

CAPACITY BUILDING FOR COLLEGE OF EDUCATION LECTURERS: A PRISMA-GUIDED SYSTEMATIC REVIEW OF RELEVANT 21ST-CENTURY DIGITAL SKILLS

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Abstract

The rapid digital transformation of education has intensified the need for sustained capacity building among College of Education lecturers, who are central to preparing pre-service teachers for 21st-century classrooms. This study systematically reviews existing literature to identify essential 21st-century digital skills required for effective teaching, professional practice, and teacher preparation in Colleges of Education. Guided by the PRISMA 2020 framework, peer-reviewed journal articles published between 2015 and 2025 were systematically retrieved from Google Scholar, Mendeley, and ResearchGate databases using predefined inclusion and exclusion criteria. A total of 241 articles were initially identified, of which 34 studies met the eligibility requirements and were included in the final synthesis. The findings indicate that the literature consistently emphasizes key digital competencies such as digital literacy, critical thinking, communication, collaboration, creativity, and innovative pedagogical practices as essential for contemporary teacher education. However, significant gaps persist in lecturers' digital capacity, curriculum alignment, and institutional support for effective digital integration. The findings also contribute to ongoing discourse on digital capacity building in teacher education and provide an evidence-based foundation for institutional policy formulation and lecturer training programmes. It is recommended that Colleges of Education should adopt a context-specific digital skills framework aligned with international models.

Keywords: 21st-century digital skills, College of Education lecturers, PRISMA, Teacher Education, Digital Pedagogy

Introduction

The 21st century has witnessed rapid technological advancements that have fundamentally reshaped education systems worldwide. As global economies transition toward knowledge-based digital frameworks, education has become a critical driver of innovation and sustainable development (Omoosejimi et al., 2018). Consequently, higher education institutions are increasingly expected to equip learners with advanced digital competencies necessary for participation in the digital economy. This expectation places significant pressure on Colleges of Education, which are responsible not only for preparing future teachers but also for modeling effective technology-enhanced pedagogical practices (Okoli & Okolo, 2024).

Digital technologies such as learning management systems, cloud computing, mobile applications, and artificial intelligence have significantly transformed teaching, learning, and assessment processes in higher education. In Nigerian Colleges of Education, empirical studies indicate that digital skills can enhance instructional delivery, facilitate collaboration, and improve learning outcomes (Joseph et al., 2025; David-West, 2022). At the same time, contemporary students increasingly expect interactive and technology-rich learning environments that support engagement, flexibility, and personalized learning experiences. Meeting these expectations requires lecturers to possess both technical proficiency and the pedagogical expertise necessary to integrate digital tools effectively into teaching and learning processes.

Furthermore, the post-pandemic educational landscape has accelerated the adoption of online, blended, and hybrid learning models across higher education institutions. As a result, strengthening lecturers' digital competence has become an urgent priority for institutions seeking to ensure effective teaching and learning in increasingly digital environments (Yurtseven et al., 2021).

Statement of the Problem

Despite the growing integration of digital technologies in higher education, significant challenges remain regarding lecturers' competence and the effective pedagogical integration of digital tools in Nigerian Colleges of Education (Agbogo Onwubuya et al., 2024). Although many lecturers demonstrate basic digital literacy, research suggests that their competence in advanced digital pedagogy remains uneven (Olupayimo & Edeh, 2024). Studies consistently reveal a gap between lecturers' recognition of the importance of digital skills and their actual level of competence, particularly in areas such as digital content creation, problem-solving, and the use of emerging technologies (Amaewhule & Nwadike, 2023; Emiri et al., 2024).

This issue is particularly critical within Colleges of Education, where lecturers play a uniquely influential role in preparing pre-service teachers. As role models for future educators, lecturers are expected to demonstrate effective digital pedagogy that student teachers can observe and replicate in their own professional practice. Consequently, deficiencies in lecturers' digital skills may negatively affect the quality of teacher preparation and ultimately undermine graduates' digital readiness for contemporary classrooms (Adesanya et al., 2024). Variations in lecturers' digital competence have been attributed to several factors, including differences in professional training, access to technological infrastructure, institutional support, and opportunities for continuous professional development (Ogunbodede et al., 2023).

In addition to these practical challenges, the existing literature on digital skills in education remains conceptually fragmented and inconsistent. Concepts such as digital literacy, digital competence, ICT skills, and 21st-century digital skills are frequently used interchangeably in the literature (Rakisheva & Witt, 2023; Sorbara, 2024). Moreover, different studies emphasize varying dimensions of digital competence, ranging from basic operational abilities to advanced skills involving creativity, collaboration, and critical thinking (Holik et al., 2023; Gomez-Trigueros, 2023). This lack of conceptual clarity makes it difficult to clearly identify and prioritize the specific digital skills required for lecturers in Colleges of Education. Therefore, there is a need to systematically synthesize existing research to clarify the key 21st-century digital skills required by College of Education lecturers. This PRISMA-guided systematic review seeks to address this gap by identifying and synthesizing relevant evidence from the literature. By consolidating fragmented findings, the study aims to provide conceptual clarity and an evidence-based understanding that can inform professional development initiatives, institutional policies, and curriculum design in teacher education.

Objectives of the Study

The study was guided by the following objectives:

1. To identify the key 21st-century digital skills that are considered essential for College of Education lecturers as reported in existing literature.
2. To examine how 21st-century digital skills are conceptualized and defined across empirical and theoretical studies related to teacher education.
3. To synthesize the identified digital skills into a comprehensive and context-appropriate digital competence framework suitable for College of Education lecturers.

Research Questions

The research questions formulated for this systematic literature review are:

1. What key 21st-century digital skills are identified in the literature as essential for College of Education lecturers?
2. How are these digital skills conceptualized and defined across existing studies?
3. How can the identified digital skills be synthesized into a comprehensive framework suitable for College of Education lecturers?

Methodology

This study adopted a systematic literature review design guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework. A PRISMA-guided approach was considered appropriate because it provides a transparent, rigorous, and replicable method for

identifying, screening, and synthesizing existing research evidence (Utaminingsih et al., 2023; Qureshi et al., 2020).

The systematic search technique applied in this study consisted of three stages: the identification phase, the screening phase, and the eligibility phase. During the identification stage, the process involves the meticulous selection of suitable keywords and search terms to find articles pertinent to the research question. Leveraging a broad spectrum of keywords increases the chances of discovering articles that are closely aligned with the objectives of the review, as noted by Fajrie et al. (2024) and Komalasari et al. (2023). The following databases were utilized to find relevant journals for the systematic review are presented in table 1.

Table 1: Articles Identified from the Systematic Review

Database	Keywords	Identification
ScienceDirect	“Digital skills and teacher educators”	32
Google Scholar	“Digital competence and college of education lecturers”	63
ResearchGate	“21st century digital literacy and teacher educators”	45
Mendeley	“ICT skills and college of education lecturers”	101
Total		241

In this phase of the research process, the researcher thoroughly examined all documents retrieved from the database to identify and exclude irrelevant materials. Duplicate articles were systematically discarded, resulting in the exclusion of 136 articles. Additionally, 27 non-English publications were excluded, along with 44 articles that were deemed unfit based on their titles and findings. Consequently, a refined selection of 34 articles was retained for progression to the subsequent phase of the study. The goal of this stage is to verify that all articles that advanced from the initial screening phase fulfil the criteria specified in table 1. At this juncture, the titles and abstracts of the journal articles were analyzed to determine if they remain suitable for review. At this stage, only those papers that completely met the criteria were selected for evaluation. Conference papers, peer-reviewed journal articles written in English, and those published in the year 2015 or later were all included.

Table 2: Eligibility Criteria for Selecting Articles for Systematic Review

Criterion	Eligibility	Exclusion
Types of Literature	Research Articles	Books, reports, and documentaries
Language Choice	English Language	Other Languages
Time Range	2015-2025	2015 and earlier
Education	College of Education lecturers, teacher educators	In-service school-teachers or professionals outside teacher education
Country	Global	

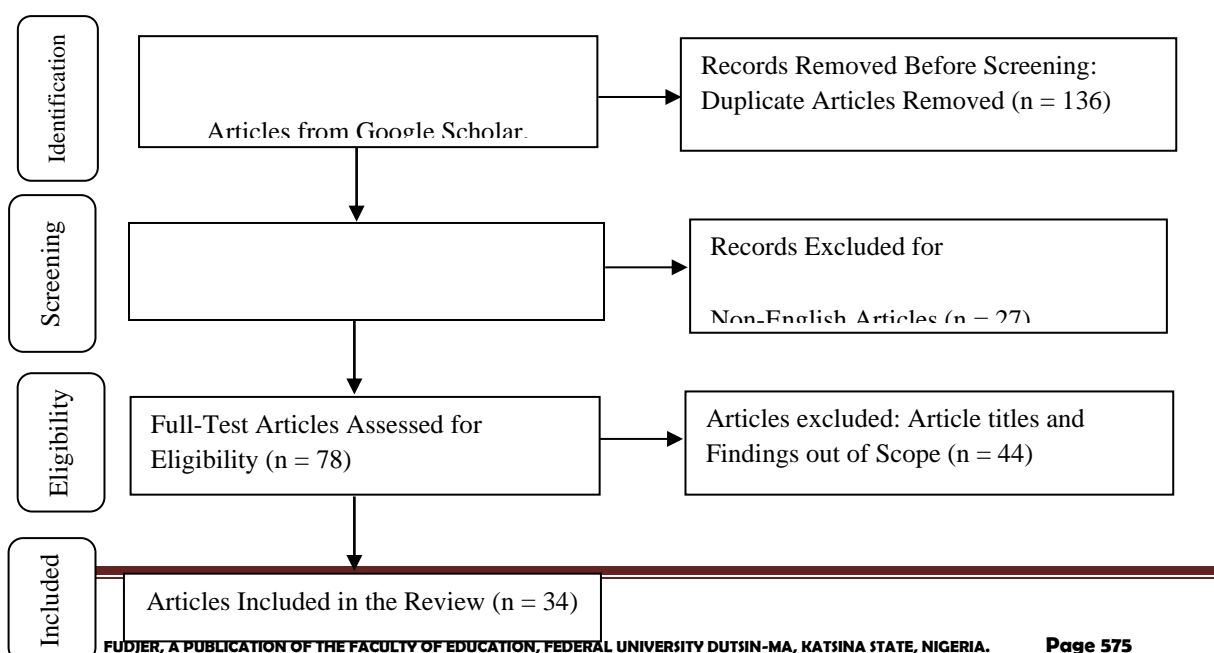


Figure 1: PRISMA Flow Chart

Table 3 presents the analysis of studies that met the inclusion criteria for this systematic review. Data were systematically extracted from each included study using a structured data extraction form developed by the researcher. The extracted information included author(s) and year of publication, country and educational context, study design and methodology, terminology used to describe digital skills (e.g., digital competence, ICT skills), identified digital skill domains, and key findings relevant to the study objectives. This approach ensured consistency and completeness in data collection across the reviewed studies.

A thematic synthesis approach was used to analyze the extracted data. Digital skills reported across the studies were coded and grouped into recurring themes and categories. These themes were reviewed and refined to identify patterns, similarities, and differences in how digital skills were conceptualized in the literature, with emphasis on technical, pedagogical, and professional dimensions relevant to College of Education lecturers. To strengthen the analysis, the identified themes were compared with established frameworks such as the Digital Competence Framework for Educators (DigCompEdu) and the Technological Pedagogical Content Knowledge (TPACK) model. This comparison supported the development of a coherent and context-specific framework of 21st-century digital skills.

Results

This section presents the findings of the systematic review in relation to the three research questions. The synthesis is based on the 10 peer-reviewed studies that met the inclusion criteria following the PRISMA screening process.

Table 3: Data Extraction and Analysis

SN	Authors' Name /Year of Pub./Title	Location of Study/Context	Study Design/Method	Terminology used	Identified Digital Skills	Findings
1	Joseph et al. (2025) Lecturers' digital literacy skills and application of artificial intelligence as predictors of online learning outcomes among undergraduates in Federal Universities in South-East, Nigeria	Nigeria/ University Lecturers	Correlational Research Design/Multi-stage sampling technique	Digital Literacy Skills	Digital Literacy Skills Online Learning Skills Artificial Intelligence Learning Skills	The study findings revealed that lecturers' digital skills are a very strong and significant predictor of online learning outcomes among undergraduates
2	Egbeyemi & Enilolobo (2022) Business educators' perception of digital skills needed for effective performance in the world of work.	Kwara, Nigeria/ College of Education Lecturers	Descriptive Survey Research Design/Stratified Sampling Technique	Digital Skills	Digital Foundation Communication Skills Digital Marketing Skills	Educators' perception of digital skills needed for effective performance in the world of work.
3	David-West (2022) Digital literacy skills and utilisation of online platforms for teaching by LIS educators	Rivers State, Nigeria/ University Lecturers	Descriptive Survey Design/Census Sampling Technique	Digital Literacy	Digital Literacy Skills Utilization of Online Platform Skills	Digital literacy skills enhance online platforms utilization for teaching

	in universities in Rivers State, Nigeria					
4	Amaewhule & Nwadike (2023) Lecturers' digital competencies for quality service delivery in public universities in Rivers State	Rivers State, Nigeria/ University Lecturers	Descriptive Survey Research Design/Stratified Sampling Technique	Digital Competencies	Digital Communication Information Sharing Skills Content Creation Problem-Solving Skills	The result of the study indicated that the lecturers were only competent in the area of digital communication and information sharing but were not competent in content creation and problem solving.
	Omosekejimi et al. (2018) ICT and digital literacy skills: A mechanism for efficient teaching in Nigerian colleges of education.	Southwest Region, Nigeria/ College of Education Lecturers	Descriptive Survey Design/Random Sampling Technique	ICT and Digital Literacy	Internet Searching Skills Operation of Application Software for Teaching Skills Operation of Computers and Gadgets Skills Communication Skills	The findings revealed that the benefits of the use of ICT and digital literacy skills for teaching in colleges of education include, but not limited to: faster lecturer-student communication; cooperative learning among students;
	Umoru & Salami (2025) Basic digital skills as determinants of business educators' job performance in tertiary institutions.	Southwest Region, Nigeria/ College of Education and University Lecturers	Descriptive Survey Design/Census Sampling Technique	Basic Digital Skills	Operation of Electronic Device Skills Internet Operation Skills Content Creation Problem-Solving Skills Collaborative Skills	There is a significant positive relationship between basic digital skills and educators' job performance in tertiary institutions
	Chukwurah & Otum (2023) Imparting digital skills as a veritable tool for promoting competencies in business education graduates in Cross River State, Nigeria.	Cross River State, Nigeria/ College of Education and University Lecturers	Descriptive Survey Design/ No Sampling Technique	Digital Skills	Online Management Skills Web Design and Development Skills Cloud Computing Skills Online Teaching Skills Network Management Skills	The result of the findings revealed that various digital skills are relevant in promoting competencies in Business Educators.
	Usip et al. (2025) Digital skills required by business education lecturers for effective instructional delivery in tertiary institutions in Rivers State.	River State, Nigeria/Tertiary Institutions	Descriptive Survey Design/ No Sampling Technique	Digital Skills	Computer Application Skills and Instructional Delivery Internet Skills and Teaching Effectiveness Desktop publishing skills Database Management skills PowerPoint Presentation Skills Webpage Design Skill	The finding indicate that respondents recognized the critical importance of specific computer application skills, including desktop publishing, database management, PowerPoint presentation, and webpage design, for Business Education lecturers to deliver instruction effectively

Ihendinihu & Osondu (2025) Strategies for enhancing digital and media literacies of Faculty of Education lecturers: A case of two universities in Abia State.	Abia State, Nigeria/ University Lecturers	Survey Design/No Sampling Technique	Digital and Media Literacies	Learning Management Systems Creation Skills Multimedia Content Creation Collaboration Skills Digital tools for Communication Skills Online Presence Skills Media Manipulation Skills	The study emphasizes the paramount importance of digital communication skills among university lecturers, highlighting proficiency in emails, instant messaging, and video conferencing as essential for fostering collaboration and engagement in higher education
Emiri et al. (2024). Digital literacy among lecturers in the age of artificial intelligence: A case study.	Delta State, Nigeria/ University Lecturers	Descriptive Survey Design/Proportionate Stratified Random Sampling Technique	Digital Literacy	Application Software Operation Skills Internet Skills AI Tools Usage Skills Research/Writing Skills	Findings indicate that while lecturers' digital literacy concerning AI is slightly above moderate, their actual use of AI tools remains low.

Research Question 1

What key 21st-century digital skills are identified in the literature as essential for College of Education lecturers?

The reviewed literature identifies a broad but convergent set of 21st-century digital skills required for College of Education lecturers. Digital literacy emerged as the most frequently reported competency, including basic computer operation, internet navigation, application software use, and information literacy. These foundational skills are consistently linked to effective teaching, research productivity, and instructional delivery. Beyond basic literacy, studies emphasize pedagogical digital skills, such as learning management system (LMS) operation, online teaching, virtual classroom management, digital assessment, and blended or distance learning competencies, particularly in post-pandemic and online education contexts.

The literature also highlights digital communication and collaboration skills, including email communication, video conferencing, social networking tools, and collaborative platforms, which enhance lecturer–student interaction and instructional effectiveness. In addition, content creation and multimedia skills, such as digital storytelling, multimedia production, webpage design, database management, and cloud computing, were identified, although several studies report that lecturers often show low competence in advanced content creation and problem-solving skills. Emerging competencies such as artificial intelligence (AI) usage, digital creativity, critical thinking, leadership, and decision-making skills were also identified in recent studies, particularly those addressing Education 4.0 environments. Overall, the findings indicate that the essential digital skills for College of Education lecturers span technical, pedagogical, communication, cognitive, and emerging technology domains.

Research Question 2

How are these digital skills conceptualized and defined across existing studies?

The reviewed studies conceptualize digital skills in diverse ways, reflecting differences in context and disciplinary focus. Various terms are used, including digital literacy, digital skills, digital competence, ICT competence, digital teaching skills, and information literacy. In many studies, digital literacy is

viewed as a foundational concept referring to the ability to access, evaluate, use, and create digital information effectively, including computer operation, internet use, and basic application skills. Other studies adopt a broader digital competence perspective, combining technical proficiency with pedagogical integration, communication, collaboration, creativity, and ethical awareness in digital environments. Some studies define digital skills from a task-oriented perspective, focusing on specific operational abilities such as LMS management, multimedia content creation, virtual classroom facilitation, cloud computing, AI tool usage, and database management. More recent literature frames digital skills within 21st-century skills and Education 4.0 frameworks, emphasizing creativity, collaboration, critical thinking, leadership, and innovation alongside digital proficiency. Despite these variations, the literature consistently recognizes digital skills as multidimensional competencies that integrate technical, pedagogical, communicative, and cognitive elements rather than existing as isolated abilities.

Research Question 3

How can the identified digital skills be synthesized into a comprehensive framework suitable for College of Education lecturers?

Based on the synthesis of findings across the reviewed studies, the identified digital skills can be organized into a comprehensive framework for College of Education lecturers. This framework reflects both the frequency of skills reported and their roles in teaching and professional practice. First, Foundational Digital Literacy Skills form the base of the framework. These include computer operation, internet navigation, application software use, information literacy, and basic ICT skills, which the literature identifies as prerequisites for other digital competencies. Second, Digital Pedagogical Skills represent the instructional core. This domain includes LMS operation, online and blended teaching, virtual classroom management, digital assessment, and instructional design, all of which directly influence teaching effectiveness and learning outcomes. Third, Digital Communication and Collaboration Skills support interaction and professional engagement. These involve the use of digital communication tools, collaborative platforms, social networking services, and online engagement strategies. Fourth, Digital Content Creation and Innovation Skills involve the development of digital learning materials. These include multimedia production, digital storytelling, web design, desktop publishing, database management, and cloud computing. Although lecturers often demonstrate lower competence in this area, studies emphasize its importance for modern teaching.

Finally, Advanced and Emerging Digital Skills form the transformative layer of the framework. These include AI usage, creativity, critical thinking, leadership, problem-solving, ethical digital practice, and decision-making skills, which align teaching with 21st-century and Education 4.0 demands. Overall, the framework provides a structured representation of the digital skills required by College of Education lecturers, integrating technical, pedagogical, communicative, innovative, and emerging competencies.

Table 4: Summary Table of Synthesized Digital Skills Framework for College of Education Lecturers

Domain	Key Skills Identified	Evidence from Reviewed Studies
Foundational Digital Literacy	Computer operation, internet use, information literacy, application software	Strong agreement; linked to teaching effectiveness and online learning outcomes
Digital Pedagogical Skills	LMS use, online/blended teaching, digital assessment, virtual classroom management	Widely recognized; limited practical application reported

Digital Communication & Collaboration	Email, video conferencing, social platforms, collaborative tools	High consensus; consistently reported as essential
Content Creation & Innovation	Multimedia production, digital storytelling, web design, database management	Importance acknowledged; low competence commonly reported
Emerging & Advanced Skills	AI usage, creativity, critical thinking, leadership, problem-solving	Increasing emphasis; low adoption and usage

Discussion of Findings

This discussion aligns the synthesized findings and situates them within existing empirical evidence drawn from the reviewed literature.

Findings from the reviewed studies indicate strong consensus that foundational digital literacy skills, including computer operation, internet navigation, application software use, and information literacy, are essential for College of Education lecturers. Studies by Joseph et al. (2025), David-West (2022), Emiri et al. (2024), Omosekejimi et al. (2018), and Sumile and Lozano (2025) reported positive relationships between lecturers' digital literacy and teaching effectiveness, online learning outcomes, and professional performance. Similarly, digital pedagogical skills, such as learning management system (LMS) operation, online teaching, virtual classroom management, and digital assessment, were consistently identified as critical for instructional delivery (Okoli & Okolo, 2024; Abdullahi & Balogun, 2025; Adesanya et al., 2024; Sanchez Villacrés et al., 2025). The importance of digital communication and collaboration skills was also widely supported. Studies by Omosekejimi et al. (2018), Ihendinihu and Osondu (2025), Zion-Ngoka and Ekoh-Nweke (2024), and Holik et al. (2023) emphasized communication, interaction, and collaboration as key competencies that enhance engagement and professional effectiveness. However, findings on lecturers' competence in content creation, innovation, and problem-solving skills were mixed. While these skills were widely recognized as important, Amaewhule and Nwadike (2023), Umoru and Salami (2025), and Cariño et al. (2024) reported relatively low lecturer proficiency in areas such as digital storytelling, multimedia creation, and digital problem-solving.

The reviewed literature also reveals conceptual inconsistencies in the definition of digital skills. Some studies conceptualized digital skills narrowly as technical abilities, focusing on computer use and internet skills (Omosekejimi et al., 2018; Emiri et al., 2024; Ogbusuo, 2025). In contrast, other studies adopted broader digital competence frameworks that integrate technical, pedagogical, communicative, and cognitive dimensions (Holik et al., 2023; Ogunbodede et al., 2023; Asagar, 2025; Sorbara, 2024). A further group of studies framed digital skills within 21st-century and Education 4.0 paradigms, emphasizing innovation, adaptability, and emerging technologies such as artificial intelligence (Joseph et al., 2025; Emiri et al., 2024; Sanchez Villacrés et al., 2025). However, Rakisheva and Witt (2023) noted the existence of multiple competing digital competence frameworks, indicating the absence of a unified definition. Overall, the findings support the development of a layered digital skills framework for College of Education lecturers. Foundational digital literacy forms the base for higher-level competencies (Joseph et al., 2025; Sumile & Lozano, 2025; Alamsyah, 2017). Digital pedagogical skills build on this foundation to support effective teaching (Okoli & Okolo, 2024; Abdullahi & Balogun, 2025; Adesanya et al., 2024). Communication and collaboration skills further strengthen interaction and professional engagement (Omosekejimi et al., 2018; Ihendinihu & Osondu, 2025; Holik et al., 2023). At the advanced level, emerging competencies such as AI usage, creativity, critical thinking, leadership, and ethical digital practice were highlighted (Holik et al., 2023; Asagar, 2025; Sanchez Villacrés et al., 2025). Nevertheless, studies by Agbogo-Onwubuya et al. (2024) and Emiri et al. (2024) reported low actual use of advanced digital tools, revealing a gap between recognized importance and practical implementation. This gap underscores the need for targeted capacity-building and institutional support.

Conclusion

This systematic review guided by PRISMA standards analyzed various studies to identify essential digital skills for College of Education lecturers. It found that foundational digital literacy, digital pedagogy, and communication skills are crucial for effective teaching. However, there are gaps in higher-order skills like digital content creation and innovative pedagogy, with low competence in emerging technologies such as artificial intelligence. The literature reveals inconsistent conceptualizations of digital skills, complicating capacity-building efforts. Overall, while lecturers possess moderate basic digital skills, significant deficits in advanced competencies remain, highlighting the need for improvement to meet modern educational demands.

Recommendations

1. Colleges of Education should adopt a context-specific digital skills framework aligned with international models.
2. Professional development programs should focus on digital pedagogy and innovative teaching practices.
3. Institutions must support the integration of emerging technologies through structured training.

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