

LECTURERS' READINESS AND COMPETENCE IN EMBRACING EMERGING-TECHNOLOGIES FOR FUTURE- ORIENTED INSTRUCTION: IMPLICATION FOR SCIENCE EDUCATION

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Abstract

This study examined lecturers' readiness and competence in embracing emerging-technologies for future-oriented instruction: implication for science education. The study adopted a descriptive survey design. The population comprised all the lecturers in University of Nigeria, Nsukka while 289 lecturers purposively sampled from faculty of education participated in the study. A structured instrument titled Questionnaire on Lecturer's Readiness and Competence for Emerging Technologies (QLRCET) was used for data collection and was face-validated by three experts. The reliability of the instrument was established using Cronbach Alpha, yielding a coefficient of 0.87, indicating high internal consistency. Descriptive statistics were used to answer the research questions, while t-test were employed to test the hypotheses at 0.05 level of significance. Findings revealed that lecturers' are highly ready and competent with positive attitudes toward deploying emerging technologies. Also, lecturer's competency were found to influence their readiness to deploy emerging technologies. In addition, notable barriers including infrastructural limitations, poor electricity supply, inadequate institutional support, limited training opportunities, and high costs of training were found to undermine readiness. Hence, investment in stable internet and electricity supply, and technical support services were recommended to ensure that lecturers' readiness translate into Technology deployment.

Keywords: Lecturers' Readiness, Competence, Emerging-Technologies & Future-Oriented Instruction

Introduction

The pandemic of late 2019 brought the world to a standstill for almost one year with little or no meaningful development. This incident resulted in global lockdown, schools were closed, and movement restricted. According to Ukala, et al., (2024) the pandemic took the world by surprise and exposed how unprepared many nations, including institutions of learning are. This was the transition point from face-to-face classroom learning to online technology-based learning globally. Educational system has since witnessed rapid proliferation of emerging technologies like; learning management systems (LMS), lecture-capture and video-conferencing platforms, mobile learning apps, Augmented/Virtual Reality (AR/VR), and, more recently, generative artificial intelligence (GenAI). These technologies have gained global acceptance due to its affordances for active, personalized, and scalable instruction that can support competency-based and future-oriented learning (Sembey, 2024; Criollo-Córdoba et al., 2023).

In developed nations, the deployment of technology in their higher institutions, has caused unprecedented transformation in our mode of learning, creating a paradigm shift for new curriculum design, pedagogy, assessment and institutional services. Agbo et al., (2023); Omaduka (2024) argued that institutional policies should focus on digital transformation and digital-skill development as strategic imperatives for 21st-century higher education. This would bridge the existing skills gaps, and ensure graduates possess digital skills needed for proper functioning in digitized global economy. According to Mmaduka, et al., (2025) the benefits of educational technologies are realized only when instructors are both ready to use technologies and are competent in their pedagogical application.

In Nigeria for instance, policy rhetoric and institutional investments over the last decade have emphasized information and communication technology (ICT) as a vehicle for improving access and quality in higher education. Federal Ministry of Education issued a National Policy on ICT in Education (2019) together with implementation guidelines that stress human-capacity development, infrastructure, and governance for technology-mediated teaching and learning. Yet empirical evidences point to a mixed and uneven picture: while many lecturers express positive perceptions of digital tools and show basic digital skills, gaps remain in advanced pedagogical competencies, institutional support, and infrastructure necessary for meaningful integration of emerging technologies into curriculum and assessment practices (Nathaniel et al., 2021; Ogunbodede, 2023).

Literarily, lecturer readiness and competence are multidimensional in nature. Olaore et al., 2020; Sembey (2024) added that lecturer readiness is not a unidimensional construct but a complex interplay of attitudinal, technical,

pedagogical, and institutional factors. While lecturers' readiness denotes attitudinal dispositions like; (perceived usefulness and openness to change), access to enabling resources (hardware, connectivity, technical support), and institutional policies that permit experimentation. Lecturers' competence refers to a spectrum of knowledge and skills: technical fluency, pedagogical skills for online/blended environments, assessment literacy for new modalities, and ethical/critical use of technologies (including data privacy and AI literacy).

Studies specifically in the contexts of higher instructions in Nigerian revealed both promise and persistent barriers. Higher institutions in Nigeria which comprise; universities, polytechnics, and colleges of education with over 170 public and private universities (National Universities Commission, 2022), their degree of ICT adoption varies significantly from one institution, and region to the other. They operate under a strain of rapid population growth and the resultant increased demand for higher education, presenting unique challenges and opportunities for innovation (Ukala, et al., 2020). In spite of these drawbacks, lecturers were found to have strong attitudes toward technology driven instruction (Idhalama, 2024), have moderate to high familiarity with common digital tools and recognise their usefulness for research and instruction (Ogunbodede, 2023), and are ready for AI integration (Mmaduka et al., 2025). However, obstacles such as unreliable power, limited institutional professional development, high cost of training, weak ICT policies, and low incentives for pedagogical innovation stand as a barrier (Mmaduka et al., 2025; Ukala et al., 2024; Emelogu, 2022;).

Other barriers to effective adoption EdTech in Nigerian universities include infrastructural deficits, such as limited access to reliable electricity and internet connectivity, gap in digital literacy among educators and students and the high cost of computers (Thomas, 2024). These challenges have persisted, creating disparities between lecturers' willingness to embrace innovation and their actual ability to implement technology-driven instruction effectively. Moreso, Nigeria-based investigations into lecturer awareness and preparedness for AI and other advanced technologies suggest that awareness is growing, yet self-efficacy and formal training remain limited. This finding raises questions whether the current levels of readiness and competence position Nigerian lecturers to enact “future-oriented” instruction that leverages the full pedagogical potential of emerging technologies.

Future-oriented instruction (FOI) connotes the ability to design instructional systems and institutional practices that ensure lecturers are able to adapt and deploy emerging technologies for teaching that produce skilled graduates, adaptive to the rapidly changing labour market. Designing a future-oriented instruction require

anticipating and integrating emerging tools (AI, adaptive learning, AR/VR, learning analytics and adaptive platforms), building educator and institutional capacity to adopt new tools effortlessly, redesigning curricula and assessment for transferable skills, and embedding equity/resilience so students accelerate with the change. In agreement, Ogwu et al., (2022); Uzorka (2023) argued that future-oriented instruction emphasizes not only adopting technologies reactively but strategically building digital infrastructures, redesigning curricula to incorporate transferable skills, and continuously upgrading lecturers' competencies to ensure resilience against disruptions such as the COVID-19 pandemic and relevance to the demands of the 21st-century workforce. This move go beyond tool adoption to a long-term transformation, preparing Nigerian universities to produce graduates who are adaptable, digitally literate, and globally competitive in a rapidly changing knowledge economy (Bali, 2024; Oladele et al., 2024).

Furthermore, Ogunbodede, 2023; Bello and Eze (2025) posited that while some lecturers possess basic digital literacy, gaps remain in specialized competencies such as designing future-oriented learning experiences and adopting AI tools responsibly. These gaps threaten the quality and sustainability of higher education, particularly as employers demand graduates who are digitally literate, innovative, and adaptable to fast changing work environments. Secondly, there is a dearth of studies in Nigeria that simultaneously address lecturers' readiness and competence in deploying emerging technologies. Most studies tend to focus either on students' digital readiness, or on lecturers' general ICT use, without adequately exploring the intersection of advanced technologies, pedagogical competence, and institutional enablers (Nathaniel et al., 2021; Emelogu, 2022).

This creates a critical knowledge gap at a time when global educational trends are shifting rapidly, and when national education policies increasingly emphasize digital transformation in higher education. Hence, the need to investigate lecturers' readiness and competency in deploying emerging technologies for future-oriented instruction. Specifically the study sought to establish:

1. Lecturers' readiness in deploying emerging technologies for future-oriented instruction
2. Lecturers' competency in deploying emerging technologies for future-oriented instruction
3. Institutional preparedness for the deployment of emerging technologies for future-oriented instruction
4. Barriers militating against lecturers' readiness and competence in adopting emerging technologies for future-oriented instruction

Hypothesis

1. Lecturers' competence does not influence their readiness to adopt emerging technologies for future-oriented instruction.

Method

This study employed a descriptive survey research design. In a descriptive study, small group (sample) are studied to make generalization for the large population. Justification was that the design allows the researchers to obtain first-hand data from the lecturers regarding infrastructure, human capacity, and institutional policies prevalent in their institutions. All university of Nigeria academic staff make-up the population, while lecturers from faculty of education was purposively sampled, and only 289 lecturers participated in the study. Education lecturers are mostly certified teachers, who have good knowledge of educational assessment, hence are most competent to evaluate the level of readiness and competence of educational program.

The instrument for data collection was a Questionnaire on Lecturers' Readiness and Competence for Emerging Technologies (QLRCET). QLRCET, a structured instrument developed by the researchers and validated by three experts from the department of Computer and Robotic Educational and Science Education all from University of Nigeria, Nsukka (UNN). The questionnaire was divided into two parts. Part 1 (respondents' demographic data), while part 2 has 21 questionnaire items in four clusters with first cluster having 6 items while others have 5 items, each measuring lecturers' readiness, competency, institutional enabler and barrier respectively. The instrument was rated on four-point Likert scale of "Strongly Agree to Strongly Disagree".

QLRCET was validation, and was trial tested on 20 lecturers from faculty of education, Nnamdi Azikiwe University Awka (UNIZIK). UNIZIK was used because they share similar characteristic. The analysed data using Cronbach's Alpha yielded a reliability coefficient of 0.75. QLRCET were administered electronically using google form. This was to give all the lecturers equal chances of being part of the study irrespective of their location. Generated data were analysed using descriptive statistics for questions while t-test tested the hypothesis at 0.05 alpha level. Decision rule for the research questions was based on grand mean of 2.50 and above is regarded as "High Extent", otherwise below 2.50 as "Low Extent" accordingly.

Result

Table 1: Descriptive Statistics on Lecturers' Readiness for Deploying Emerging Technologies for Future-Oriented Instruction

S/N	Item	Mean	SD	Remark
1	I am willing to experiment with new and emerging technologies to prepare for future-oriented teaching.	3.31	0.69	Accept
2	I believe new technologies like; AI, AR/VR, adaptive systems can improve students' learning outcomes and prepare them for future-oriented teaching.	3.39	0.71	Accept
3	I spend enough time learning new skill to enable me adapt new technologies for future-oriented teaching.	2.93	1.15	Accept
4	I am confident in my ability to use emerging technologies as I prepare for future-oriented teaching.	3.34	0.79	Accept
5	I have received adequate training or professional development opportunities that prepare me for future-oriented teaching.	3.29	0.76	Accept
6	I know how to effectively align EdTech with my teaching objectives and instructional strategies.	3.21	0.83	Accept
Grand mean		3.25	High extent	

Table 1 revealed that UNN lecturers' are ready to a high extent to deploy emerging technologies for future-oriented instruction. This was anchored on the grand mean score of 3.25 which is higher than 2.5 mean score bench mark for the study. To validate the grand mean, all the item statements had mean score ranging between 2.93 to 3.39 which were far higher than the 2.5 mean score bench mark for the study.

Table 2: Descriptive Statistics on Lecturers' Competency in Deploying Emerging Technologies for Future-Oriented Instruction

S/N	Item	Mean	SD	Remark
7	I can confidently use basic ICT tools (e.g., PowerPoint, LMS, email) in teaching.	3.34	0.73	Accept
8	I can integrate advanced tools such as AI-driven platforms or AR/VR into lesson delivery.	3.61	0.55	Accept
9	I am able to design and redesign course content to align with technology-enhanced teaching.	3.62	0.60	Accept
10	I can assess students' learning effectively using digital platforms.	3.24	0.91	Accept
11	I am aware of ethical issues with emerging technologies such as data privacy, academic integrity, and responsible AI use.	3.31	0.78	Accept
Grand mean		3.42	High Extent	

Table 2 shows that UNN lecturers have high competency to deploy emerging technologies for future-oriented instruction. This was anchored on the grand mean score of 3.42 which is higher than 2.5 mean score bench mark for the study. To validate the grand mean, all the five item statements had mean score ranging from 3.24 to 3.62 which were far higher than the 2.5 mean score bench mark for the study.

Table 3: Descriptive Statistics on Institutional Preparedness for the Deployment of Emerging Technologies for Future-Oriented Instruction

S/N	Item	Mean	SD	Remark
12	My institution has adequate ICT infrastructure to support technology-enhanced learning.	2.79	1.13	Accept
13	My institution has enough technical support staff who are readily available when I encounter challenges with technology.	2.42	0.94	Reject
14	My institution provides incentives for lecturers who integrate emerging technologies.	2.10	0.22	Reject
15	There is a clear institutional policy guiding the adoption of emerging technologies.	2.61	1.01	Accept
16	My institution provides continuous staff training opportunities to prepare us for future-oriented teaching.	2.38	1.82	Reject
Grand mean		2.46	Low Extent	

Table 3 shows that UNN lecturer's perception on institutional preparedness for the deployment of emerging technologies for future-oriented instruction is very low. This was anchored on the grand mean score of 2.46 which is lower than 2.5 mean score bench mark for the study.

Table 4: Descriptive Statistics on Lecturers' Limitations Adopting Emerging Technologies for Future-Oriented Instruction

S/N	Item	Mean	SD	Remark
17	My institution has poor internet connectivity and electricity which limits my preparation for future-oriented technology driving teaching	3.23	0.87	Accept
18	High costs of training and software discourage my adoption of digital tools	3.35	0.84	Accept
19	Lack of institutional policy reduces my motivation to integrate technologies	2.91	0.90	Accept

20	There are limited training opportunities in the institution	3.24	0.32	Accept
21	Large class sizes make it difficult to implement technology-rich pedagogies	2.32	0.92	Reject
Grand mean		3.01		Accept

Table 4 shows that lecturers' accept four out of the five items as their limitations adopting emerging technologies for future-oriented instruction. They rejected that large class sizes make it difficult to implement technology-rich pedagogies. However, based on the grand mean score of 3.01 which is higher than the 2.5 mean score bench mark for the study, it suggest that the respondents accept the items as the limitations affecting the adoption of emerging technologies for future-oriented instruction.

Table 5: t-test on the influence of lecturer's competency on their readiness to deploy technology for future-oriented instruction

Gender	N	Mean	SD	df	Std.Er	t-cal	p.value	Remark
Competency	203	19.58	2.17	201	.23	10.27	0.000	Rejected
Readiness	203	17.14	2.58					

The result in Table 4 showed a significant value of t-cal of 10.27 and P-value of 0.00. With P-value of 0.00 which is less than 0.05 level of significance for the study, the null hypothesis which states that lecturer's competency does not influence their readiness to adopt emerging technologies for future-oriented instruction is therefore rejected. Implying that lecturer's competency actually influences their readiness to use technology.

Discussion

The findings of this study revealed a generally positive disposition and readiness of lecturers to integrate emerging technologies into future-oriented instructional delivery in tertiary institutions. It revealed further that lecturers are highly competent in embracing these tools, suggesting that the higher education sector in Nigeria is on a positive trajectory towards technology-driven teaching. These findings aligns with recent studies Adedokun-Shittu and Shittu (2020); Omodan (2021) whose findings shows that lecturers in higher institutions are increasingly

aware of the pedagogical potential of emerging technologies and demonstrate willingness to adopt technology to enhance teaching and learning. Similarly, Agbo et al. (2023), Mmaduka et al., (2025) found that Nigerian university lecturers exhibited moderate to high readiness in adopting digital innovations, particularly when supported with institutional training and infrastructure.

Secondly, the findings also captured some of the challenges that often hinder the effective integration of emerging technologies in Nigerian tertiary institutions. While lecturers' readiness appears encouraging, infrastructural limitations, inconsistent electricity supply, inadequate institutional support, limited training opportunities, and high costs of training and buying software significantly undermine their readiness. The findings corroborate with the findings of Okoye and Okechukwu (2021); Yakubu and Dasuki (2019) whose findings also revealed infrastructural challenges and institutional support as the greatest limitation against the deployment of technologies in instruction delivery. Bello and Johnson (2022) found that lecturers' limited digital competence, resistance to change, and lack of technical support, also stand as a barrier despite their positive attitudes. Hence, while the results of the study suggest that lecturers are ready and competent, the actual implementation may still face hurdles if systemic issues of training, resources, and sustainability are not addressed.

The findings further revealed that lecturers' competency does influence their readiness to adopt emerging technologies. This underscores the strong link between digital competence and actual technology adoption. This finding is consistent with several studies which emphasize that lecturers who possess higher digital literacy and pedagogical competence are more likely to adopt emerging technologies for innovative instruction (Yakubu & Dasuki, 2019; Adedokun-Shittu & Shittu, 2020). According to Agbo et al. (2023), competence in areas such as learning management systems, digital collaboration tools, and online assessment strongly predicts readiness to integrate technology for effective teaching. Conversely, while some scholars argue that competency is important, they emphasized that other factors such as infrastructural challenges, institutional policies, and access to resources can sometimes outweigh competence in shaping lecturers' readiness to adopt technology (Okoye & Okechukwu, 2021; Bello & Johnson, 2022).

The finding by implication suggest that lecturer may be highly competent but may remain reluctant to adopt emerging technologies if there is inadequate technical support, poor internet access, and lack of institutional incentives. Similarly, Omodan (2021) contends that systemic and environmental factors play a mediating role in the relationship between competence and readiness. Hence, while the findings strengthen the evidence that competency significantly influences readiness,

it should be interpreted within the broader context of structural and institutional enablers that make adoption feasible and sustainable.

Conclusion

Based on the findings, lecturers demonstrated a generally positive disposition towards technology integration. An indication that lecturers are not only aware of the effectiveness of emerging technologies but are also prepared for the integration of innovative instructional practices. Similarly, the findings revealed that lecturers' readiness to adopt emerging technologies for future-oriented instruction is strongly influenced by their level of competence. Although, while competence significantly shapes readiness, its practical impact is mediated by other factors such as infrastructure, institutional support, and access to resources, which remain critical for sustainable implementation. Hence, promoting lecturers' competencies through continuous professional development, alongside addressing systemic barriers, is essential for fully realizing the potential of emerging technologies in higher education in Nigeria.

Recommendations

1. Universities should organize regular training, workshops, and seminars to strengthen lecturers' digital competence, focusing on practical skills for integrating emerging technologies into instruction.
2. Institutions should invest in stable internet connectivity, reliable electricity supply, and technical support services to ensure that lecturers' readiness and competence translate into effective utilization of technologies.

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