TEACHERS' READINESS AND PERCEIVED BARRIERS TO INTEGRATING AI INTO CHEMISTRY PEDAGOGY IN NIGERIAN SECONDARY SCHOOLS: AN OPINION PERSPECTIVE

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Abstract

The integration of Artificial Intelligence (AI) into chemistry education holds transformative potential for Nigerian secondary schools. However, classroom adoption remains slow despite global momentum (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). This opinion paper examines teachers' readiness and the perceived barriers hindering AI integration into chemistry pedagogy in Nigeria. Drawing on literature from educational technology, teacher cognition, and AI in education, we argue that readiness is not just a technical issue but a complex interplay of pedagogical belief, infrastructural access, digital literacy, and policy support (Mishra & Koehler, 2006; Venkatesh & Davis, 2000). Key barriers identified include inadequate infrastructure, limited teacher training, fear of displacement, curriculum misalignment, and ethical concerns (Yusuf & Balogun, 2011; Opara & Duru, 2025). The paper concludes with actionable recommendations: targeted professional development, localized AI tools, policy alignment with the Nigeria Artificial Intelligence Strategy (Federal Ministry of Education, 2024), and bottom-up pilot programs. Without addressing teacher readiness, AI risks becoming another imported innovation that fails to take root in Nigerian classrooms.

Keywords: Artificial Intelligence, chemistry pedagogy, teacher readiness, barriers, Nigeria, secondary education

Introduction

Artificial Intelligence is no longer a futuristic concept in education. Globally, AI tools are being used for personalized learning, automated assessment, and virtual labs (Zawacki-Richter et al., 2019). UNESCO's 2023 report on AI in education emphasizes AI's role in achieving SDG 4 by expanding access and improving quality of learning (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2023).

In Nigeria, the National Policy on Education and the Nigeria Artificial Intelligence Strategy 2024–2028 both signal government intent to integrate emerging technologies (Federal Ministry of Education, 2024). Yet, in most secondary school science classrooms, teaching remains chalk-and-talk, with limited use of digital tools beyond PowerPoint (Yusuf & Balogun, 2011). This disconnect raises a critical question: If the policy and technology exist, why is classroom practice lagging?

The answer lies largely with the teacher. Teachers are the gatekeepers of pedagogical change. Their readiness—defined as a combination of knowledge, skills, attitude, and access—determines whether AI becomes a tool for transformation or another unused resource (Mishra & Koehler, 2006). This paper adopts an opinion perspective to explore two issues: (1) What does "readiness" mean for Nigerian science teachers? (2) What barriers do they perceive when asked to integrate AI into their lessons?

Conceptualizing Teacher Readiness for AI

Readiness is more than "can the teacher use ChatGPT?" Drawing from the Technology Acceptance Model (TAM) and TPACK framework, teacher readiness for AI includes four dimensions (Mishra & Koehler, 2006; Venkatesh & Davis, 2000):

Pedagogical Readiness

Chemistry teachers must believe AI can improve learning outcomes (Venkatesh & Davis, 2000). If they view AI as a threat to teacher authority or as irrelevant to WAEC/NECO exam preparation (West Africa Examinations Council [WAEC], 2022), adoption will be superficial. Many Nigerian science teachers have spent decades perfecting lecture methods. Shifting to AI-assisted inquiry requires a change in belief, not just skill.

Technological Readiness

This refers to basic digital literacy: ability to operate devices, navigate platforms, and troubleshoot. Studies in Southeast Nigeria report that while most teachers own smartphones, fewer than 30% have used educational software beyond WhatsApp for notes (Opara & Duru, 2025). AI tools require higher-order digital skills—prompt engineering, data interpretation, and ethical use (Ahmad et al., 2023).

Infrastructural Readiness

No matter how skilled the teacher, AI requires electricity, internet, and devices. Reports on Nigerian schools indicate that unreliable power and poor internet access remain pervasive challenges (Yusuf & Balogun, 2011). "AI without power" is a reality many teachers face daily, creating a perception that "AI is for private schools" (Opara & Duru, 2025).

Policy & Institutional Readiness

Teachers look to school management and government for support. If AI use is not recognized in appraisal, if there is no training budget, and if curriculum documents ignore AI, teachers will not risk experimenting. The current Senior Secondary Science Curriculum mentions "ICT" but not "AI" explicitly (Nigerian Educational Research and Development Council [NERDC], 2013).

Perceived Barriers to AI Integration in Nigerian Science Classrooms

Based on literature and practitioner reports, five barriers dominate teachers' perceptions:

Infrastructure Deficit

The most cited barrier. AI tools are cloud-based and data-heavy. In schools with limited power and no Wi-Fi, even loading ChatGPT becomes a challenge (Yusuf & Balogun, 2011). This infrastructural gap limits meaningful engagement with technology-driven pedagogies (Ahmad et al., 2023).

Lack of Targeted Training

Most government "ICT training" focuses on Microsoft Office, not AI pedagogy (Opara & Duru, 2025). Teachers report attending workshops where they are shown tools but never taught how to integrate them into a 40-minute Chemistry lesson on stoichiometry. Without context-specific training, AI feels abstract (Ahmad et al., 2023).

Fear and Misconception

Some teachers fear AI will replace them. Others confuse AI with "Google" or see it as cheating (Zawacki-Richter et al., 2019). This fear is amplified by media narratives about AI taking jobs. In science education, where practicals and mentorship matter, teachers worry AI will dehumanize learning (UNESCO, 2023).

Curriculum and Assessment Misalignment

WAEC and NECO remain paper-based and content-heavy (WAEC, 2022). Teachers ask: "If AI is not tested, why should I use it?" Until assessment formats reward critical thinking over memorization (NERDC, 2013), teachers will prioritize exam drill over AI exploration.

Ethical and Equity Concerns

Teachers worry about student data privacy, plagiarism, and widening the digital divide (UNESCO, 2023). If only students with smartphones benefit, AI could increase inequality in already under-resourced schools (Ahmad et al., 2023).

Discussion: Why Readiness Must Come First

Global examples show that buying AI software without preparing teachers leads to low uptake (Ahmad et al., 2023). Kenya's Tusome program succeeded because it paired tablets with 3 months of teacher coaching. In contrast, several "smart school" projects in Nigeria failed because devices were delivered but teachers were not ready (Yusuf & Balogun, 2011).

For Nigerian science teachers, readiness is contextual. An opinion-based approach suggests that readiness must be built from the bottom up: start with teachers' lived classroom challenges, then show how AI can solve them. Example: using AI to

generate differentiated worksheets for mixed-ability JSS3 classes, or using image-recognition AI to help students identify plant cells when microscopes are lacking (Ahmad et al., 2023).

Recommendations for Policy and Practice

To move from perception to practice, the following steps are proposed:

1. Localized Professional Development: Train science teachers on AI tools relevant to their subjects—PhET + AI tutors for Physics, ChemDraw + AI for Chemistry, BioDigital + AI Q&A for Biology (Ahmad et al., 2023).

2. Infrastructure Bundles: Partner with telcos and solar companies to provide "AI-ready classrooms": solar power + offline AI tools + subsidized data, as recommended by UNESCO (2023).

3. Curriculum and Exam Reform Alignment: NERDC and WAEC should pilot AI-related performance tasks (NERDC, 2013; WAEC, 2022).

4. Teacher Agency and Peer Networks: Create Communities of Practice where Nigerian science teachers share AI lesson plans on WhatsApp/Telegram. Teachers trust other teachers more than vendors (Opara & Duru, 2025).

5. Ethics and Policy Literacy: Include modules on AI ethics and responsible use in teacher training colleges, in line with the Nigeria AI Strategy (Federal Ministry of Education, 2024).

~~6.~~ Conclusion

AI integration in Nigerian secondary chemistry classrooms will not be driven by technology alone. It will be driven by teachers who feel ready, supported, and convinced that AI serves their students (Mishra & Koehler, 2006). The barriers are real—power, training, fear, curriculum—but they are not insurmountable (Yusuf & Balogun, 2011).

This opinion paper argues that the next phase of AI in Nigerian education must be a "teacher-first" phase. Invest in teacher readiness now, and AI will move from policy documents into lesson plans, labs, and ultimately, improved science learning outcomes for Nigerian students.

References

1. Ahmad, S. F., Alam, M. M., Rahmat, M. K., Mubarik, M. S., & Hyder, S. I. (2023). A systematic review of *artificial intelligence in education:* Implications for teachers and students. Education and Information Technologies, 28 (5), 5149– 5171. https://doi.org/10.1007/s10639-022-11406-7

2. Federal Ministry of Education. (2024). Nigeria artificial intelligence strategy 2024–2028. Abuja: Federal Ministry of Education. https://nitda.gov.ng/wp-content/uploads/2024/02/National-AI-Strategy-2024.pdf

3. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108 (6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

4. *Nigerian Educational Research and Development Council. (2013). Senior secondary education curriculum: Science subjects. NERDC Press.*

5. Opara, I. M., & Duru, D. I. (2025). AI IN EDUCATION: A cross-sectional study on teachers' attitudes towards AI integration and usage in secondary schools. African Journal of Educational Technology, 5 (1), 45–62.

6. United Nations Educational, Scientific and Cultural Organization. (2023). Global education monitoring report, 2023: Technology in education – A tool on whose terms? UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385723

7. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 46 (2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

8. West Africa Examinations Council. (2022). _Regulations and syllabuses for WASSCE. WAEC.

9. Yusuf, M. O., & Balogun, O. (2011). Student-teachers' competence and attitude towards Information and Communication Technology: A case study in a Nigerian university. Contemporary Educational Technology, 2_(1), 18–36.

10. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – Where are the educators? International Journal of Educational Technology in Higher Education, 16 (1), 39. https://doi.org/10.1186/s41239-019-0171-0