaluated 13 questions on instructional space capacity and adequacy, including the number of classrooms, average classroom size, seating capacity, availability of dedicated teaching spaces, and the presence and condition of instructional equipment (desks, chairs, whiteboards, projectors, ventilation, lighting, and cleanliness).

3. **Library and Learning Resources:**

This section examined 5 questions on the availability and accessibility of both physical and digital learning resources, including library facilities, education-related textbooks, academic journals, e-books, learning management systems (LMS), and relevant educational software.

4. **Technology and Equipment:**

This domain assessed 25 questions on technological readiness, including availability of primary and backup power sources, internet connectivity, IT laboratory infrastructure (number of computers, functionality, availability for instructional use and examinations), presence of microteaching laboratories and other practicum facilities, technical support systems, and student access to digital devices such as tablets or computers.

5. **Administrative and Institutional Support:**

This section evaluated 6 questions on the presence of enabling administrative structures, including security measures, functional restrooms and recreational facilities, and availability of dedicated full-time IT personnel to support instructional technology integration.

Data Collection Procedure

Data were collected through direct institutional observation using the structured checklist. Each selected CoE was systematically assessed against the predefined criteria to determine its level of preparedness for implementation of the 4-in-1 teacher training model. Observations were recorded across the 62 questions in standardised formats to ensure consistency across institutions.

Data Analysis

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Using Microsoft Excel, descriptive statistical techniques were used to summarise institutional readiness across the five domains. Frequencies and proportions were computed to categorise institutions based on their readiness level. Identified gaps were documented to inform targeted capacity-strengthening recommendations prior to implementation of the training model.

RESULTS

The findings from Table 1 show the gender distribution of staff and students across six colleges of education in Nigeria. Our result indicates that of the six colleges of education, Kano state had the highest number of male students (67%) enrolled. In contrast, Enugu State College of Education had the least number of male students (11%) enrolled. FCE Oyo State had the highest female student enrollment (66%), and Akwa Ibom State College of Education had just 80% students enrolled. The gender distribution for academic staff indicates that Kano state had the highest proportion of Male teachers (77%) while Enugu state had the least proportion of male academic staff (52%). 40% of the academic staff in Oyo state had CoE were females, making it the highest across the 6 facilities, and Enugu had 48% female academic staff, making it the least across the six colleges.

Overall, findings from this study show that more female students were enrolled across the six facilities than male students, and, conversely, there are more male academic staff than female staff in these institutions.

Table 1: Gender distribution of staff and students across six colleges of education

Socio demographic	FCE Oyo State (%)	FCT College of Education	FCE Kano State	Enugu State College of Education	College of Education Zing (Taraba)	Akwa Ibom State College of Education
Gender distribution of 200-level students						
Male	392 (34%)	574 (46%)	1,173 (67%)	23 (11%)	400 (40%)	43 (20%)
Female	761 (66%)	673 (54%)	577 (33%)	186 (89%)	600 (60%)	172 (80%)
Total	1,153	1, 247	1,750	209	1, 000	215
Gender distribution of Academic staff						
Male	290 (60%)	218 (62%)	408 (77%)	38 (52%)	201 (67%)	135 (55%)
Female	193 (40%)	133 (38%)	122 (23%)	35 (48%)	99 (33%)	111 (45%)
Total	483	351	530	73	300	246

Classroom infrastructure: The result of our study shows that all the Colleges of Education (CoE) assessed have classrooms which can facilitate training. In the study, students had regular access to classrooms dedicated to training. At the same time, 83% of the schools indicated the availability of desks and chairs, as well as learning aids such as boards for teaching. 67% of the schools reported that they do not have visual learning aids like projectors and screens to facilitate learning, and schools stated that their classrooms were not well-lit. The lack of chairs and tables, as well as teaching boards, has a low impact on implementation because the number of facilities

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without these amenities is below average. In contrast, the impact of poorly lit classrooms and those without projectors is high because it may affect training, as well as increase the cost of carrying out training.

Technology and Equipment: Our study found that all CoE have adequate power supply, secondary power supply such as solar or generator, IT laboratories (equipped with projector and screens), technical support in the IT laboratories, micro-teaching laboratories, audio-visual equipment, maintenance for the IT equipment within the last year, lightning, electrical outlets, and extension outlets in their facilities. Conversely, 33% of the facilities lack a good internet connection. The impact of this amenity is high, and it affects training activities like T-PACK.

Library and Learning: Results from this study show that 100% of the CoE lack learning Management Systems, while 67% of the schools lack educational software, and one (17%) lacks digital resources. These can negatively impact online learning and grading of exams and tests, as well as limit digital competencies. Overall, this highlights that these inadequacies may cause students to be insufficiently prepared for modern classroom demands. Still, it has a low impact on our study, as it does not negatively impact implementation. However, all the schools had libraries, which are essential to improve critical thinking skills as well as reading culture.

Administrative Support: Our results show that all facilities have functional restrooms, with males and females having separate restrooms. We also observed that IT laboratories have designated staff members who offer support and guidance to students. 50% of the schools reported that they have adequate security measures, such as CCTV cameras, while another 50% reported having no security measures in place. All but one amenity has a high impact on our study because its absence can negatively influence our study. Separate toilets for males and females have a low impact on the implementation and training activities.

General: Our study observed that 67% of the schools are prone to security challenges that require urgent attention. At the same time, 83% of these institutions have a security apparatus on the school premises. 83% of these institutions are prone to flooding, and all of them have demonstration schools. The security challenges may negatively impact training, and our study activities may be interrupted by miscreants. Flooding will also impact this training negatively, especially during the rainy season, as access to classrooms may be blocked by floodwater.

Table 2: Landscape assessment on the selected themes across the selected Colleges of Education

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Theme	Number of schools with amenities (%)	Number of schools without amenities (%)	Impact
Classroom Infrastructure			
Regular access to a dedicated classroom to facilitate the training?	6 (100%)	0	High
Are there enough desks and chairs for all students?	5 (83%)	1 (17%)	Low
Are there whiteboards/blackboards in each classroom?	5 (83%)	1 (17%)	Low
Are the classrooms equipped with projectors and screens?	2 (33%)	4 (67%)	High
Are the classrooms adequately lit?	4 (67%)	2 (33%)	High
Technology and Equipment			
Is there power supply in the institution?	6 (100%)	0	High
Is there availability of a secondary source of power supply (Generators, Solar)?	6 (100%)	0	High
Is there an IT lab in the school?	6 (100%)	0	High
Are the IT Labs equipped with projectors and screens?	6 (100%)	0	High
Are there any technical support services available in the IT Lab?	6 (100%)	0	High
Is there good network coverage in the school?	4 (67%)	2 (33%)	Low
Is there a micro-teaching laboratory?	6 (100%)	0	High
Is audio-visual equipment available in the IT Lab?	6 (100%)	0	High
Has maintenance been done in the IT Lab in the last year?	6 (100%)	0	High
Is the IT Lab sufficiently equipped with lighting, power sockets, and extension outlets?	6 (100%)	0	High
Library and learning support			
Is a learning management system (LMS) available?	0	6 (100%)	Low
Does the school have educational software?	2 (33%)	4 (67%)	Low
Is a library available?	6 (100%)	0	Low
Are there digital resources available (e-books, Online journals)?	5 (83%)	1 (17%)	Low
Administrative Support			
Are security measures in place (CCTV, Guards)?	3 (50%)	3 (50%)	High
Are there functional restrooms available in this institution?	6 (100%)	0	High
Do you have separate restrooms for males and females?	6 (100%)	0	Low
Are there dedicated staff for the IT Lab?	6 (100%)	0	High
General			
Are there security concerns that will require urgent attention?	2 (33%)	4 (67%)	High
Is there a security apparatus in place around the school premises?	5 (83%)	1 (17%)	High
Is the school prone to flooding?	1 (17%)	5 (83%)	High
Do you have a Demonstration School?	6 (100%)	0	High

DISCUSSION

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The result from our study shows that across the six CoE there were more female students than male students, with FCE Oyo State having the highest female enrollment and Akwa Ibom State College of Education having the least number of female students enrolled. These results contrast with findings from Unterhalter et al. (2015), who found that more male students are enrolled in colleges of education across five states (Lagos, Rivers, Sokoto, Kano, and Jigawa) than females. In terms of academic staff gender distribution, there were more male staff than female staff, with FCE Kano State having the most male staff and Enugu State College of Education having the least number of male staff. These findings corroborate another study that found that there are more male staff than female academic staff across 95 Colleges of Education (Jacob & Garba, 2021). This evidence indicates the need to balance gender distribution across teachers' training colleges to improve inclusivity and gender representation.

Across the six Colleges of Education (CoE) assessed in this study, we found that classrooms were available to facilitate training, and students had regular access to classrooms dedicated to training. We also found that most of the CoE had desks and chairs, as well as learning aids, such as teaching boards. However, some CoE lack visual learning aids such as projectors and screens, and some reported poorly lit classrooms. This corroborates the findings from Wogboroma & Emmanuel (2025) who reported the absence of essential amenities, including ergonomic furniture, water supply, ventilation, and visual aids, at a Nigerian institution. The inadequacy of these amenities negatively impacts learning activities in these CoE; hence, there is a need to address these inadequacies.

Our study found that although the CoE have adequate power supply, secondary power supply such as solar or generator, IT laboratories (equipped with projector and screens), technical support in the IT laboratories, micro-teaching laboratories, audio-visual equipment, maintenance for the IT equipment (within the last year), lightning, electrical outlets, and extension outlets in their facilities, some of the facilities lack good internet connection which affects training activities like T-PACK. This aligns with findings from Etesike et al. (2024) who reported varying availability of digital technologies and internet access in some schools.

Results from this study indicate that all the CoE lack Learning Management Systems, with more than half lacking educational software and a few lacking digital resources. Although all the CoE had libraries, which are essential for improving critical thinking skills and reading culture, the absence of digital resources negatively impacts online learning, grading of exams and tests, as well as limits digital competencies. This opposes findings from Bello & Musa (2025) who found that digital learning resources exist, but the utilisation is hampered by insufficient subscription, unstable internet, and frequent power outages. These findings indicate that the inadequacies may leave students insufficiently prepared for modern classroom activities.

The study found that all facilities have functional restrooms, with separate restrooms for males and females. We also observed that IT laboratories have designated staff members who offer support and guidance to students. Half of the CoE reported having adequate security measures, such as CCTV cameras, while the other half reported having none. This affirms findings from Jiya & Osuji (2025) who reported the presence of security personnel in an institution but found that amenities such as toilets required improved sanitation and water access. In addition, Egwu

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(2025) reported the presence of security amenities such as fencing around the school, security checkpoints, and surveillance cameras, which improve safety within the school premises.

This study found that more than half of the CoE are prone to security challenges requiring urgent attention. Although most of these institutions have security apparatus on their premises, more than half are prone to flooding, which can negatively affect training, especially during the rainy season, as classrooms may be blocked by floodwater. All the CoE have demonstration schools. Our findings are in line with reports from Egwu (2025) who found the availability of security resources, such as perimeter fences, security check posts, and CCTV cameras, which improve safety within the school premises. Our finding is similar to what was reported by Ewe et al. (2022), who found that a technical college in Rivers State was prone to flooding, which negatively affected schooling.

CONCLUSION

Based on the study's findings, the selected colleges of education have a basic level of institutional capacity to implement the proposed 4-in-1 model of teacher training, but this readiness is incomplete. Although the institutions have basic training structures such as classrooms, IT labs, microteaching rooms, libraries, and basic administrative support, this shows that these institutions are viable for implementing the 4-in-1 model, but the lack of learning management systems, educational software, digital learning tools, and internet connectivity hampers the implementation of the model. Additionally, Infrastructure and security challenges also pose barriers to implementation. The study concludes that the selected Colleges of Education are viable for implementation, but they require targeted improvements in security, digital infrastructure, and learning technologies to ensure the model's effective and sustainable adoption.

POLICY RECOMMENDATIONS

The Federal Ministry of Education and the National Commission for Colleges of Education (NCCE) should prioritise the deployment of institution-wide Learning Management Systems (LMS) in all public Colleges of Education. This should be complemented with access to licensed educational software, stable broadband connectivity, and structured digital maintenance plans. Dedicated budget lines for ICT renewal and periodic upgrades are essential to sustain reform efforts.

Given the identified gaps in reliable internet access, government and institutional leadership should establish partnerships with telecommunications providers to secure subsidised broadband for campuses. Colleges located in areas with weak connectivity should be supported with alternative technologies such as satellite-based internet solutions to ensure equitable digital access. Investment is required to equip classrooms with projectors, interactive screens, and adequate lighting. National standards for instructional facilities should be enforced through periodic compliance audits. These upgrades are necessary to support collaborative, technology-integrated pedagogies embedded within the 4-in-1 model.

While female student enrolment is strong, academic staffing remains male-dominated. Policies should promote equitable hiring practices, mentorship pathways for female academics, and transparent recruitment systems. Incentive-based schemes may encourage balanced gender

International Journal of Sub-Saharan African Research (IJSSAR)
Vol. 4, Issue 1, pp. 438-453, March 2026, ISSN: 3043-4467 (Online), 3043-4459 (Print)
doi:10.5281/zenodo.18077527

representation in both student admissions and faculty appointments. Colleges lacking structured security measures should be supported to install surveillance systems, strengthen perimeter fencing, and formalise security protocols. Collaboration with local security agencies and the integration of risk management plans will help safeguard academic continuity.

Institutions prone to flooding or environmental disruption should develop resilience strategies, including improved drainage systems, infrastructure elevation where feasible, and contingency learning plans (such as hybrid delivery options). Environmental risk audits should form part of accreditation and quality assurance processes. Implementation of the 4-in-1 model requires consistent financing. Federal and state governments should establish performance-linked funding mechanisms tied to institutional readiness indicators. Regular monitoring and evaluation frameworks should track infrastructure improvements, digital adoption, and pedagogical integration outcomes. Continuous professional development for academic staff should focus on practical digital pedagogy, TPACK integration, and blended learning strategies. Colleges should institutionalise technical support units with adequately trained personnel to sustain innovation beyond pilot phases.

Ethical Clearance

Ethical approval with ref number: NHREC/01/01/2007-31/10/2024 was obtained from the National Health Research Ethics Committee (NHREC) of the Federal Ministry of Health (FMoH) in Abuja. Informed consent was received from the respondents after the aim of the study was explained to them, and their rights were fully explained. All study respondents were informed of their voluntary participation in the study, and the confidentiality and anonymity of all data collected were maintained by avoiding the inclusion of possible identifiers, such as names and contact details. Participants' responses were anonymised using identification codes throughout the analysis.

Acknowledgements

The authors acknowledged the enabling environment provided by Sydani Group which greatly facilitated this research.

Funding

This research was supported by the GPE-KIX–IDRC partnership. The views and interpretations presented in this paper are those of the authors alone and do not necessarily reflect the official position or policies of the GPE-KIX–IDRC partnership.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors' Contribution

All authors contributed substantially to the conception and design of the study. Literature search, data extraction, synthesis, and manuscript drafting were collaboratively undertaken. All authors reviewed and approved the final version of the manuscript.

Availability of data and materials
The data are available from the corresponding author upon reasonable request.

Citation
Okagbue, H. I., Ibanga, A., Ayodeji, O., Barlow, C., Adewalure, S., Nto, S., Otu, E., Kolawole, D., Anosike, I., Okezie-Okafor, O. (2026). Institutional Readiness for Implementing the 4-in-1 Teacher Training Model in Pre-Service Teacher Education in Selected Colleges of Education in Nigeria. *International Journal of Sub-Saharan African Research*, 4(1), 438-453. doi:10.5281/zenodo.18077527

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Vol. 4, Issue 1, pp. 438-453, March 2026, ISSN: 3043-4467 (Online), 3043-4459 (Print)
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