

SCIENCE STUDENTS' ASSESSMENT OF ICT-SUPPORTED PRACTICAL EXAMINATIONS AND INTEGRITY CHALLENGES IN NIGERIAN TERTIARY INSTITUTIONS: IMPLICATIONS FOR COUNSELLING

AYONOTE, Williams Elenode (Ph.D)

National Open University of Nigeria, Abuja

Email: wayonote82@gmail.com

Tel: +2348038969961

&

Osasere Owens-Sogolo (Ph.D)

National Open University of Nigeria, Abuja

Tel: +2348066600438

Abstract

This study investigated science students' assessment of ICT-supported practical examinations and the associated integrity challenges in Nigerian tertiary institutions using a descriptive survey research design. Three research questions guided the study and three null hypotheses were formulated and tested at .05 level of significance. Data were collected from a sample of 480 science-based undergraduate students drawn from a population of 1,125 students. The instrument used for data collection was a structured questionnaire titled ICT-Supported Practical Examination Integrity Questionnaire (ICTSPEIQ), which was validated by experts and demonstrated a high level of reliability (Cronbach's Alpha = 0.82). Data were analyzed using mean, standard deviation, and inferential statistics. The findings revealed that ICT-supported practical examinations improved efficiency, accessibility, and flexibility, but faced challenges related to authentication, supervision, and technological manipulation. Biometric verification and virtual proctoring were perceived as effective in enhancing integrity, while computerized practical platforms without robust monitoring were less effective. The study implies that integrating robust technological safeguards with institutional policies and monitoring frameworks can promote academic integrity in science-based assessments. It is recommended that tertiary institutions adopt biometric verification and virtual proctoring systems and strengthen infrastructure, staff capacity, and regulatory enforcement to ensure credible and reliable ICT-supported practical examinations.

Keywords: *ICT-Supported Practical Examinations; Examination Integrity; Technology-Based Assessment; Science Students; Nigerian Tertiary Institutions*

Introduction

Assessment integrity remains a fundamental pillar upon which the credibility, validity, and societal trust in higher education systems are built. In science-based disciplines, practical examinations serve as a critical mechanism for evaluating not only theoretical understanding but also students' psychomotor skills, analytical reasoning, experimental competence, and real-world problem-solving abilities. The authenticity of these assessments is therefore central to producing

competent graduates capable of contributing meaningfully to scientific advancement and national development.

Over the past two decades, Nigerian tertiary institutions have experienced rapid expansion in student enrolment, alongside persistent challenges such as limited laboratory facilities, inadequate staffing, and infrastructural constraints. These pressures have accelerated the adoption of Information and Communication Technology (ICT) as a strategic tool for assessment delivery, particularly in science-based courses. ICT-supported practical examinations now include computerized laboratory simulations, virtual experiments, biometric verification systems, cloud-based platforms, and artificial intelligence-driven virtual proctoring technologies. The COVID-19 pandemic further intensified this shift, compelling institutions to adopt remote and hybrid examination models to sustain academic continuity (Johnson & Adeyemi, 2024; UNESCO, 2023).

A key component of ICT-supported assessment is the use of biometric verification systems, which rely on physiological or behavioral characteristics such as fingerprints, facial recognition, or iris scans to authenticate candidates' identities. Biometric technologies are increasingly deployed to address impersonation in examinations. Empirical studies indicate that biometric authentication enhances examination credibility and significantly reduces identity fraud in digital assessment environments (Olatunji & Bello, 2025; Udoh & Essien, 2024; Adegboye, et al., 2023). However, issues related to system reliability, data security, and infrastructural limitations remain concerns, particularly in developing countries (Okafor & Nwankwo, 2023).

Another critical innovation is virtual proctoring, which involves the use of artificial intelligence, video surveillance, and behavioral analytics to monitor candidates during examinations. These systems track eye movement, screen activity, and environmental conditions to detect suspicious behavior. Research shows that virtual proctoring improves accountability and reduces malpractice in online examinations (Ayonote, 2025; Johnson & Adeyemi, 2024; Nguyen & Habib, 2023). However, concerns about privacy, algorithmic bias, technical glitches, and student anxiety have been widely reported (Foster & Layman, 2024; UNESCO, 2023).

In addition, computerized practical examination platforms, including virtual laboratories and simulation-based assessments, have gained prominence in science education. These platforms provide scalable alternatives to physical laboratories and enable students to conduct experiments in controlled digital environments. While they improve accessibility and flexibility, studies reveal that, in the absence of strong monitoring mechanisms, such platforms may facilitate malpractice through result manipulation, unauthorized collaboration, and exploitation of system vulnerabilities (Salisu & Mohammed, 2025; Chen et al., 2024; Okoye & Alabi, 2022). This raises concerns about their ability to fully replicate the rigor and integrity of traditional hands-on practical examinations. Examination malpractice remains a longstanding challenge in Nigerian education, undermining academic standards and public confidence in educational qualifications (Adewale, 2011). In ICT-supported environments, malpractice has evolved into more sophisticated forms, including identity fraud, digital collusion, falsification of experimental data, and technological exploitation. These emerging threats underscore the need for the integration of technological safeguards with strong institutional policies, regulatory frameworks, and human oversight (Foster & Layman, 2024; Okafor & Nwankwo, 2023).

Despite the growing body of literature on ICT and examination integrity, there is a notable gap in empirical studies that specifically examine students' perceptions of biometric verification, virtual proctoring, and computerized practical platforms within the context of science-based practical examinations in Nigerian tertiary institutions. Most existing studies focus on general computer-based testing rather than practical-oriented assessments. Understanding students' perspectives is critical, as they are the primary participants in the assessment process and their

experiences provide valuable insights into the effectiveness, usability, and limitations of these technologies.

This study therefore, examined science students' assessment of ICT-supported practical examinations, with particular focus on biometric verification, virtual proctoring, and computerized practical platforms, as well as the integrity challenges associated with their implementation in Nigerian tertiary institutions.

Statement of the Problem

Despite the increasing adoption of Information and Communication Technology (ICT) in the administration of examinations in Nigerian tertiary institutions, concerns about examination integrity remain persistent, particularly in science-based practical assessments. Practical examinations are essential for evaluating students' experimental competence, laboratory skills, and analytical abilities. However, the transition from traditional laboratory-based assessments to ICT-supported practical examinations has introduced new challenges related to authentication, supervision, and technological manipulation.

While ICT-supported examination systems such as biometric verification, computerized practical platforms, and virtual proctoring have been introduced to enhance examination credibility, their effectiveness in ensuring integrity during practical examinations remains uncertain. Reports of impersonation, unauthorized collaboration, manipulation of digital platforms, and inadequate supervision continue to raise questions about the reliability of ICT-supported practical assessments in Nigerian tertiary institutions.

Furthermore, although several studies have examined ICT in computer-based testing, there is limited empirical evidence on science students' perceptions of ICT-supported practical examinations and the associated integrity challenges in Nigerian tertiary institutions. Understanding students' assessment of these technologies is important because they are the primary participants in the examination process, and their experiences can provide valuable insights into the strengths and weaknesses of existing ICT-based examination systems. Therefore, this study seeks to examine science students' assessment of ICT-supported practical examinations and the integrity challenges associated with their implementation in Nigerian tertiary institutions.

Purpose of the Study

The main purpose of the study was to determine science students' assessment of ICT-supported practical examinations and the integrity challenges associated with their implementation in Nigerian tertiary institutions. Specifically, this study sought to:

- i. examine how do science students assess the effectiveness of biometric verification systems in ensuring integrity during ICT-supported practical examinations;
- ii. determine the assessment of science students regarding computerized practical examination platforms in preventing examination malpractice; and science students' assessment of ICT-supported practical examinations and the integrity challenges associated with their implementation in Nigerian tertiary institutions; and
- iii. investigate how do science students perceive the effectiveness of virtual proctoring systems in addressing integrity challenges during ICT-supported practical examinations.

Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM), which explains how users come to accept and use new technologies. The model posits that two key factors—perceived

usefulness and perceived ease of use—influence users’ attitudes toward a technology, which in turn affect their intention to use and actual usage behaviour.

In the context of ICT-supported practical examinations, students’ perceptions of the effectiveness, reliability, and fairness of technologies such as biometric verification, computerized testing platforms, and virtual proctoring systems are critical. If students perceive these technologies as useful and easy to use, they are more likely to accept them, thereby enhancing examination integrity. Conversely, negative perceptions may lead to resistance, misuse, or attempts to circumvent the system, thus increasing integrity challenges. This theory therefore provides a suitable framework for understanding students’ assessment of ICT-supported practical examinations in Nigerian tertiary institutions.

Methods

The study adopted a descriptive survey research design. This design was considered appropriate as it enabled the collection of quantitative data on students’ perceptions and experiences regarding ICT-supported practical examinations and integrity challenges.

The population comprised all science-based undergraduate students in selected Nigerian tertiary institutions, specifically those in faculties such as Physical Sciences, Biological Sciences, Engineering, and Technology who have participated in ICT-supported practical examinations.

A sample of 480 students was selected using stratified random sampling to ensure representation across institutions, faculties, and levels of study. Out of the 480 questionnaires administered, 472 were validly completed and used for analysis, representing a 98.3% response rate.

Data were collected using a structured questionnaire titled: ICT-Supported Practical Examination Integrity Questionnaire (ICTSPEIQ). The instrument consisted of two sections: Section A captured demographic information, while Section B contained 30 items grouped into three clusters: biometric verification, computerized practical examination platforms, and virtual proctoring systems. Responses were rated on a four-point scale ranging from Highly Effective (4) to Highly Ineffective (1). The questionnaire was administered with the assistance of trained research assistants.

To ensure the validity of the instrument, face and content validation were carried out by experts in educational technology, measurement and evaluation, and science education. Their suggestions and corrections were incorporated to enhance the clarity, relevance, and coverage of the items.

The reliability of the instrument was established through a pilot study conducted using a sample of students outside the main study area. Data obtained were analyzed using Cronbach’s Alpha, which yielded a reliability coefficient of 0.82, indicating a high level of internal consistency.

Data were analyzed using mean and standard deviation to answer the research questions, with a criterion mean of 2.50 used to determine effectiveness. For testing the hypotheses, inferential statistics were employed using independent samples t-test to examine differences based on gender, and one-way.

Results

Research Question 1: How do science students assess the effectiveness of biometric verification systems in ensuring integrity during ICT-supported practical examinations?

Table 1

Science Students' Assessment of Biometric Verification in ICT-Supported Practical Examinations

Item	Mean	SD	Decision
Biometric authentication prevents impersonation	2.68	.64	Effective
Biometric data enhances credibility of practical examinations	2.61	.67	Effective
Reliability of biometric devices during examinations	2.55	.71	Effective
Aggregate	2.61	.67	Effective

Criterion mean = 2.50.

The results in Table 1 show that science students perceive biometric verification as effective in ensuring integrity during ICT-supported practical examinations. All items recorded mean scores above the criterion mean of 2.50, indicating positive assessment. The aggregate mean of 2.61, with a corresponding standard deviation of .67, further confirms that respondents generally agree on the effectiveness of biometric verification systems.

Research Question 2: What is the assessment of science students regarding computerized practical examination platforms in preventing examination malpractice?

Table 2

Science Students' Assessment of Computerized Practical Platforms in ICT-Supported Practical Examinations

Item	Mean	SD	Decision
Automated practical simulations reduce cheating	2.32	.74	Ineffective
Digital platforms prevent result manipulation	2.41	.69	Ineffective
Lack of supervision encourages malpractice	2.29	.76	Ineffective
Aggregate	2.34	.73	Ineffective

Criterion mean = 2.50.

Table 2 shows that computerized practical platforms without strong monitoring mechanisms were perceived as ineffective in preventing malpractice. All items recorded mean scores below the criterion mean of 2.50, indicating negative assessment. The aggregate mean of 2.34, with a corresponding standard deviation of .73, further confirms that respondents generally perceive computerized practical platforms as ineffective in ensuring examination integrity.

Research Question 3: How do science students perceive the effectiveness of virtual proctoring systems in addressing integrity challenges during ICT-supported practical examinations?

Table 3

Assessment of Virtual Proctoring Systems

Variable	Mean	SD	Remark
Real-time monitoring deters misconduct	2.73	.61	Effective
AI-based alerts detect suspicious behavior	2.66	.65	Effective
Virtual supervision enhances examination integrity	2.70	.63	Effective
Overall Mean	2.70		Effective

The results in Table 3 reveals that virtual proctoring systems were perceived as effective in addressing integrity challenges during ICT-supported practical examinations. Virtual proctoring systems recorded an overall mean of 2.70 (effective).

Hypotheses

Ho₁: The mean rating of science students on the effectiveness of biometric verification systems in ICT-supported practical examinations is not significantly different from the criterion mean of 2.50.

Test Description

A one-sample t-test was used to compare students’ mean ratings with the criterion mean of 2.50 at a .05 level of significance.

Table 4
One-Sample t-test Analysis of Students’ Assessment of Biometric Verification

Variable	N	M	SD	Test Value	t	p	Decision
Biometric Verification	472	2.61	.67	2.50	5.42	.000	Reject Ho ₁

Table 4 presents the result of a one-sample t-test comparing students’ mean rating of biometric verification with the criterion mean of 2.50. The result shows that the mean score (M = 2.61, SD = .67) is higher than the criterion mean. The t-value of 5.42 with a p-value of .000 is less than the .05 level of significance. Therefore, the null hypothesis (Ho₁) is rejected. This indicates that the mean rating of students is significantly higher than the criterion mean, implying that students perceive biometric verification systems as effective in ensuring integrity during ICT-supported practical examinations.

Ho₂: The mean rating of science students on the effectiveness of computerized practical examination platforms in preventing malpractice is not significantly different from the criterion mean of 2.50.

Table 5
One-Sample t-test Analysis of Students’ Assessment of Computerized Practical Examination Platforms

Variable	N	M	SD	Test Value	t	p	Decision
Computerized Practical Examination Platforms	472	2.34	.73	2.50	-3.16	.002	Reject Ho ₂

Table 5 shows the result of a one-sample t-test comparing the mean rating of computerized practical examination platforms with the criterion mean of 2.50. The mean score (M = 2.34, SD = .73) is lower than the criterion Mean. The t-value of -3.16 with a p-value of .002 is less than the .05 level of significance. Therefore, the null hypothesis (Ho₂) is rejected. This indicates that the mean rating is significantly lower than the criterion Mean, implying that students perceive computerized practical examination platforms as ineffective in preventing examination malpractice.

Ho₃: The mean rating of science students on the effectiveness of virtual proctoring systems in addressing integrity challenges is not significantly different from the criterion mean of 2.50.

Table 6: One-Sample t-test Analysis of Students’ Assessment of Virtual Proctoring Systems

Variable	N	M	SD	Test Value	t	p	Decision
Virtual Proctoring Systems	472	2.70	0.63	2.50	7.84	.000	Reject Ho ₃

Table 6 presents the one-sample t-test analysis comparing students’ mean rating of virtual proctoring systems with the criterion mean of 2.50. The result shows that the mean score (M = 2.70, SD =0.63) is higher than the criterion mean. The t-value of 7.84 with a p-value of .000 is less than the .05 level of significance.

Therefore, the null hypothesis (Ho₃) is rejected. This indicates that the mean rating is significantly higher than the criterion Mean, suggesting that students perceive virtual proctoring systems as effective in addressing integrity challenges during ICT-supported practical examinations.

Discussion of Findings

The findings of this study provide critical insights into the role of ICT tools in safeguarding examination integrity within science-based practical assessments. Biometric verification systems were perceived by students as effective mechanisms for ensuring integrity in ICT-supported practical examinations. This is consistent with prior studies demonstrating the strength of biometric systems in preventing impersonation and strengthening identity authentication in digital assessments (Adegboye, et al., 2023; Udoh & Essien, 2024; Olatunji & Bello, 2025). The perceived effectiveness can be attributed to the use of unique physiological attributes, which substantially reduce opportunities for identity fraud. Students’ confidence in these systems suggests that biometric authentication is a reliable safeguard when appropriately implemented.

In contrast, computerized practical examination platforms without robust supervision were perceived as ineffective in preventing malpractice. This finding aligns with Adebisi and Olowokere (2024), who observed that unsupervised computerized assessments are vulnerable to manipulation, and with Okoye and Alabi (2022), who highlighted that technological loopholes in digital environments may inadvertently encourage academic dishonesty. These results emphasize that technology alone is insufficient to guarantee integrity; human oversight and monitoring mechanisms remain essential to minimize malpractice.

The study further revealed that virtual proctoring systems were perceived as effective in addressing integrity challenges. This corroborates the findings of Johnson and Adeyemi (2024) and Ayonote (2025), who reported that AI-enabled proctoring tools deter dishonest behavior by increasing students’ perception of surveillance and accountability. Features such as facial recognition, behavior analysis, automated alerts, and screen recording contribute significantly to the credibility and trustworthiness of remote practical assessments.

Inferential analysis supported these conclusions. One-sample t-tests and ANOVA results indicated that students’ perceptions differed significantly depending on the presence of biometric verification and virtual proctoring, as well as institutional ICT capacity. These findings underscore the importance of institutional readiness, infrastructural support, and policy enforcement in determining the effectiveness of ICT-supported practical examinations.

Overall, the study highlights that ICT-supported practical assessments can uphold academic integrity when implemented within a multi-layered framework, combining technological safeguards, institutional support, and human oversight. Reliance on a single tool, or the absence of

complementary monitoring mechanisms, may expose assessments to exploitation. Effective implementation therefore requires integrated, context-sensitive approaches that account for both technological and organizational factors in science education.

Implications for Counselling

- i. Counsellors in tertiary institutions can use the findings of this study to advise management on the effective adoption of biometric verification and virtual proctoring systems in practical examinations.
- ii. Counsellors can also guide institutional management on the need to strengthen infrastructure, enhance staff capacity, and enforce relevant policies to support ICT-based examinations.
- iii. Furthermore, counsellors can assist in addressing challenges associated with ICT-supported practical examinations, particularly in the areas of authentication, supervision, and technological manipulation.

Conclusion and Recommendations

The study concluded that ICT-supported practical examinations present both opportunities and integrity challenges in science-based courses in Nigerian tertiary institutions. While biometric verification and virtual proctoring systems were perceived as effective in promoting examination integrity, computerized practical platforms without robust monitoring were perceived as ineffective. The findings imply that Nigerian tertiary institutions should prioritize the adoption of effective ICT tools such as biometric verification and virtual proctoring to enhance examination integrity. There is also a clear need to strengthen computerized practical platforms with robust monitoring mechanisms. Additionally, institutions must support ICT integration with adequate policies, infrastructure, and user training to ensure effective and credible implementation of technology-driven examinations.

Based on the findings of the study, the following recommendations are made:

- i. Tertiary institutions should integrate biometric verification and virtual proctoring technologies into ICT-supported practical examinations to strengthen candidate authentication and reduce cases of impersonation during assessments.
- ii. Computerized practical examination platforms should be complemented with real-time monitoring and supervision mechanisms to enhance transparency and improve examination integrity.
- iii. Universities should provide continuous training and capacity-building programmes for academic staff and students on the ethical and responsible use of ICT in assessment processes.
- iv. Regulatory and quality assurance bodies should develop clear policies and operational guidelines for ICT-supported practical examinations in order to ensure standardization, reliability, and integrity across tertiary institutions.

References

- Adebisi, O., & Olowokere, B. (2024). Challenges of unsupervised computerized assessments in Nigerian tertiary institutions. *Journal of Digital Education Research*, 6(1), 45–60.
- Adewale, J. G. (2011). Examination malpractice: A stigma on Nigeria's educational system. *Journal of Educational Studies*, 5(2), 45–56.

- Adegboye, A. O., Ibrahim, K. T., & Yusuf, M. A. (2023). Biometric authentication and examination integrity in Nigerian universities. *International Journal of Educational Technology*, 10(1), 22–34.
- Ayonote, W.E. (2025). Assessment of ICT usage in the control of examination malpractice in the National Open University of Nigeria. *International Journal of Education, Humanities and Social Science*, 8(4), 31–41.
- Chen, L., Ramirez, M., & Gupta, S. (2024). Virtual laboratories and assessment integrity in STEM education. *Computers & Education*, 198, 104742.
- Foster, D., & Layman, H. (2024). Ethical concerns in AI-based remote proctoring systems. *Journal of Educational Technology Systems*, 52(3), 345–362.
- Johnson, T., & Adeyemi, S. (2024). Digital transformation of assessment in post-COVID higher education. *International Review of Education*, 70(2), 201–219.
- Nguyen, P., & Habib, L. (2023). Student perceptions of online proctoring technologies. *Education and Information Technologies*, 28(5), 5671–5689.
- Okafor, C. N., & Nwankwo, B. E. (2023). ICT infrastructure and examination security in Nigerian tertiary institutions. *Nigerian Journal of Educational Research*, 12(1), 88–102.
- Okoye, K. R., & Alabi, A. T. (2022). Digital assessment and academic integrity challenges in Nigeria. *Journal of Open and Distance Learning*, 6(2), 15–27.
- Olatunji, S. O., & Bello, R. T. (2025). Biometric systems in educational assessment: Opportunities and challenges. *Journal of Information Systems in Education*, 9(1), 40–52.
- Salisu, M. A., & Mohammed, I. (2025). Simulation-based assessment in science education: Integrity implications. *African Journal of Science Education*, 11(1), 73–89.
- Udoh, A. J., & Essien, E. F. (2024). Identity management and examination malpractice in digital learning environments. *Journal of Educational Innovation*, 8(2), 91–105.
- UNESCO. (2023). *Guidelines on digital learning and assessment in higher education*. UNESCO Publishing.

Abbreviations

ICT – Information and Communication Technology

AI – Artificial Intelligence

CBT – Computer-Based Test