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Original Research Article

INNOVATIVE ONLINE ASSESSMENT METHODS AS CORRELATES OF STUDENTS' LEARNING OUTCOMES IN NATIONAL OPEN UNIVERSITY OF NIGERIA, RIVERS AND BAYELSA STATES STUDY CENTRES

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ABSTRACT: This study investigated innovative online assessment methods as correlates of students' learning outcomes in National Open University of Nigeria (NOUN) Rivers and Bayelsa States study centres. Two objectives, two research questions and two null hypotheses guided the study. The study adopted correlational research design. The total population of the study was 355 comprising 91 facilitators and 264 final year learners from National Open University of Nigeria, Rivers and Bayelsa States study centres. The entire population was used as sample which infers adopting census sampling method. The instruments for the study were two self-structured questionnaires titled: "Innovative Online Assessment Methods Questionnaire" and "Students' Learning Outcomes Questionnaire" which were on a 4-point rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree. The instruments were face and content validated by three experts from the Department of Educational Management and Measurement and Evaluation respectively in Rivers State University and tested for reliability using Cronbach Alpha statistics which yielded reliability indexes of 0.84, 0.88 and 0.82. Pearson Product Moment Correlation statistics was used in answering the research questions while the null hypotheses were tested using t-Transformation at .05 level of significance. The study found significant relationship between virtual simulations assessment method, e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres. Based on the findings, it was recommended among others that NOUN should invest in low-bandwidth-compatible simulation tools that allow students to practice decision-making and apply theoretical knowledge in realistic virtual environments so as to enhance practical skills and problem-solving abilities in them.

Keywords: Innovative Online Assessment Methods, Students' Learning Outcomes, Virtual Simulations Assessment Method, E-Portfolio Assessment Method.

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INTRODUCTION

Education is a vital tool for nation building. Amie-Ogan and Epelle (2021) defined education as a process by which abilities and capabilities of individuals are developed for the actualization of human potential to enable transformation of individuals and nations in a broader way. In a

similar view, Onyali and Akinfolarin in Offem (2021) viewed education as an indispensable means of transmitting the skills and knowledge that are required by individuals to fully participate and contribute to the development of economic, social and political activities of any country. Education aids in the transmission of specialized knowledge, skills, moral values and attitude for character building and creativeness in all facets of life. These indices of education have made education a crucial index for economical, societal, personal and national development. There is no gainsaying that the education sector of any nation is vital because it provides the kind of knowledge necessary to sustain her citizenry in a competitive world.

The rapid growth of digital technology has profoundly impacted education, reshaping how instructions and assessments are designed and delivered. This shift has been particularly significant in open and distance learning institutions like the National Open University of Nigeria (NOUN), where online assessments can provide flexible, scalable solutions that meet the needs of a diverse and geographically dispersed student population. In Nigeria, the National Open University of Nigeria (NOUN) serves as a significant platform for advancing open and distance education. As the largest single-mode open university in West Africa, NOUN caters to a diverse student population, many of whom are adults with professional commitments and other responsibilities. This diversity necessitates the adoption of assessment methods that align with the principles of flexibility and accessibility.

Traditional assessment approaches often constrained by physical and temporal limitations have proven to be inadequate in addressing the unique needs of distance learners (Aminu & Murtala, 2023). Particularly, online assessment methods have gained prominence in higher education, by offering new possibilities in measuring student learning beyond traditional paper-based examinations Yusuf and Alabi (2021) stated that online assessment promotes students' engagement, enhance motivation and provide immediate feedback, all of which are critical for improving students' learning outcomes. Globally, higher education institutions have increasingly adopt online assessment tools to promote flexibility, accessibility and inclusivity in evaluating learners (Timmis et al., 2016). Consequently, the shift towards online assessment methods have become imperative to ensure that students' learning outcomes are measured effectively and equitably (Okonkwo & Chukwuedo, 2021).

Students' learning outcome refers to the desired learning objectives or standard that students are expected to achieve. Brown (2022) defined students' learning outcomes as what represents the bedrock of educational assessment, which encapsulates the knowledge, skills and competencies students are expected to acquire throughout their academic journey. The learning outcomes of students change their behaviour pattern through different courses. When students meet the expectation of a learning programme, they are said to have positive learning outcome, while the reverse is the case whereby their expectations are not met. Also, students' learning outcomes have been articulated to include the ability of students to understand content taught in a clear and understandable manner, been able to have appropriate, relevant and timely communication with the instructor, ability to acquire theoretical and practical knowledge and the ability to think critically (Owolabi & Adebayo, 2021). These concerns however are rested on the assessment methods adopted in the open and distance learning institutions like the National Open University of Nigeria.

Innovative online assessment methods are modern technology-driven approaches which evaluate students' learning progress, skills and knowledge in a virtual environment. According to Malin and Akimov (2020), it is a form of evaluation that involves the use of synchronous and asynchronous methods. Innovative online assessment methods are essential tools for evaluating

students' knowledge, skills and competencies in digital learning environments (Cheng & Chau, 2018). Heil and Ifenthaler (2023) defined online assessment as an electronic method of gathering information about a learner and learning processes to draw inferences about the learner's dispositions. These methods integrate emerging technologies such as artificial intelligence, gamification and interactive multimedia to create assessments that are not only more personalized but also reflective of real-world applications (Redecker & Johannessen, 2018).

The application of these methods makes learners to be able to expand their knowledge, find solutions to issues and provide the right assignment response which in turn improves their learning outcomes (Morgan, 2020). Studies have shown that when effectively implemented, innovative online assessments could enhance students' engagement, provide real-time feedback and foster the development of critical thinking and problem-solving skills. Moreover, such assessments can bridge the gap between theoretical knowledge and practical application, thereby improving students' overall outcomes.

UNESCO (2024) asserted that innovative online assessment methods promote students' engagement and motivation by aligning assessments with learners' abilities and progress. Hiruni et al. (2023) noted that online assessment methods include online quizzes, virtual simulations, online discussions, e-portfolios and peer assessment. Virtual simulation is an assessment method that leverages computer-based or online simulation environments to assess learners' knowledge, skills and competencies. Merchant et al. (2019) referred to virtual simulations as an online assessment that creates realistic scenarios that enable students to apply theoretical knowledge in practical contexts. Virtual simulations bridge the gap between theory and practice, preparing students for real-world challenges. Through the provision of a more interactive and immersive learning experience, virtual simulations can increase student engagement and motivation, leading to better learning outcomes.

According to Aldrich (2019), virtual simulations engage students by allowing them to make decisions, observe outcomes and receive immediate feedback. This interactive process helps learners to internalize concepts more effectively compared to traditional assessment methods. For example, in a study on medical education, Cook et al. (2020) found that students who participated in virtual simulations demonstrated higher knowledge retention and improved clinical reasoning skills than those assessed through conventional methods.

Virtual simulations enable students to repeatedly practice and refine their skills in a controlled environment, which is crucial for mastering complex tasks (Clark et al., 2016). These tools can be customized to meet the specific needs of various disciplines, ranging from engineering to social sciences. Research has shown that virtual simulations can increase student engagement and motivation, leading to better learning outcomes (Broadbent, 2017). This is particularly relevant in open and distance learning institutions like National Open University, where students may not have the same level of face-to-face interaction with instructors as traditional university students. When virtual simulations are incorporated into the assessment process, instructors are able to create a more interactive and immersive learning experience that motivates students to learn and engage with the course material. Virtual simulations provide an excellent framework for engaging in inquiry-based learning, because they enable students to gain conceptual knowledge while independently investigating a scientific issue with the relevant methodology in the field. Furthermore, virtual simulations are able to motivate students by giving them challenges combined with continuous feedback in a learning environment that is more tailored to their individual learning needs and interests (Honey & Hilton in Kizilcec & Halawa, 2018).

Makransky et al. (2016) found that virtual simulations increased student's intrinsic motivation, in addition to learning and self-efficacy. A study conducted by Yeo and Jang (2023), showed that the virtual simulations has developed confidence, achievement and satisfaction among the learners in addition to correcting their errors from failure. One key application of virtual simulation in education is immersive simulations, where students can participate in realistic scenarios and hands-on experiences, thus fostering active learning and deep engagement (Kizilcec & Halawa, 2018). For example, virtual simulation can recreate laboratory experiments or historical events, allowing students to explore concepts in a more interactive and memorable way, leading to higher levels of engagement and knowledge retention. Additionally, virtual simulation offers opportunities for collaboration and social interaction, mimicking the dynamics of traditional face-to-face learning environments (Wang & Wu, 2020). Through the facilitation of real-time communication and teamwork, virtual simulation promotes a sense of community among online learners, which is crucial for sustaining engagement and motivation over time.

E-portfolio refers to the evaluation of students' learning, skills and development through a digital collection of their work. An e-portfolio is an electronic repository where students compile evidence of their learning, such as essays, projects, presentations, videos and reflection (Cheng & Chau, 2018). The versatility of e-portfolios lies in their ability to integrate multimedia elements such as videos, images, and written reflections, thus providing a comprehensive view of students' competencies and growth. Research has demonstrated that e-portfolios can promote deeper learning and understanding of course material (Chen & Light, 2020). This requires students to reflect on their learning and select examples of their work to include in their e-portfolio. Also, instructors can help students develop a more nuanced understanding of the subject matter. Additionally, e-portfolios can provide students with opportunities to develop important skills such as critical thinking, problem-solving and communication (Lorenzo & Ittelson, 2015).

E-portfolios can also enhance student engagement and motivation by allowing students to take ownership of their learning and showcase their achievements while instructors increase students' interest and motivation which leads to better learning outcomes (Banta et al., 2020). Providing students with opportunities to reflect on their learning and showcase their achievements, instructors are able to help students develop important skills and knowledge that are relevant to their future careers. E-portfolio allows for collecting and presenting diverse artefacts, including written work, multimedia projects, and reflections, which provide a more comprehensive view of students' learning outcomes (Lu, 2021). It enables students to showcase their knowledge, skills and growth over time, and also demonstrate their ability to think critically, solve problems and be creative. E-portfolios provide a platform for students to curate and present evidence of their learning journey, which goes beyond the limitations of traditional assessments. This reflective component of e-portfolios encourages students to think critically about their learning and make connections between different areas of knowledge.

E-portfolios support formative assessment practices by providing ongoing feedback and opportunities for revision and improvement (Pourdana & Tavassoli, 2022). Instructors can provide timely feedback on students' e-portfolios, fostering a continuous learning process and enabling students to track their progress over time. This formative feedback helps students identify their strengths and areas for development, enhancing their self-assessment skills and promoting a growth mindset.

E-portfolios enable students to showcase their knowledge, skills, and growth over time, demonstrating their ability to think critically, solve problems, and be creative. The strength of e-

portfolios lie in the extensive use of reflective learning practices. These are through interaction content and with others, reflective learning, creatively designed learning activities, continuous feedback and authentic assessment, students first master self-learning and self-evaluation skills and being able to co-learn and co-produce knowledge with peers (De Jager, 2019). It has proven that the process of building e-portfolios assist students in becoming active and independent lifelong learners, who in a technology-enriched space, could cultivate their learning and knowledge through collaborative projects and peer learning (Beckers et al., in Ajayi et al., 2022).

Statement of the Problem

Assessment remains a fundamental aspect of teaching and learning, particularly in open and distance learning (ODL) institutions such as the National Open University of Nigeria (NOUN), where learners are dispersed across various locations and rely heavily on technology-mediated instructional delivery. In recent years, innovative online assessment methods such as virtual simulations and e-portfolios have gained prominence for their potential to enhance authentic learning, through critical thinking and Provision of continuous feedback to learners. These tools are designed to measure knowledge retention as well as practical skills and problem-solving abilities, which are crucial for improved learning outcomes. However, despite their relevance, their effective integration and utilization in NOUN's assessment practices continue to be a mirage over the years.

Notably, many facilitators and students lack adequate exposure and technical competence to fully utilize virtual simulations and e-portfolios for teaching and evaluation. It has been observed that in spite of the fact that virtual simulations and e-portfolios can provide experiential and interactive learning opportunities, as well as serve as reflective tools for tracking learning progress and showcasing competencies over time, their adoption in NOUN is far from the reality as little is known about how effectively they contribute to students' learning outcomes. Furthermore, issues such as poor internet connectivity, limited access to reliable digital infrastructure and insufficient institutional support often pose as challenges to successfully deploy these innovative assessment methods. The scarce empirical evidence on the relationship between innovative online assessment methods such as virtual simulations and e-portfolios and students' learning outcomes in National Open University of Nigeria creates a knowledge gap. This study, therefore, sought to address this gap by identifying the strengths of these innovative online assessment methods and how they correlate with students' learning outcomes. It is against this background that the study investigated innovative online assessment methods as correlates of students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Purpose of the Study

The study investigated innovative online assessment methods as correlates of students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States Study Centres. Specifically, the study sought to:

- Determine the relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

- Examine the relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Research Questions

Two research questions guided the study:

- What is the relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres?
- What is the relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres?

Hypotheses

Two hypotheses further guided the study:

- There is no significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.
- There is no significant relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

METHODOLOGY

The study adopted correlational survey research design. The population of the study was 355 comprising of 91 facilitators and 264 final year learners from National Open University of Nigeria, Rivers and Bayelsa States study centres. The entire population was used as the sample which infers adopting the Census sampling method. Two different questionnaires titled: "Innovative Online Assessment Methods Questionnaire (IOAMQ)" and "Students' Learning Outcomes Questionnaire (SLOQ)" which were on a 4-point rating scale of Strongly Agree, Agree, Disagree and Strongly Disagree were used for data collection. The instruments were face and content validated by three experts, one from the Department of Educational Management and two from Measurement and Evaluation respectively in Rivers State University. The instruments were tested for reliability using Cronbach Alpha statistics which yielded reliability indexes of 0.84, 0.88 and 0.82. Pearson Product Moment Correlation statistics was used to answer the research questions. The hypotheses were tested using t-Transformation at .05 level of significance with a critical t-value of ±1.96. Analysed data therefore with t-Transformed value above the t-critical value of ±1.96 was rejected and below was accepted.

RESULTS

Research Question 1: What is the relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres?

Table 1: Summary of Pearson Product Moment Correlation on the Relationship Between Virtual Simulations Assessment Method and Students' Learning Outcomes in National Open University of Nigeria, Rivers and Bayelsa States Study Centres

		Virtual Simulations Assessment Method	Students' Learning Outcomes
Virtual Simulations Assessment Method	Pearson Correlation	1	.732**
	Sig. (2-tailed)		.000
	N	355	355
Students' Learning Outcomes	Pearson Correlation	.732**	1
	Sig. (2-tailed)	.000	
	N	355	355

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1 revealed a correlation value of r = .732**. The r-value was high and positive, thus indicating a high and positive relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres. This implies that the adoption of virtual simulations assessment method will enhance students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Research Question 2: What is the relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres?

Table 2: Summary of Pearson Product Moment Correlation on the Relationship Between Virtual E-Portfolios Method and Students' Learning Outcomes in National Open University of Nigeria, Rivers and Bayelsa States Study Centres

		E-Portfolios Assessment Method	Students' Learning Outcomes
E-Portfolios Assessment Method	Pearson Correlation	1	.583**
	Sig. (2-tailed)		.000
	N	355	355
Students' Learning Outcomes	Pearson Correlation	.583**	1
	Sig. (2-tailed)	.000	
	N	355	355

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2 revealed a correlation value of r = .583**. The r-value was moderate and positive, thus indicating that there is a moderate and positive relationship between e-portfolios assessment

method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres. This implies that the adoption of e-portfolios assessment method enhances students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Hypotheses

Hypothesis One: There is no significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Table 3: Summary of t-Transformation on the significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States Study Centres

Variables	N	df	r-value	t-Trans.	t-crit.	α
Virtual Simulations Assessment Method	355	353	.732	20.19	±1.96	.05
Students' Learning Outcomes	355					

Table 3 showed a t-Transformation value of 20.19 which was greater than the t-critical value of ±1.96 at .05 level of significance with a degree of freedom of 353. Since the t-Transformation value of 20.19 was greater than the t-critical value of ±1.96, the null hypothesis of no significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres was rejected and the alternative upheld which states that there is a significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Hypothesis Two: There is no significant relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

Table 4: Summary of t-Transformation on the significant relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States Study Centres

Variables	N	df	r-value	t-Trans.	t-crit.	α
E-Portfolios Assessment Method	355	353	.583	13.49	±1.96	.05
Students' Learning Outcomes	355					

Table 4 showed a t-Transformation value of 13.49 which was greater than the t-critical value of ±1.96 at .05 level of significance with a degree of freedom of 353. Since the t-Transformation value of 13.49 was greater than the t-critical value of ±1.96, the null hypothesis of no significant relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres was rejected and the alternative upheld which states that there is a significant relationship between e-portfolios

assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres.

DISCUSSION OF FINDINGS

Findings for Research Question 1 in Table 1 indicated that there is a high and positive relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres with 'r' as .732**. Correspondingly, hypothesis 1 in Table 3 showed a significant relationship between virtual simulations assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres with t-Transformation value of 20.19 which was greater than the z-critical value of $\pm$1.96. The findings were in agreement with Aldrich (2019), who opined that virtual simulations engage students by allowing them to make decisions, observe outcomes and receive immediate feedback. This interactive process helps learners to internalize concepts more effectively compared to traditional assessment methods. The findings were supported by a study conducted by Yeo and Jang (2023), whose findings showed that virtual simulations develop confidence, achievement and satisfaction among the learners in addition to correcting their errors from failure.

The findings for Research Question 2 in Table 2 indicated that there is a moderate and positive relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres with 'r' as .583**. Hypothesis 2 in Table 4 showed that there is a significant relationship between e-portfolios assessment method and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres with t-Transformation value of 13.49 which was greater than the z-critical value of $\pm$1.96. The findings were in tandem with Lu (2021), who opined that e-portfolio allows for collecting and presenting diverse artefacts, including written work, multimedia projects and reflections, which provide a more comprehensive view of students' learning outcomes. The findings were also in line with De Jager (2019), who stated that the strength of e-portfolios lie in the extensive use of reflective learning practices which emanate from interaction with content and with others, reflective learning, creatively designed learning activities, continuous feedback and authentic assessment, students first master self-learning and self-evaluation skills and being able to co-learn and co-produce knowledge with peers.

CONCLUSION

Based on the findings of the study, it was concluded that a high, moderate, positive and significant relationship exist between virtual simulations and e-portfolios assessment methods and students' learning outcomes in National Open University of Nigeria, Rivers and Bayelsa States study centres. It is also noted worthy that as education becomes increasingly digitized, innovative online assessment methods have emerged as vital tools to enhance students' learning outcomes.

Recommendations

Based on the findings of this study the following recommendations were made:

- National Open University of Nigeria, Rivers and Bayelsa States study centres should invest in low-bandwidth-compatible simulation tools that allow students to practice decision-making and apply theoretical knowledge in realistic virtual environments so as to enhance practical skills and problem-solving abilities in them.
- Facilitators in National Open University of Nigeria, Rivers and Bayelsa States study centres, should promote the use of e-portfolios assessment method by requiring students to compile and reflect on learning artifacts through their academic journey so as to improve their lifelong learning.

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