EXPLORING THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN STRENGTHENING THE INTEGRITY OF SCHOOL-BASED ASSESSMENTS IN INDUSTRIAL AND TECHNOLOGY EDUCATION PROGRAMMES

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Abstract
This study aimed to explore the application of Artificial Intelligence (AI) in strengthening the integrity of school-based assessments in Industrial and Technology Education (ITE) Programmes. It employed a cross-sectional descriptive survey design. North-Central Nigeria was selected as the study region due to its concentration of higher institutions offering ITE Programmes. The population comprised 600 individuals: 300 ITE lecturers, 200 EdTech professionals specializing in AI for education, and 100 IT support staff at universities offering ITE. Using stratified random sampling, a sample of 240 participants was selected, ensuring representation from all categories within the population. Data collection was conducted through a self-developed Likert scale questionnaire containing 20 items evenly distributed between the two research questions. The instrument was validated by three experts. Cronbach's Alpha confirmed the reliability of the instrument, yielding indices of .89 and .92 for the two sections, indicating high internal consistency. Data was collected electronically via Google Forms, with a 95% response rate. Descriptive statistical methods including mean, mode, and standard deviation were used to analyze the data. The findings revealed potential AI technologies such as AI-powered proctoring tools, machine learning algorithms, and AI-based plagiarism detection tools. Implementation strategies include regular teacher training, stakeholder collaboration, infrastructure investment, establishing feedback loops, pilot testing before full-scale implementation, curriculum integration, and strategies addressing resistance to AI. Based on these findings, the study recommended that curriculum developers of ITE programmes should tailor AI tools to specific student needs and integrate them into the curriculum as well as University administrators offering ITE programmes should enter into collaborations with AI tech firms or experts to deliver effective training for ITE lecturers in using AI technologies.
Keywords: Industrial and Technology Education, School-Based Assessment, Integrity, Artificial Intelligence

Introduction

In the context of Nigeria's Technical and Vocational Education and Training (TVET) system, Industrial and Technology Education (ITE) Programmes refer to structured educational initiatives aimed at equipping students with practical skills and theoretical knowledge in diverse industrial sectors and technological disciplines. These programmes play a pivotal role in Nigeria's TVET system by promoting technical and vocational skills development, fostering local industrial growth, and contributing to national socio-economic development (Bakare et al. 2020). They aim to equip students with practical skills and knowledge needed for various industrial sectors, thereby advancing self-reliance, stimulating local industries, and reducing unemployment (Pacher et al., 2024). However, challenges in implementing these programmes, particularly concerning school-based assessments, risk hindering their effectiveness and the attainment of their objectives.

School-based assessment is a continuous process where teachers evaluate students' understanding and progress throughout the academic year. The process is central to the successful implementation of ITE Programmes. These assessments support continuous learning, ensuring that students acquire necessary skills over time (Lund & Kirk, 2019). They also offer insights into students' strengths and weaknesses, allowing for individualized instructions to improve outcomes (Dejene & Chen, 2019). However, Cotton et al. (2023) disclosed that, issues

ranging from grading inconsistencies to subjectivity and potential academic dishonesty undermine the integrity of these assessments.

The integrity of school-based assessments entails conducting evaluations in a manner that is fair, accurate, and truly reflective of a student's competence. This integrity is crucial for maintaining the credibility of qualifications awarded under such programmes, ensuring equal learning opportunities, and upholding the overall value of education (Rosli et al., 2024). The absence of such integrity could lead to flawed evaluations of student abilities, diminishing trust in the education system, and ultimately impeding the effective delivery of ITE Programmes (Zia & Khan, 2023). It could also erode trust in the education system, slowing down progress, and obstructing the effective delivery and impact of these crucial programmes on national development. Hence, to avert these consequences, there is need for innovative solutions like Artificial Intelligence technologies.

Artificial Intelligence (AI) technologies may offer a solution to counteract this pressing issue. AI involves computer systems capable of executing tasks typically requiring human intelligence, such as decision-making, pattern recognition, and learning from experience (Duan et al., 2019). Within the educational context, AI holds substantial potential for enhancing various aspects, notably the integrity of school-based assessments. AI can automate grading processes to reduce subjectivity, provide personalized feedback, and detect instances of academic dishonesty, thereby fostering a more reliable and robust assessment environment (Trunk et al., 2020). According to Aloisi (2023), given the instrumental role of school-based assessments in ITE Programmes and the prevalent challenges, it is paramount to explore how AI technologies can enhance assessment integrity. Thus, this exploration has the potential to lead to more accurate evaluations of student abilities, improved programmes delivery, and ultimately, a stronger contribution of these programmes to Nigeria's national development.

Statement of the Research Problem

In an ideal scenario, school-based assessments in the ITE Programmes would be fair, consistent, and accurately reflective of students' abilities (Venatius et al., 2023). Such assessments would provide a valid basis for evaluating students' competencies, thereby promoting deeper learning and readiness for industry demands. However, the real situation seems to contrast starkly with this ideal. Numerous challenges currently undermine the school-based assessment system in Nigeria's ITE Programmes (Ebete et al., 2020). These issues encompass inconsistent grading practices, subjectivity in marking, susceptibility to academic dishonesty, and lack of standardized assessment procedures (Kubiszyn & Borich, 2024).

Efforts have been made to address these problems; for instance, implementing standardized grading rubrics, providing invigilator training, and enforcing stringent rules against academic misconduct (Tu et al., 2020). Despite such measures, the challenges persist, pointing to the need for innovative solutions that can more effectively uphold the integrity of school-based assessments. The persistence of these challenges has serious implications. It not only jeopardizes the credibility of the assessment system but also compromises students' learning progress, their readiness for the job market, and even the overall reputation of the ITE Programmes (Chisom et al., 2023). This situation, if unaddressed, could undermine national efforts aimed at fostering self-reliance and industrial growth through technical education.

This study seeks to address these enduring problems by exploring the potential of AI (AI) technologies. Yang (2020) stress that AI offers promising solutions, as it can automate grading, provide personalized feedback, and detect academic misconduct, potentially strengthening the integrity of school-based assessments. Thus, by investigating how AI can be utilized within the context of the ITE Programmes, this study sought to contribute to improving the integrity of school-based assessments. The goal is to narrow the gap between the current situation and the ideal, thereby enhancing educational quality, boosting student outcomes, and fostering a stronger Industrial and technology workforce in Nigeria.

Aim and Objectives of the Study

The study aimed to explore the application of AI in strengthening the integrity of school-based assessments in ITE Programmes. To achieve the aim, the study sought to achieve the following objectives:

1. To identify various AI technologies that could potentially enhance the integrity of school-based assessments in the ITE Programmes.
2. To investigate strategies for applying AI technologies to strengthen the overall integrity of school-based assessments within the ITE Programmes.

Research Questions

To achieve the aim of the study, the following research questions were raised and answered:

1. What are the various AI technologies that could potentially enhance the integrity of school-based assessments in the ITE Programmes?
2. What strategies can be employed in applying AI technologies to strengthen the overall integrity of school-based assessments within the ITE Programmes?

Literature Review

School-based assessment

School-based assessment refers to assessments conducted by teachers within the school environment to evaluate students' academic achievements and practical skills as part of the learning process (Tu et al., 2020). It involves various assessment methods such as quizzes, assignments, class projects, practical examinations, and presentations designed to complement formal exams. According to Firoozi et al. (2023), school-based assessment enables educators to provide immediate feedback, which enhances students' learning experiences and encourages the development of critical thinking and problem-solving skills. Dejene and Chen (2019) assert that school-based assessment supports active learning by allowing educators to design tasks that match real-world applications and student-centered learning approaches. The inclusive nature of school-based assessment makes it adaptable to the diverse needs of learners, fostering a more comprehensive assessment system (Rosli et al., 2024).

Despite its importance, several challenges threaten the integrity of school-based assessment. Bretag et al. (2018) emphasize that academic dishonesty, such as contract cheating, unauthorized assistance, and plagiarism, undermines the credibility of assessments. Additionally, the lack of standardized evaluation criteria creates inconsistencies in grading and can affect the comparability of student results across institutions (Aloisi, 2023). Tu et al. (2020) highlight that teacher biases, either intentional or unintentional, further jeopardize the reliability of school-based assessment outcomes. These challenges necessitate urgent measures to safeguard the integrity of school-based assessment and maintain its credibility as a valuable educational assessment tool.

Integrity of school-based assessment

The integrity of school-based assessment involves ensuring that assessments are conducted in a manner that upholds fairness, authenticity, and accuracy in evaluating students' knowledge and skills (Rosli et al., 2024). Maintaining integrity is essential for building trust among educators, students, and stakeholders, as well as ensuring that assessment outcomes are credible and reliable (Aloisi, 2023). According to Dejene and Chen (2019), the presence of integrity in school-based assessment motivates learners to put in their best efforts and fosters confidence in educational assessment systems. Furthermore, Aloisi (2023) asserts that assessments conducted with high integrity are more valid and defensible in high-stakes academic and professional settings.

Strengthening the integrity of school-based assessment requires the adoption of innovative technologies such as AI. Alam (2023) emphasizes that AI can automate assessment processes, enhancing objectivity and reducing errors associated with human bias. The implementation of

machine learning techniques for detecting patterns of academic dishonesty has proven effective in combating issues such as contract cheating and plagiarism (Alsabhan, 2023). Cotton et al. (2023) argue that AI-powered proctoring systems are essential for maintaining secure assessment environments and preventing dishonest practices during remote evaluations. Moreover, AI's ability to standardize assessment processes ensures consistency and fairness, thereby reinforcing the credibility of school-based assessment outcomes (Firoozi et al., 2023). The ethical adoption of AI technologies, as outlined by Ashok et al. (2022), is critical to sustaining trust and maintaining the integrity of school-based assessment.

Artificial Intelligence

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by computer systems to perform tasks such as learning, reasoning, and decision-making (Duan et al., 2019). In the education sector, AI has emerged as a transformative tool for enhancing instructional delivery, assessment, and administrative operations (Alam, 2023). AI-powered systems are capable of providing personalized learning experiences by analyzing students' learning patterns and adapting instructional content to their individual needs (Ebadi & Amini, 2022). Furthermore, Luckin and Cukurova (2019) highlight the potential of AI in automating routine tasks for educators, such as grading and attendance management, thereby increasing teaching efficiency.

AI plays a critical role in strengthening the integrity of school-based assessment and addressing its associated challenges. Alam (2023) asserts that AI can enhance the objectivity and standardization of assessments, thereby reducing inconsistencies in grading. AI-powered plagiarism detection systems are effective in identifying and preventing academic dishonesty, ensuring the authenticity of student submissions (Alsabhan, 2023). Cotton et al. (2023) emphasize that intelligent proctoring systems powered by AI can monitor students during assessments, minimizing cheating opportunities and safeguarding assessment security. Moreover, Firoozi et al. (2023) argue that AI's ability to provide instant feedback and identify learning gaps contributes to the accuracy and reliability of assessments. Ethical considerations, as outlined by Ashok et al. (2022), are essential for guiding the responsible adoption of AI in educational settings to ensure transparency and trustworthiness in assessment practices.

Research Methodology

The study employed a cross-sectional descriptive survey research design. Cross-sectional designs collect data at a specific point in time from different groups, which allows for comparisons and conclusions to be drawn (Spector, 2019). This design was suitable because it allowed for an understanding of the assessment of AI technologies and implementation strategies for strengthening the integrity of assessment in ITE Programmes. North-Central, Nigeria was selected as the area of study. This region was identified due to its concentration of higher institutions offering ITE Programmes (Auta, 2017), making it an appropriate setting to explore AI use in school-based assessments. The population consisted of 600 individuals, divided among three groups: 300 ITE lecturers, 200 EdTech professionals specializing in AI for education, and 100 IT support staff at universities offering ITE Programmes. These groups were selected due to their direct involvement with AI technologies in educational contexts (Ebadi & Amini, 2022).

A stratified random sampling technique was used to select a sample of 240 participants, ensuring representation from all categories within the population (Obilor, 2023). The sample size was justified as it represented 40% of the population, which is within the acceptable range for such studies. A self-developed Likert scale questionnaire, consisting of 20 items divided equally between the two research questions, was used for data collection. The Likert scale is a useful tool for capturing attitudes or opinions and allows for straightforward analysis (Alabi & Jelili, 2023). The instrument was validated by three experts including an ITE lecturer, an EdTech

professional specializing in AI for education, and an IT support staff member. Their expert validation ensured content relevance, clarity, and comprehensiveness (Colquitt et al., 2019).

The reliability of the instrument was confirmed using Cronbach's Alpha, which yielded indices of .89 and .92 for the two sections. This method is widely accepted for evaluating internal consistency and these scores indicate high reliability (Izah et al., 2023). Data was collected electronically using Google Forms. This method was selected due to its proven efficiency, speed of data gathering, and relative ease in management of collected data (Hair Jr et al., 2019). However, 229 out of the 240 questionnaire was filled, indicating 95% response rate. Descriptive statistics (mean and standard deviation) were used to address the research questions. A mean score of 3.50 and above indicated agreement with the statement, while a mean below 3.50 signified disagreement (Weir & Vincent, 2020). These statistical methods allow for a detailed exploration and confirmation of variables (Weir & Vincent, 2020).

Results

Research Question 1: What are the various AI technologies that could potentially enhance the integrity of school-based assessments in the ITE Programmes? Results for answering research question one is contained in Table 1.

Table 1: Mean and standard deviation for the responses of respondents on the various AI technologies that could potentially enhance the integrity of school-based assessments in the ITE Programmes

S/N	AI Technologies	Mean	SD	Remark
1	AI-powered proctoring tools enhance the integrity of online assessments.	4.30	.78	Agreed
2	Machine Learning algorithms are effective in detecting cheating patterns in assessments.	4.32	.76	Agreed
3	AI-based plagiarism detection tools significantly reduce instances of academic dishonesty.	4.38	.80	Agreed
4	Natural Language Processing (NLP) tools accurately grade open-ended responses in assessments.	4.30	.78	Agreed
5	AI-protected databases securely store sensitive assessment information.	4.30	.79	Agreed
6	Automated scoring systems using AI provide reliable and timely results.	4.44	.80	Agreed
7	AI predictive analyses help identify areas of concern in assessments.	4.31	.75	Agreed
8	Intelligent tutoring systems provide personalized learning experiences, improving preparation for assessments.	4.40	.77	Agreed
9	AI speech recognition tools improve the accessibility and inclusivity of assessments.	4.22	.91	Agreed
10	AI adaptive learning systems effectively tailor content delivery, enhancing comprehension and performance in assessments.	4.37	.79	Agreed

Table 1 displays participant responses to various AI technologies that could potentially enhance the integrity of school-based assessments in the Industrial and Technology Education Programmes. The mean values range from 4.22 to 4.44, signifying high concurrence among respondents. Standard deviation ranges from 0.75 to 0.91, suggesting that responses were closely clustered around the means. Therefore, all listed AI technologies were agreed upon by respondents as beneficial in enhancing the integrity of assessments.

Research Question 2: What strategies can be employed in applying AI technologies to strengthen the overall integrity of school-based assessments within the ITE Programmes? Table 2 contains results for answering research question two.

Table 2: Mean and standard deviation for the responses of respondents on the strategies in applying AI technologies to strengthen the overall integrity of school-based assessments within the ITE Programmes

S/N	Strategies to Apply AI Technologies	Mean	SD	Remark
1	Regular training for teachers on AI usage in assessment is effective.	4.26	.85	Agreed
2	Collaborative efforts among stakeholders can successfully establish AI implementation guidelines.	4.33	.79	Agreed
3	Infrastructure investment in AI hardware and software is beneficial.	4.33	.87	Agreed
4	Addressing ethical considerations linked to AI use is crucial for successful implementation.	4.30	.86	Agreed
5	Establishing regular feedback loops involving teachers, students, and AI providers improves the system.	4.23	.84	Agreed
6	Partnerships with AI tech firms help keep the technology updated.	4.40	.84	Agreed
7	Resilience of AI systems is essential to guard against technical failures during assessments.	4.30	.78	Agreed
8	Pilot testing before full-scale AI implementation can identify potential issues.	4.43	.80	Agreed
9	Integrating AI usage into curriculum and teaching methodologies enhances learning outcomes.	4.20	.98	Agreed
10	Strategies addressing potential resistance from teachers or students towards AI implementation are necessary.	4.40	.88	Agreed

Table 2 presents respondents' views on various strategies that can be employed to apply AI technologies to strengthen the overall integrity of school-based assessments within the ITE Programmes. Mean scores range from 4.20 to 4.43, showing high consensus among respondents. Standard deviations range from 0.78 to 0.98, suggesting that respondent reactions were tightly grouped around the means. Thus, all listed strategies were agreed upon by respondents as effective approaches for implementing AI to enhance assessment integrity.

Findings

1. AI technologies such as AI-powered proctoring tools, machine learning algorithms for detecting cheating, plagiarism detection tools, and natural language processing for grading were found to be effective in enhancing the integrity of school-based assessments in the ITE Programmes. Other notable technologies included AI-protected databases, automated scoring systems, and intelligent tutoring systems, all contributing to improved assessment reliability and accessibility.
2. Strategies to apply AI to strengthen the integrity of assessments included regular training for teachers, collaborative efforts to establish AI guidelines, and infrastructure investments. Other strategies involved addressing ethical considerations, forming partnerships with AI firms, conducting pilot testing, and integrating AI into curricula to ensure smooth and effective implementation.

Discussion of Findings

The study's findings indicate the significant potential of various AI technologies including AI-powered proctoring tools, machine learning algorithms for detecting cheating, AI-based plagiarism detection tools, Natural Language Processing (NLP) tools for grading, AI-protected databases, automated scoring systems, AI predictive analyses, intelligent tutoring systems, AI speech recognition tools, and AI adaptive learning systems to enhance the integrity of school-based assessments in the ITE Programmes. In accordance with these findings, several studies have highlighted the role of AI technologies in improving assessment processes. For instance, intelligent proctoring tools have been recognized as effective mechanisms for preventing academic misconduct during online exams (Lee & Fanguy, 2022). Similarly, machine learning algorithms are increasingly being leveraged to detect anomalous patterns that may indicate cheating (Alsabhan, 2023).

Plagiarism detection has also been significantly enhanced by AI technologies, aligning with the findings of this study (Bretag et al., 2018). This study also echoes the growing body of research illustrating the effectiveness of NLP tools in accurately grading open-ended responses (Wilson et al., 2022), along with the use of automated scoring systems that provide reliable and timely results (Firoozi et al., 2023). Furthermore, the significance of AI predictive analyses, intelligent tutoring systems, AI speech recognition tools, and AI adaptive learning systems in enhancing educational outcomes is well-documented in literature (Alam, 2023). The implications of these findings are profound. They suggest there are numerous AI technologies that can be harnessed to improve the integrity and efficiency of school-based assessments. Yet, their successful implementation will require concerted effort in addressing related ethical, practical, and technical challenges.

Furthermore, the study also highlights a variety of strategies for enhancing the integrity of school-based assessments in the ITE Programmes through the implementation of AI (AI) technologies. First of these strategies is regular teacher training. This finding aligns with Fakhar et al.'s (2024) emphasis on the importance of continuous professional development for teachers to effectively use AI technologies. Another critical strategy is stakeholder collaboration. Luckin and Cukurova (2019) also identified this as a key component for successfully integrating AI into educational settings, as it involves the active participation of not only teachers, but also students, administrators, parents, and other community members. A third strategy is investing in infrastructure. Shwedeh's (2024) research underscores how important having robust infrastructure is for the successful implementation and use of AI technologies in an educational context.

Furthermore, addressing ethical considerations is another imperative strategy when implementing AI technologies. Ashok et al. (2022) has highlighted similar concerns, emphasizing the need to address issues related to data privacy and fairness. Next, the strategy of establishing feedback loops is crucial. Valencia's et al. (2023) research supports this, suggesting that mechanisms for regular feedback improve the integration and usefulness of AI technologies. Additionally, partnerships with AI tech firms can be beneficial. Fakhar et al. (2024) found that such collaborations provide invaluable resources and technical expertise, facilitating successful AI adoption. Ensuring system resilience is also essential. Ashok et al. (2022) stresses this point, explaining that robust systems provide protection against data breaches and ensure overall system stability.

Finally, the study reveals two additional strategies: pilot testing before full-scale implementation and addressing resistance to AI. These findings correspond with those of Luckin and Cukurova (2019) and Fakhar et al. (2024), respectively. Luckin and Cukurova suggests that running pilot tests can help identify potential challenges and make necessary adjustments before a full-scale deployment, while Fakhar et al. emphasizes the need to manage resistance to change for successful technology integration. These findings are significant as they provide a comprehensive plan for integrating AI into educational assessments, considering both technical requirements and human factors. This could lead to improved assessment integrity, more personalized learning, increased digital competency, and better handling of ethical challenges.

Conclusion

The study demonstrates that applying AI technologies can significantly strengthen the integrity of school-based assessments in the ITE Programmes. Several AI tools were identified as beneficial, including AI-powered proctoring tools, machine learning algorithms for detecting cheating, AI-based plagiarism detection tools, Natural Language Processing tools for grading, AI-protected databases, automated scoring systems, AI predictive analyses, intelligent tutoring systems, AI speech recognition tools, and AI adaptive learning systems. Moreover, the study outlined comprehensive strategies for effective implementation of these AI technologies. These include regular teacher training, stakeholder collaboration, infrastructure investment, addressing

ethical considerations, establishing feedback loops, partnerships with AI tech firms, ensuring system resilience, pilot testing, and curriculum integration. This comprehensive approach combining potent AI tools with strategic implementation offers a promising pathway toward enhancing assessment integrity in the ITE Programmes. It reveals the potential of AI in reshaping educational assessments while highlighting the importance of a mindful, deliberate, and inclusive approach towards its integration. In conclusion, the findings of this study open up new avenues for research and action, setting a valuable precedent for similar initiatives aiming to integrate AI in education.

Recommendations

Based on the findings from the study, the following recommendations were made:

1. Curriculum Developers of ITE Programmes should integrate AI tools into the curriculum, tailoring them to specific student needs.
2. The Administrators of Universities offering ITE Programmes should collaborate with AI tech firms or experts for training ITE lecturers in using AI technologies to leverage these tools effectively.

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