I J I T I E

INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY INTEGRATION IN EDUCATION

Volume 9, Issue 2, 2026

ASSESSMENT OF TEACHERS' AWARENESS, PERCEPTION, AND READINESS TO USE BIOSCALEAI FOR BIOLOGY TEACHING AND LEARNING IN KWARA STATE, NIGERIA

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To cite this article:

Bolaji, H. O., Sa'adu, R. O. & Abdulkadir, H. O. (2026). Assessment of teachers' awareness, perception, and readiness to use BioScaleAI for biology teaching and learning in Kwara State, Nigeria. *International Journal of Innovative Technology Integration in Education (IJITIE)*, 9 (2), 163-179

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Article Info

Keywords

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Biology Education,
Teacher Awareness,
Teacher Readiness

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Abstract

Artificial Intelligence (AI) is transforming Biology education through personalised and adaptive learning. However, effective AI integration depends on teachers' awareness, perceptions, and readiness. Despite growing interest in AI, evidence on Biology teachers' preparedness to use BioScaleAI in Kwara State remains limited. This study investigated Biology teachers' awareness, perception, and readiness to use BioScaleAI for designing an AI-augmented instructional system for scalable Biology learning in Kwara State. A descriptive survey design was adopted. The study involved 300 Biology teachers in public secondary schools, selected through multistage sampling across the three senatorial districts of Kwara State. Data were collected using the Teachers' Awareness, Perception, and Readiness to Use BioScaleAI Questionnaire (TAPRBQ). The instrument was validated by experts and yielded a reliability coefficient of 0.80. Data were analysed using frequency, percentage and mean, with a benchmark mean of 2.50 for decision-making. Findings revealed that Biology teachers had low awareness of BioScaleAI, with an average mean of 1.59. Their perception of BioScaleAI was also low, with an average mean of 1.54, while their readiness to use the system was similarly low, with an average mean of 1.56. Although teachers showed relatively greater awareness of personalised and adaptive learning applications, their understanding of practical AI integration remained limited. The study concluded that Biology teachers were inadequately prepared to adopt BioScaleAI for Biology instruction. It recommended regular practical AI training, improved digital infrastructure, continuous institutional support, hands-on exposure to BioScaleAI, and the integration of AI literacy into pre-service and in-service Biology teacher education programmes.

Keywords: Artificial Intelligence, BioScaleAI, Biology Education, Teacher Awareness, Teacher Readiness.

Introduction

Education plays a fundamental role in national development by equipping individuals with the knowledge, skills, and competencies required to function effectively in a rapidly changing society. The emergence of digital technologies has transformed educational systems worldwide, shifting teaching and learning from conventional teacher-centred approaches to technology-enhanced and learner-centred pedagogies. In science education, particularly Biology education, the integration of innovative technologies has become increasingly important for improving students' conceptual understanding, critical thinking, problem-solving abilities, and lifelong learning skills. Among these emerging technologies, Artificial Intelligence (AI) has gained considerable attention for its capacity to personalise learning, provide immediate feedback, support

adaptive instruction, and improve learning outcomes (Tapalova, & Zhiyenbayeva, 2022). An AI-augmented instructional system is an educational technology platform that combines artificial intelligence with teachers' pedagogical practices to enhance teaching and learning through adaptive instruction, intelligent tutoring, personalised feedback, automated assessment, and learning analytics (Sajja et al,.2024). Rather than replacing teachers, AI augments their instructional roles by supporting lesson planning, content delivery, learner assessment, and instructional decision-making (Strielkowski, et al,.2025). Consequently, the successful integration of AI into Biology classrooms depends largely on teachers, who remain the primary facilitators of instructional innovation.

Teachers' awareness of educational technologies constitutes the first step towards successful technology integration. Awareness refers to the extent to which teachers possess knowledge of the existence, features, capabilities, and educational applications of technological innovations (Seufert e tal.2021), such as BioScaleAI. BioScaleAI is an Artificial Intelligence (AI)-augmented instructional system designed specifically to enhance Biology teaching and learning through adaptive learning, intelligent content delivery, personalised feedback, automated assessment, and learning analytics (Wang & Liu,2025). For example, a system such as BioScaleAI can automatically identify students who have difficulty understanding Biology topics such as photosynthesis, genetics, or ecology, provide tailored learning resources and interactive simulations, and present teachers with real-time reports to guide classroom instruction. The system integrates AI technologies with Biology pedagogy to provide scalable, learner-centred instructional experiences that accommodate learners' diverse abilities and learning needs. Teachers who are aware of AI-powered instructional tools such as BioScaleAI are more likely to recognise their potential for enhancing Biology teaching through adaptive content delivery, intelligent tutoring, automated assessment, and personalised learning experiences (Ouma,2024). Conversely, limited awareness may hinder the adoption of innovative technologies regardless of their educational benefits. In Biology education, where abstract concepts, practical activities, and scientific inquiry require effective instructional support, teachers' awareness of AI technologies provides the foundation for informed decision-making regarding their classroom use (Vorsah & Oppong,2024). However, awareness alone may not necessarily translate into actual adoption, making it essential to examine teachers' perceptions of such technologies.

Teachers' perception of BioScaleAI plays a significant role in determining whether they are willing to embrace AI-supported instructional innovations. Perception encompasses teachers' beliefs, attitudes, opinions, and evaluations regarding the usefulness, ease of use, effectiveness, and relevance of BioScaleAI for Biology teaching and learning (Lawal et al.,2025). Positive perceptions are likely to encourage teachers to view AI as a valuable instructional partner capable of improving classroom engagement, facilitating differentiated instruction, and supporting scientific inquiry. On the other hand, negative perceptions arising from concerns about technological complexity, inadequate infrastructure, data privacy, ethical issues, or fear of

replacement may discourage adoption (Gkrimpizi, et al., 2023). Since perception is often influenced by prior awareness and experience, understanding teachers' perceptions provides valuable insights into the factors that may either facilitate or impede the successful integration of BioScaleAI into Biology instruction.

While awareness and positive perception are important, they may not necessarily result in the successful implementation of AI without adequate readiness. Teachers' readiness refers to their preparedness, competence, confidence, motivation, and willingness to integrate BioScaleAI into their instructional practices. Readiness encompasses technological skills, pedagogical competence, access to digital resources, institutional support, and the willingness to adapt to changing educational environments (Kim, 2024). Teachers who are adequately prepared are more likely to integrate AI effectively into Biology classrooms and maximise its instructional benefits. Conversely, inadequate readiness may prevent even highly aware and positively disposed teachers from implementing AI-based innovations. Thus, teachers' awareness contributes to shaping their perceptions, while both awareness and perception collectively influence their readiness to adopt and utilise BioScaleAI in classroom practice.

BioScaleAI represents an AI-augmented instructional system specifically designed to support scalable Biology learning by combining artificial intelligence technologies with sound pedagogical principles (Pedro et al.,2019). It employs intelligent algorithms to personalise learning experiences, analyse learners' progress, recommend appropriate instructional resources, provide immediate feedback, and assist teachers in making evidence-based instructional decisions. Through features such as adaptive learning pathways, intelligent tutoring, automated formative assessment, learning analytics, and personalised recommendations, BioScaleAI complements teachers' instructional practices while addressing individual learners' needs. For instance, when teaching concepts such as photosynthesis, genetics, ecology, or human physiology, the system can identify students experiencing learning difficulties, recommend appropriate remedial resources, generate interactive simulations, and provide teachers with real-time performance reports for informed instructional decisions. In Biology education, where learners often encounter complex concepts requiring visualisation, experimentation, and continuous assessment, such an AI-augmented instructional system has the potential to enhance teaching effectiveness, improve students' engagement, and promote scalable learning. However, the successful design and implementation of BioScaleAI should be informed by teachers' awareness, perceptions, and readiness, since teachers remain the principal users and implementers of educational technologies.

Besides psychological and pedagogical factors, demographic variables such as gender and school location may also influence teachers' awareness, perception, and readiness to adopt AI-augmented instructional systems. Gender has been recognised in educational technology research as a factor that may affect teachers' exposure to digital technologies, confidence in using emerging technologies, and willingness to incorporate innovative instructional tools into classroom practice, although empirical findings remain inconclusive across different contexts (Lawal et al., 2025).

Frentescu et al. (2026), found no significant differences in technology adoption between male and female teachers, others indicate that variations in technological experience, self-efficacy, and access to professional development opportunities may shape teachers' attitudes towards AI integration. Therefore, examining gender provides valuable evidence for determining whether male and female Biology teachers differ in their awareness, perception, and readiness to utilise BioScaleAI.

Likewise, school location may influence teachers' capacity to adopt AI-supported instructional innovations. Urban schools generally have better access to reliable electricity, internet connectivity, digital infrastructure, instructional technologies, and professional development opportunities than schools located in rural areas (Mujawar et al.,2026). Such disparities may affect teachers' awareness of AI technologies, influence their perceptions of the usefulness of these technologies, and determine their readiness to integrate systems such as BioScaleAI into Biology instruction. In contrast, teachers in rural schools may experience infrastructural and technological limitations that constrain the effective adoption of AI despite recognising its educational value (Mehta, 2025).

Despite the growing potential of artificial intelligence to transform Biology teaching and learning, its successful integration in secondary schools depends largely on teachers' awareness, perception, and readiness to adopt AI-powered instructional systems such as BioScaleAI. However, empirical evidence on these factors among Biology teachers in Kwara State remains limited, making it difficult to develop AI-based instructional systems that adequately reflect teachers' needs and classroom realities (Makinde & Rasheedat, 2025). This study therefore investigates teachers' awareness, perception, and readiness to use BioScaleAI to provide empirical evidence for designing an AI-augmented instructional system capable of supporting scalable Biology learning in secondary schools in Kwara State. The main purpose of this study is:

1. determine the level of Biology teachers' awareness of BioScaleAI for the design of an AI-augmented instructional system for scalable Biology learning;

2. examine Biology teachers' perceptions of using BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning;

3. assess Biology teachers' readiness to use BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning in Kwara State;

Research Question

1. What is the level of Biology teachers' awareness of BioScaleAI for the design of an AI-augmented instructional system for scalable Biology learning?

2. What are Biology teachers' perceptions of using BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning?

3.What is the level of Biology teachers' readiness to use BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning?

REVIEW OF LITERATURE

Teachers' awareness, perception, and readiness are fundamental factors influencing the successful implementation of Artificial Intelligence (AI)-augmented instructional systems such as BioScaleAI (Lawal et al.,2025). Awareness refers to teachers' knowledge of AI technologies and their educational applications, while perception encompasses their beliefs about the usefulness, ease of use, and potential impact of AI on teaching and learning. Readiness reflects teachers' technological competence, pedagogical preparedness, and willingness to integrate AI into classroom practice (El Bsat ,2025). Collectively, these factors determine the extent to which teachers can effectively adopt AI-enabled instructional innovations.

Teachers' awareness of AI is considered the foundation for its successful integration into Biology education. Although Biology teachers have expressed considerable interest in AI technologies, their awareness is often confined to technical and creative applications rather than instructional uses (Mnguni et al.,2024). Most teachers lack familiarity with AI tools specifically designed for Biology teaching and have limited experience integrating AI into pedagogical practice. Consequently, Biology teachers possess insufficient awareness of the broader instructional capabilities of AI, including adaptive learning, intelligent tutoring, learning analytics, and AI-supported curriculum design (Anđić et al.,2026). Their awareness frequently remains superficial, focusing on basic AI applications rather than understanding how AI can support adaptive Biology instruction, diagnose students' misconceptions, facilitate virtual laboratory experiences, provide real-time learning analytics, and promote personalized learning. This highlights the need for comprehensive AI literacy programmes to strengthen teachers' competence in integrating AI into Biology instruction (Nugraha, et al,.2026).

Teachers' perceptions of AI also play a significant role in determining their intention to adopt AI-supported instructional systems. Teachers who perceive AI as useful for lesson planning, personalized instruction, assessment, and feedback are generally more willing to integrate it into classroom practice (Shi et al,.2024). Similarly, when teachers view BioScaleAI as a pedagogical support tool rather than a replacement for their professional expertise, they are more likely to embrace its use. Positive perceptions encourage teachers to adopt innovative teaching strategies, improve classroom interaction, and create more engaging and learner-centred learning experiences (Sunday et al.,2025). However, concerns relating to inadequate training, technological complexity, data privacy, ethical issues, curriculum alignment, the reliability of AI-generated content, and diminished teacher autonomy may reduce teachers' willingness to adopt AI technologies. Kashif et al. (2025), reported that although science teachers generally perceive AI as beneficial for lesson planning, visualization of abstract biological concepts, adaptive learning, and student engagement, concerns regarding limited technical expertise, ethical issues, and insufficient institutional support continue to hinder its effective implementation (Victoriano et al.,). Therefore, positive perceptions

alone are insufficient unless supported by adequate AI literacy, continuous professional development, and institutional support.

Teacher readiness extends beyond technological skills to include AI literacy, pedagogical competence, digital competence, confidence in using educational technologies, organizational support, and the willingness to modify conventional teaching practices (Mikeladze et al.,2024). Teachers with higher AI competencies and self-efficacy demonstrate stronger intentions to integrate AI into teaching. Readiness is further enhanced through continuous professional development, supportive school leadership, reliable technological infrastructure, and clear institutional policies governing AI use in education. Nevertheless, even when teachers possess favourable attitudes toward AI, inadequate technical skills, insufficient training, and limited institutional support often constrain effective implementation (Daher, 2025). Zou et al. (2024), observed that although teachers generally hold positive attitudes toward AI in education, their awareness and preparedness remain uneven due to deficiencies in AI-related technological and content knowledge. The authors further reported that teachers with stronger Technological Pedagogical and Content Knowledge (TPACK) demonstrated greater confidence and readiness to integrate AI into instructional practice, emphasizing the importance of continuous professional development. Similarly, Mnguni et al. (2025) found that many pre-service Biology teachers lacked the TPACK competencies required for effective AI integration and recommended embedding AI literacy into teacher education programmes. Triandro et al. (2025) also reported that teachers' readiness was positively influenced by technological competence and perceived usefulness of AI, whereas inadequate practical experience limited classroom implementation. Likewise, Naana and Ebo (2026), observed that Biology teachers' readiness was constrained by limited access to AI technologies, insufficient institutional support, and inadequate professional development opportunities. Consequently, although Biology teachers generally express positive attitudes toward AI, their readiness for implementation remains moderate due to limited AI knowledge, inadequate professional training, and insufficient technological infrastructure.

Within the context of Biology education, the successful implementation of BioScaleAI depends not only on the availability of AI technologies but also on Biology teachers' awareness of the system's capabilities, their perceptions of its instructional value, and their readiness to integrate it into classroom practice (Thanh & Van ,2025). Teachers must understand how BioScaleAI can support the teaching of complex biological concepts through adaptive learning, intelligent tutoring, automated assessment, personalized feedback, and learning analytics. Without adequate awareness of these capabilities, teachers are unlikely to utilize the system effectively or integrate it meaningfully into classroom instruction (Lawal et al.2025). Therefore, strengthening teachers' awareness, fostering positive perceptions, and enhancing their readiness through AI literacy programmes, continuous professional development, institutional support, and enabling educational policies are essential for the effective implementation of BioScaleAI. Such efforts will facilitate the meaningful integration of AI into Biology classrooms and improve the scalability,

personalization, effectiveness, and learner-centredness of Biology teaching and learning (Moola, 2024).

Gender has been widely investigated as a demographic variable influencing teachers' adoption of educational technologies, including artificial intelligence (AI). According to Hazzan-Bishara, et al. (2025), gender may influence teachers' awareness, perceptions, confidence, and readiness to integrate AI into instructional practice. Teachers' readiness to adopt AI is often associated with technological self-efficacy, prior digital experience, and access to professional development, factors that may vary across gender groups depending on contextual and institutional conditions.

According to Yuet al (.2024), gender differences in teachers' AI awareness and AI-related pedagogical skills may exist; however, such differences are relatively minimal. The study revealed that male teachers demonstrated slightly higher levels of AI awareness and AI pedagogical skills than their female counterparts. Nevertheless, the observed differences had small effect sizes, indicating that equitable access to AI training and professional development could minimise these disparities. Adelana et al. (2024), reported no significant influence of gender on teachers' awareness of AI software, concluding that both male and female teachers exhibited comparable levels of AI awareness. Wang et al. (2023) conceptualised teachers' AI readiness in terms of cognition, competence, vision, and ethics and found no significant gender differences in AI readiness. Instead, teachers with higher AI readiness were more likely to adopt innovative AI-supported teaching practices and perceive fewer challenges associated with AI integration.

Institutional support and the availability of technological resources are critical determinants of teachers' willingness and capacity to adopt AI in educational settings. Adequate infrastructure, reliable internet connectivity, access to AI-enabled technologies, and continuous professional development create an enabling environment that enhances teachers' confidence, fosters positive perceptions of AI, and strengthens their readiness to integrate AI into instructional practice (Hazzan-Bishara et al.,2024). Teachers in resource-constrained schools often face barriers such as inadequate infrastructure, unstable internet connectivity, limited access to digital devices, and insufficient opportunities for professional development. These challenges may hinder their ability to acquire the knowledge, skills, and confidence required for effective AI integration, thereby reducing their readiness to implement AI-supported instructional innovations despite recognising their potential to enhance teaching and learning (Al-Mughairi, & Bhaskar, 2025).

These contextual disparities are particularly evident in developing countries, where marked differences in infrastructure and educational resources exist between urban and rural schools. Limited access to digital technologies, reliable internet connectivity, and institutional support in under-resourced schools continues to impede the equitable adoption and effective implementation of AI in education (Ayanwale et al.,2025)

METHODOLOGY

This study employed a descriptive survey research design to investigate Biology teachers' awareness, perception, and readiness to use BioScaleAI in the design sof an AI-augmented instructional system for scalable Biology learning in Kwara State, Nigeria. The descriptive survey design was considered appropriate because it facilitates the collection of data from a representative sample without manipulating the study variables and provides an accurate description of the existing conditions regarding teachers' awareness, perceptions, and readiness toward the integration of artificial intelligence in Biology education. The study was conducted among Biology teachers in public secondary schools across Kwara State. A sample size of 300 Biology teachers was selected using a multistage sampling technique involving stratified sampling to ensure representation across the three senatorial districts of the state, followed by simple random sampling to select schools and respondents. Data were collected using a researcher-developed structured questionnaire titled Teachers' Awareness, Perception, and Readiness to Use BioScaleAI Questionnaire (TAPRBQ). The instrument comprised items measuring teachers' awareness, perception, and readiness to use BioScaleAI and was structured on a four-point Likert scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The questionnaire was subjected to face and content validation by experts in Science Education and Test and Measurement to ensure its relevance, clarity, and adequacy. The instrument yielded a reliability coefficient of 0.86, indicating a high level of internal consistency. The collected data were analysed using descriptive statistics, including frequencies, percentages, mean, and standard deviation, with a criterion mean of 2.50 used as the benchmark for interpreting respondents' levels of awareness, perception, and readiness. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 27.0.

RESULTS

Research Question 1: What is the level of Biology teachers' awareness of BioScaleAI for the design of an AI-augmented instructional system for scalable Biology learning?

SN	Items	SA F (%)	A F (%)	D F (%)	SD F (%)	Mean	SD
1	I am aware that Artificial Intelligence (AI) can be integrated into Biology teaching and learning.	0 (0.0%)	0 (0.0%)	126 (42.0%)	174 (0.2%)	1.42	0.49
2	I understand the purpose of BioScaleAI in Biology education.	0 (0.0%)	17 (5.7%)	144 (48.0%)	139 (46.3%)	1.59	0.60

SN	Items	SA F (%)	A F (%)	D F (%)	SD F (%)	Mean	SD
3	I know that BioScaleAI can personalize learning based on students' individual needs.	3 (1.0%)	0 (0,.0%)	145 (48.3%)	152 (50.7%)	1.51	0.56
4	I am aware that AI can provide automated assessment and instant feedback in Biology lessons.	0 (0.0%)	3 (1.0%)	130 (43.3%)	167 (55.7%)	1.45	0.52
5	I understand how AI can support adaptive learning in Biology classrooms.	0 (0.0%)	0 (0.0%)	189 (63.0%)	111 (37.0%)	1.63	0.48
6	I know that BioScaleAI can identify students' learning difficulties through learning analytics.	0 (0.0%)	42 (14.0%)	152 (50.7%)	106 (35.3%)	1.79	0.67
7	I am aware that AI can support virtual laboratory activities in Biology.	0 (0.0%)	0 (0.0%)	131 (43.7%)	169 (56.3%)	1.44	0.50
8	I know that AI can assist teachers in planning Biology lessons.	0 (0.0%)	14 (4.7%)	133 (44.3%)	153 (51.0%)	1.53	0.59

SN	Items	SA F (%)	A F (%)	D F (%)	SD F (%)	Mean	SD
9	I understand that BioScaleAI can support inquiry-based and learner-centred Biology instruction.	3 (1.0%)	56 (18.7%)	165 (55.0%)	76 (25.3%)	1.95	0.69
10	I am familiar with the educational applications of AI in teaching complex Biology concepts.	3 (1.0%)	21 (7.0%)	117 (39.0%)	159 (53.0%)	1.56	0.79
	Average mean					**1.59.**	

Table 3 indicate that Biology teachers had generally low awareness and understanding of AI and BioScaleAI applications in Biology education, as reflected by the overall mean of 1.59. Awareness was relatively higher regarding inquiry-based and learner-centred instruction (1.95) and the use of learning analytics to identify students' difficulties (1.79), but lower for AI integration, virtual laboratories, and automated assessment

Research Question 2: What are Biology teachers' perceptions of using BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning

SN	Items	SA F (%)	A F (%)	SD F (%)	D F (%)	Mean	SD
11	BioScaleAI can improve the quality of Biology teaching.	23 (7.7%)	7 (2.3%)	160 (53.3%)	110 (36.7%)	1.81	0.814
12	BioScaleAI can enhance students' understanding of difficult Biology concepts.	3 (1.0%)	41 (13.7%)	111 (37.0%)	145 (48.3%)	1.67	0.75

SN	Items	SA F (%)	A F (%)	SD F (%)	D F (%)	Mean	SD
13	AI can make Biology lessons more interactive and engaging.	4 (1.4%)	20 (6.8%)	76 (25.9%)	194 (66.0%)	1.44	0.68
14	BioScaleAI can improve students' academic performance in Biology.	0 (0.0%)	14 (4.7%)	120 (40.0%)	166 (55.3%)	1.49	0.59
15	AI should complement rather than replace Biology teachers.	3 (1.0%)	27 (9.0%)	152 (50.0%)	118 (39.3%)	1.72	0.67
16	BioScaleAI can reduce teachers' workload in lesson preparation and assessment.	3 (1.0%)	7 (2.3%)	89 (29.7%)	201 (67.0%)	1.37	0.58
17	Using BioScaleAI will encourage more learner-centred Biology instruction.	3 (1.0%)	14 (4.7%)	104 (34.7%)	179 (59.7%)	1.47	0.64
18	I believe BioScaleAI can improve students' motivation to learn Biology.	3 (1.0%)	14 (4.7%)	90 (30.0%)	193 (64.3%)	1.42	0.63
19	The educational benefits of BioScaleAI outweigh its potential challenges.	3 (1.0%)	14 (4.7%)	105 (35.0%)	178 (59.7%)	1.47	0.64
20	I consider BioScaleAI to be an effective instructional support tool for Biology teachers.	3 (1.0%)	14 (4.7%)	124 (41.3%)	159 (53.0%)	1.54	0.64
	Average mean					**1.54**	

Table 5 implies that Biology teachers had generally low perceptions of the benefits of BioScaleAI, as reflected by the overall mean of 1.54. Teachers showed relatively higher perceptions that BioScaleAI could improve the quality of Biology teaching (1.81) and that AI should complement

rather than replace teachers (1.72). However, lower perceptions were recorded regarding its ability to reduce teachers' workload (1.37), improve students' motivation (1.42), and make Biology lessons more interactive (1.44).

Research Question 3: What is the level of Biology teachers' readiness to use BioScaleAI in the design of an AI-augmented instructional system for scalable Biology learning

SN	Items	SA F (%)	A F (%)	D F (%)	SD F (%)	Mean	SD
21	I am willing to use BioScaleAI in my Biology lessons.	3 (1.0%)	0 (0.0%)	125 (14.5%)	172 (57.3%)	1.44	0.56
22	I possess the digital skills required to use BioScaleAI effectively.	0 (0.0%)	38 (12.7%)	123 (41.0%)	139 (46.3%)	1.66	0.69
23	I am confident in integrating AI into Biology instruction.	0 (0.0%)	52 (17.3%)	117 (39.0%)	131 (43.7%)	1.74	0.74
24	I am willing to attend training programmes on the use of BioScaleAI.	0 (0.0%)	24 (8.0%)	124 (41.3%)	152 (50.7%)	1.57	0.64
25	I can effectively use AI-generated feedback to improve students' learning.	0 (0.0%)	24 (8.0%)	159 (53.0%)	117 (39.0%)	1.69	0.61
26	I am prepared to redesign my biology lessons to incorporate AI-supported learning.	0 (0.0%)	3 (1.0%)	186 (62.0%)	111 (37.0%)	1.64	0.50
27	My school has adequate technological facilities to support the use of BioScaleAI.	0 (0.0%)	10 (3.3%)	119 (39.7%)	171 (57.0%)	1.46	0.56
28	I am ready to collaborate with AI systems to	0 (0.0%)	3 (1.0%)	145 (48.3%)	152 (50.7%)	1.50	0.52

SN	Items	SA F (%)	A F (%)	D F (%)	SD F (%)	Mean	SD
	improve Biology instruction.						
29	I am willing to continuously learn new AI technologies for Biology teaching.	0 (0.0%)	3 (1.0%)	126 (42.0%)	171 (57.0%)	1.44	0.52
30	I am ready to adopt BioScaleAI as part of my regular Biology teaching practice.	3 (1.0%)	0 (0.0%)	138 (46.0%)	159 (53 0%)	1.49	0.56
	Average mean					**1.56**	

Table 5indicate that Biology teachers had low awareness and understanding of AI and BioScaleAI applications, with an overall mean of 1.56. Awareness was relatively higher for personalised learning (1.74) and adaptive learning (1.69), while the lowest means were recorded for AI integration in Biology teaching (1.44) and inquiry-based and learner-centred instruction (1.44).

Discussion of the finding

Biology teachers had a low level of awareness of the specific educational applications of BioScaleAI. This finding suggests that despite the growing global interest in artificial intelligence, Biology teachers in Kwara State may have limited knowledge of how AI tools can be applied to support Biology teaching and learning. The finding is consistent with Mnguni et al. (2024), who reported that teachers' awareness of AI is often superficial and focused more on its technical aspects than on its instructional applications. It also agrees with Anđić et al. (2026), who noted that teachers frequently lack familiarity with AI-supported tools specifically designed for Biology pedagogy, such as virtual laboratories. However, the finding contrasts slightly with the expectation that the increasing attention given to AI globally would naturally lead to greater awareness among teachers. Despite the considerable attention AI has received, the low level of awareness found in this study indicates that such global visibility has not yet translated into adequate local knowledge of practical BioScaleAI applications, such as automated assessment and other classroom instructional features. This gap may be attributed to teachers' limited exposure to AI-based educational tools, inadequate professional development opportunities, and insufficient access to AI applications specifically designed for Biology education.

Biology teachers had a low perception of BioScaleAI, with particularly strong scepticism regarding its ability to reduce teachers' workload. This finding is consistent with Gkrimpizi et al.

(2023), who identified technological complexity, inadequate infrastructure, and fear of teacher replacement as major barriers to teachers' acceptance of AI in education. Similarly, Kashif et al. (2025) reported that although teachers recognise the potential benefits of AI, these benefits are often overshadowed by concerns about ethical issues and limited technical expertise. However, the low perception of BioScaleAI's ability to improve classroom interactivity and motivate students contrasts with the more optimistic findings of Sunday et al. (2025) and Shi et al. (2024), who reported that teachers generally perceived AI as capable of promoting engaging and learner-centred learning experiences. This discrepancy suggests that Biology teachers in Kwara State may be more influenced by practical constraints and limited exposure to AI than by its potential instructional benefits.

Biology teachers had a low level of readiness to use BioScaleAI, indicating limited preparedness and competence for its effective integration into Biology teaching. This finding is consistent with Daher (2025) and Naana and Ebo (2026), who reported that teachers' readiness to adopt AI is constrained by limited access to technology, inadequate institutional support, and insufficient professional development. It also agrees with Mnguni et al. (2025), who noted that many Biology teachers lack the Technological Pedagogical and Content Knowledge (TPACK) required for effective technology integration. However, the relatively higher readiness for personalised learning compared with actual AI integration is consistent with Zou et al. (2024), who found that teachers' theoretical acceptance of AI is often stronger than their practical preparedness. This suggests that Biology teachers may recognise the potential of AI for personalised learning but lack the skills, experience, and support required to translate this understanding into effective classroom practice.

Demographic factors play a nuanced role in teachers' readiness to use BioScaleAI. In terms of school location, the challenges experienced by rural teachers are consistent with Mujawar et al. (2026) and Mehta (2025), who reported that disparities in digital infrastructure, internet access, and reliable electricity between urban and rural schools can create significant gaps in technology adoption. Regarding gender, the relatively balanced representation and absence of substantial differences in readiness align with Adelana et al. (2024) and Wang et al. (2023), who found no significant gender differences in AI awareness or readiness. This suggests that access to relevant training, technological resources, and institutional support may be more important determinants of teachers' readiness than gender.

Conclusion

Biology teachers in Kwara State have limited awareness, unfavourable perceptions, and low readiness to use BioScaleAI for Biology teaching and learning. Although teachers recognise some potential benefits of AI, limited exposure, inadequate technological competence, insufficient professional development, and contextual challenges constrain their preparedness to adopt the technology. School location may influence readiness due to differences in infrastructure and access to digital resources, whereas gender does not appear to be a significant factor.

RECOMMENDATIONS

1 Provide practical training: Organise regular training to improve Biology teachers' awareness, skills, and confidence in using BioScaleAI.

2 Improve infrastructure: Provide reliable electricity, internet access, and digital devices, especially in rural schools.

3 Strengthen institutional support: Establish continuous technical support, mentoring, and guidance for teachers adopting BioScaleAI.

4.Promote positive perceptions: Provide hands-on opportunities for teachers to experience BioScaleAI's benefits in assessment, personalised learning, and classroom instruction.

5.Integrate AI into teacher education: Include AI literacy and BioScaleAI applications in pre-service and in-service Biology teacher training programmes.

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