

INFLUENCE OF ITEM SELECTION MIX AND DIGITAL PEDAGOGICAL COMPETENCY ON UNDERGRADUATES OUTCOME IN SELECTED TERTIARY INSTITUTIONS IN LAGOS STATE, NIGERIA

¹PROFESSOR AREMU, V.I., ²UDOFIA, I.G. (PhD) & ³OKUNTADE, J.O. (PhD)

^{1,3}*Department of Educational Technology, College of Informational and Technology Education, Lagos State University of Education, Lagos, Nigeria*

&

²*Department of Counselling Psychology, College of Specialised and Professionalised Education, Lagos State University of Education, Lagos, Nigeria.*

udofiamofe19@gmail.com

Abstract

The study adopted survey research design using descriptive approach as estimate of 18,350 undergraduates (Faculties and Colleges) formed population of students across 4 selected Public Universities in Lagos State. Using purposive and simple random sampling strategies, a sample of 400 students were selected across four universities in the state. Data were collected using two instruments, the adapted Edu-Technology Scale (Edu.211), a multiple choice test of 60 items on 4 response options while the Digital Pedagogical Competency Scale (DPCS) contained 20 items on 4-Likert scale type. Reliability coefficients, $r = 0.794$ (Edu. 211 Test) and 0.864 (Digital Pedagogical Competency Scale) were obtained using Cronbach's alpha method. Data was analysed using One-way ANOVA and Two- way ANOVA tested at 0.05 level of significance. The study concluded that integrating diverse assessment strategies with robust digital pedagogical skills is essential for improving quality of teaching and learning. It recommended that stakeholders like Vice-Chancellors, government, researchers among others should invest more in capacity-building programmes for lecturers, promote the adoption of adaptive digital assessment tools, and develop policies that support innovative and inclusive assessment practices.

Keywords: Item Selection Mix, Digital Pedagogical Competency, Undergraduates, Classical Test Theory

Introduction

The quality of undergraduates' outcome in public institutions has become a major concern due to increasing turn out of graduates who possess low critical thinking skills and problem-solving abilities. The 21st century mandate of Public institutions is expected to produce highly skilled personnel who can compete effectively in a technologically driven environment where instruction is technology driven; however, many of our institutions continue to experience low technology support from NGOs', low student engagement and academic staff recruitment. Research have shown that the effectiveness of teaching methods and assessment practices can sometimes influence students' academic outcome and overall educational experience. Sulaimon, & Eniola (2020) Assessment practices, particularly the selection and combination of test items used in evaluating students, play a crucial role in determining whether learning objectives are adequately measured and achieved.

In determination of item selection mix, Udofia and Iberedem (2026) stated that assessment can be executed through the identification of the various measurement scale be it, multiple-choice questions, essay questions,

short-answer items, practical tasks, and project-based assessments which are widely accepted as part of evaluation in learning outcome. Item selection mix is a self designed strategy by test developer in pooling items based on psychometric property of difficulty level. The degree of difficulty index provides a baseline for the selection of items into test forms (ascending, descending, randomisation). Item selection mix is a deliberate and conscious arrangement of tests based on conditions of randomness, ascending and descending order of magnitude (Gholam-Reza & Hanieh, 2019). The sequence of item selection is designed to determine the path and pattern of students' responses to test items. Item selection mix identifies the dynamics test developers consider and their choice of preference in pooling items in a scale. This test forms centres on the ability of students to respond favourably to an item the way the topics were arranged in the teaching process by the teacher. Meanwhile Opara & Uwah (2017) emphasized that the choice and sequence of test items may sometimes afford students the ability to recall things dependent on the order in which they were exposed to them in the class.

According to Aderogba and Akinlolu (2020), Opara and Uwah (2017) the ascending order type also known as easy-to-hard sequence generally begins with simpler questions to build students' confidence before advancing to more complex tasks. This method can be beneficial in that it helps students establish a rhythm, potentially enhancing their performance on more difficult questions later in the test. If easy items are placed at the beginning of the test and difficult items at the end, students may become discouraged or demotivated early on if they struggle with the easier questions. The easy-to-hard order also has its limitations as it can lead to students overestimating their abilities early in the test. Moreso, Ogunleye & Aina (2020) noted that if students perform well on the initial easy questions, they may become complacent and approach the harder questions with less focus or effort. This sequence help induce anxiety when students reach more difficult questions toward the end of the test.

The descending order, according to Udofia (2026) is also known as hard-to-easy sequence when items begin with more challenging questions and ends with simpler ones. This sequence can help mitigate test anxiety, as students face the toughest questions first, when their mental energy is highest. If difficult items are placed first, students may become overwhelmed and loose confidence, leading to poorer performance overall. Some students might appreciate this approach as it allows them to tackle the most difficult questions while they are still mentally fresh.

A non-consistent order of test items (randomized form) according to Sulaimon and Eniola, (2020) ensures that the sequence of questions is not predictable, which help reduce any test-taking strategy students might have employed. By randomizing the order, all questions, whether easy or hard, are treated with equal importance and challenge. This order has the advantage of testing a student's ability to engage with the entire range of questions without the psychological bias introduced by a fixed progression. In high-stakes examinations like the WASSCE or UTME, randomizing the questions can encourage students to rely on their knowledge and skills without relying on strategies based on questions order (Sulaimon & Eniola 2020).

Moreover, randomisation can provide a more accurate reflection of a student's true ability, as they are not given an opportunity to approach the test in a biased or formulaic way. Randomised order also mitigates the potential for pattern recognition, which is a common issue in multiple-choice testing. Sulaimon & Eniola (2020) further reiterated that with randomized items, patterns are less likely to emerge, making the test more reliable in assessing students' true mathematical understanding. Furthermore, randomisation help reduce anxiety that students experience when confronted with an overwhelming difficult questions at the start or end of the test.

The use of item selection mix which entails the use of any of either ascending, descending or randomised format may affect students' ability to respond to test-taking strategies effectively especially with the use technology. If similar items are clustered together, students may be able to apply a common strategy to answer them more efficiently. However, if items are randomly arranged, students may have to constantly switch between different strategies, which can be confusing and lead to errors (Sulaimon & Eniola, 2020). Student's score in a test is not an accurate measure or estimate of the student's true score due to various conditions that are associated or responsible for the response pattern of students towards a test. Be it power test, speed test or tailored test, test takers response to items especially to multiple choice test type is greatly influenced by the difficulty index of the items. When students' ability is being examined, there are other unknown factors like random or chance factors that do influence the score obtained by a student in such a test.

It can be recalled that experts measurement experts like Nitko and Brookhart (2014), Opara & Uwah (2017) emphasized that no single assessment format can adequately measure all domains of learning as a result a balanced mix of assessment items is necessary to capture cognitive, affective, and psychomotor competencies. In many public institutions, lecturers often rely heavily on multiple choice test since its assumed to be easier to administer and score, despite criticisms that such methods may not sufficiently measure higher-order thinking skills (Nitko & Brookhart, 2014). Inappropriate item selection can negatively affect students' performance, creativity and analytical ability, thereby limiting the achievement of intended learning outcomes. This suggests that the type and variety of assessment items used by lecturers may significantly influence undergraduate academic success (Brookhart, 2017).

The integration of digital technologies into higher education has transformed teaching and learning processes thereby making digital pedagogical competency an essential requirement for lecturers in public institutions. Digital pedagogical competency involves the knowledge, skills and attitudes required for effective teaching using digital tools, online platforms and technology-enhanced instructional methods. According to the European Commission (2018), educators' digital competence includes the ability to design digital learning experiences, facilitate online interaction and apply technology-based assessment strategies effectively. However, Aremu, Udofia & Okuntade, (2024) reported that rapid expansion of e-learning and blended learning environments, especially after the COVID-19 pandemic, exposed significant lacuna in lecturers'

digital readiness in many public institutions. Inadequate digital pedagogical skills noticeable among lecturers have been associated with ineffective instructional delivery, low student participation, and poor learning outcomes. As a result improving lecturers' digital competencies has become central to enhancing the quality of undergraduate education.

Undergraduates in public institutions are gradually being expected to learn within digitally mediated environments that require active engagements, collaboration and independent learning. The effectiveness of these learning environments largely depends on the ability of academic staff to integrate technology meaningfully into pedagogy and assessment practices. Research by Aremu & Udofia (2024) has demonstrated that lecturers with strong digital pedagogical competencies are better able to create interactive and student-centered learning experiences that improve students' motivation and academic achievement. However, many public institutions, particularly in developing countries, continue to face challenges such as inadequate technological infrastructure, limited training opportunities, and resistance to technology adoption among lecturers. These challenges have been identified to contribute towards hindering the effective implementation of digital pedagogy which consequently affect learners outcomes. As a result, there is growing interest in understanding how digital pedagogical competency contributes to students' academic performance and learning effectiveness in public institutions (Aremu, Udofia & Okuntade, 2024).

Going forward Smith, and Storrs (2023) emphasized that the relationship between assessment practices and digital pedagogy has become so important in universities as assessment in digital learning environment requires lecturers to possess competencies not only in technology use but also in selecting suitable assessment items or scale that align with instructional objectives and students' learning needs. A study by Aremu, Udofia & Okuntade, (2024) have argued that combining diverse assessment formats with technology-enhanced instructional methods can promote deeper learning, critical thinking, and improved academic outcomes. Digital tools such as online quizzes, discussion forums, simulations, and project-based learning platforms provide opportunities for academics to diversify assessment methods and improve feedback mechanisms. Nevertheless, the extent to which item selection mix and digital pedagogical competency jointly influence undergraduate outcomes in public institutions remains insufficiently explored, especially within the confine of public higher education systems.

Existing studies like (Nitko & Brookhart, 2014; Redecker, 2017) have largely examined assessment practices and digital pedagogy separately, with limited attention given to their combined influence on students' academic outcomes. This deficiency in literature highlights the need for investigation into how the integration of appropriate item selection mix and effective digital pedagogical competency can enhance undergraduate learning outcomes. As part of its effort, this study seek to examine the influence of item selection mix and digital pedagogical competency on undergraduate outcomes in public institutions in other to provide timely based recommendations for improving teaching effectiveness and student academic achievement.

Theoretical Framework of the Study: Classical Test Theory

This study lies on the use of classical test theory propounded by Charles Spearman in 1904. His work on measurement error and reliability laid the ground work for the theory. The theory holds that: $X = T + E$, where X -is the observed score, T -is the true score and E -is measurement error or expected score. The theory emphasized that students' observed performance is a combination of their true ability and measurement error, making it essential for educators to design assessment items that are reliable, valid and appropriately balanced across cognitive levels. Through proper item selection, lecturers can ensure that examinations accurately measure students' knowledge, critical thinking, and practical competencies, thereby improving the credibility of academic outcomes. In addition, the increasing integration of digital technologies in higher education highlights the importance of digital pedagogical competency among instructors, as technologically skilled instructors are better able to develop, administer and evaluate assessments using digital platforms. Classical Test Theory supports the analysis of item difficulty, discrimination indices, and test reliability remains suitable parameters expected in a scale to identify weaknesses in assessment practices and improve instructional delivery. However the theory serves as a foundational guide for understanding how effective assessment designs and digital teaching competence collectively contribute to enhanced student achievement, fairness in evaluation and general educational quality in public tertiary institutions.

Statement of the Problem

The unstable dropout rate, not so encouraging academic performance rate and negative attitude of students towards technology use in schools may have drawn the attention of stakeholders like teachers, policymakers, researchers, government regarding the effectiveness of available instructional practices and best assessment strategy to adopt in this digital era. One major issue that may have been identified is lack of inadequate integration of appropriate item selection mix in assessment processes, which may address cognitive diversity, critical thinking and practical competency. Despite growing attention to digitalise teaching and learning in higher institutions, there remains inadequate empirical studies on how item selection mix and digital pedagogical competency jointly influence undergraduate academic outcomes, especially within public institutions. The rapid expansion of digital learning environments have also exposed deficiencies in digital pedagogical competency among lecturers in the area of limited skills in digital tool use, online instructional design and technology-supported assessment techniques.

Previous studies on technology related use by Aremu & Udofia (2024); Blayone, vanOostveen, Mykhailenko & Barber (2018) and Udofia (2026) revealed that insufficient digital competence among educators negatively affect students' engagement, learning effectiveness, and overall academic performance in higher education institutions. The mismatch between modern digital learning demands and lecturers' pedagogical readiness has created learning gaps that continue to affect undergraduate outcomes in public institutions. As a result

this study is out to examine the influence of item selection mix and digital pedagogical competency on undergraduate outcomes in public institutions with the aim of improving assessment quality and teaching effectiveness.

Objectives of the study

This study explored the influence of Item Selection-Mix and Digital Pedagogical Competency among Undergraduates in Selected Tertiary Institutions in Lagos State, Nigeria. Specifically this study:

- a. assess how the use of item selection mix influences students performance
- b. assess how Digital Pedagogical Competency influence undergraduates outcome
- c. examine the influence of Item Selection Mix and Digital Pedagogical Competency on Undergraduates outcome by gender

Hypotheses

Three null hypotheses were formulated and tested at .05 significant level:

H01: Item Selection Mix does not have any statistical significant influence on Undergraduates Outcome in Selected Public tertiary institutions in Lagos State

H02: Digital Pedagogical Competency does not have any statistical significant influence on Undergraduates Outcome in Selected Public tertiary institutions in Lagos State

H03: Item Selection Mix and Digital Pedagogical Competency does not have any statistical significant influence on Undergraduates Outcome by gender in Selected Public tertiary institutions in Lagos State

Methodology

The study adopted the survey research design using descriptive approach as estimate 18,350 undergraduates (Faculties and Colleges) formed population of students across 4 selected Public Universities in Lagos State. Using purposive and simple random sampling strategies, a sample of 400 students were selected across four universities in the state. Data were collected using two instruments, the adapted Edu-Technology Scale (Edu.211), a multiple choice test of 60 items on 4 response options while the Digital Pedagogical Competency Scale (DPCS) contained 20 items on 4-Likert scale type. Reliability coefficients, $r = 0.794$ (Edu. 211 Test) and 0.864 (Digital Pedagogical Competency Scale) were obtained using Cronbach's alpha method. Data was analysed using One-Way ANOVA and Two- way ANOVA tested at 0.05 level of significance.

Data

H0₁: Item Selection Mix does not have any statistical significant influence on Undergraduates Outcome in Selected Public tertiary institutions in Lagos State

Table 1: ANOVA Analysis showing significant influence of Item Selection Mix on Undergraduates Outcome

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1676.242	2	838.121	44.005	.000
Within Groups	7580.446	398	19.046		
Total	9256.688	400			

Source: Fieldwork, (2026)

The ANOVA result in Table 1 shows an F-value of 44.005 and a p- value of .000, testing at an alpha level of .05. Since the p-value is less than the alpha level ($p < 0.05$), the null hypothesis is rejected. Consequently, it posits that item selection mix have a significant influence on undergraduates outcome. With the significant value, a Post-hoc test of comparison to determine where the influence lies is needed.

Table 2: POST HOC Test for Multiple Comparisons of the influence in Undergraduate Outcome

(I) TEST 2021	(J) TEST 2021	Mean Difference (I-J)	Sig.
1	2	-4.522*	.000
	3	-4.712*	.000
2	1	4.522*	.000
	3	-.189	.612
3	1	4.712*	.000
	2	.189	.612

Source: Fieldwork, (2026)

The data in Table 2 shows the LSD Post Hoc Test used to determine the direction of difference in the three Item Arrangements. For ascending order format (1) to descending order format (2) is significant at .000 with mean difference of -4.522, Ascending (1) to Randomised (3) is significant at .000 with mean difference of -4.712; Descending (2) to Ascending (1) is significant at .000 with mean difference of 4.522, Descending (2) to Randomised (3) is not significant at .612 with mean difference of -.189; Randomised (3) to Ascending (1) is significant at .000 with mean difference of 4.712 and Randomised (3) to Descending (2) not significant at .612 with mean difference of .189. Hence the influence in the item selection mix lies in randomised order format where sig-value of .000 ($p < .05$).

H0₂: Digital Pedagogical Competency does not have any statistical significant influence on Undergraduates Outcome in Selected Public tertiary institutions in Lagos State

Table 3: ANOVA Analysis showing significant influence of Digital Pedagogical Competency on Undergraduates Outcome

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1054.106	2	527.053	27.363	.013
Within Groups	7666.231	398	19.261		
Total	8720.337	400			

Source: Fieldwork, (2026)

The ANOVA result in Table 3 shows an F-value of 27.363 and a p- value of .013 testing at an alpha level of .05. Since the p-value is less than the alpha level ($p < 0.05$), the null hypothesis is rejected. Consequently, the alternative which states that digital pedagogical competence have significant influence on learners outcome is retained.

H03: Item Selection Mix and Digital Pedagogical Competency does not have any statistical significant influence on Undergraduates Outcome by gender in Selected Public tertiary institutions in Lagos State

Table 4: Two-way ANOVA showing influence of Item Selection Mix and Digital Pedagogical Competency on Undergraduates Outcome by Sex

Source	Type Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.911 ^a	3	.304	1.261	.000
Intercept	.005	1	.005	.022	.013
Item Selection Mix*Digital Pedagogy competency*Sex	.883	2	.441	0.876	.004
Error	65.912	398	.165		
Total	366.442	400	.916		
Corrected Total	432.354	399			

Source: Fieldwork, (2026)

The two-way ANOVA table shows the difference in the mean score for item selection mix and digital pedagogical competency by Sex. It shows that item selection mix with an F- value of .251 and a p – value of .005 was found significant ($P < .05$); Digital Pedagogy competency, F-value of 1.028 was also found significant at .022 ($P < .05$), Item Selection Mix^Digital Pedagogy competency, F- value of 3.541 was also significant at .012 ($P < .05$), Sex, F-value of 1.981 was also found significant at .001 ($P < .05$), Item Selection Mix and Digital Pedagogy competency*Sex, F-value of .876, Significant at .004, meaning there is a significant influence of item selection mix and digital pedagogy competency on learners outcome by sex. Consequently, the null hypothesis is rejected respectively.

Discussion

Result from hypothesis one shows that item selection mix have a significantly influence on undergraduates' academic outcome. This is as the influence in the outcome can be attributed to selection of items using randomised item mix format. The result suggests that the manner in which test items are organized has

implications for students' performance during examinations. This finding may be attributed to the psychological and cognitive influence associated with test-taking behaviour, such as confidence building, anxiety reduction, concentration, and motivation. The outcome of this study aligns with that of Galle, Andzutsi & Paul (2022) who found that changes in item sequence significantly influenced students' achievement with randomly arranged items producing better performance as it discourages guessing, build self-confidence, show subject mastery and dexterity in learners ability. When items are presented in no particular order of difficulty index, students tend to develop confidence and maintain better engagement throughout the examination process, thereby improving their overall academic outcome.

For hypothesis two, the data revealed that digital pedagogical competency have a significant influence on undergraduates' academic outcomes. This implies that lecturers who possess adequate digital pedagogical skills are better equipped and positioned to integrate technology-driven instructional strategies that would enhance students' engagement, critical thinking, collaboration and an improved outcome. The result corroborates with the study by Aremu & Udofia (2024) who were of the assertion that effective use of digital tools in teaching and learning promotes interactive learning experiences and improves students' cognitive and psychomotor development. With the growing adoption of online learning platforms, computer-based testing, virtual classrooms, and artificial intelligence applications in our tertiary institutions, Aremu and Udofia (2024) further reported that digital literacy skills have positively influenced undergraduate performance in Lagos State tertiary institutions, as students exposed to digitally enhanced learning demonstrated improved analytical and critical thinking abilities. Similarly, Joseph et al. (2025) found that lecturers' digital literacy skills significantly predicted online learning outcomes among undergraduates in federal universities in South-East Nigeria, indicating that technologically competent educators create more effective and learner-centred instructional environments. Furthermore, Olurinola and Olugbade (2024) observed that digital pedagogy competence among Nigerian educators improved teaching effectiveness and confidence in technology integration, thereby contributing positively to students' learning experiences and outcomes. This findings underscore the necessity for continuous professional development in digital pedagogy to enhance undergraduate educational outcomes in Nigerian universities.

The data from hypothesis three also reveals that item selection mix and digital pedagogical competency have an influence on undergraduates' learning outcomes across gender. This implies that properly structured test items and the effective integration of digital pedagogical skills enhance students' academic performance irrespective of gender differences. The result agrees with the submission of Aremu and Udofia (2024), who found that digital literacy and technology-driven instructional practices positively improve undergraduate students' academic achievement and critical thinking abilities in Nigerian tertiary institutions. Their study further established that learners who possess higher digital competencies demonstrate better engagement and performance during computer-based assessments irrespective gender differential. Similarly, Kayode and

Govender (2021) reported that students' proficiency in computer-based technology significantly affects learning outcomes and that gender variations in technological skills can influence students' academic participation and achievement in Nigerian universities. The finding is also consistent with Adeoye and Adeoye (2017) assertion that digital literacy skills are indispensable for undergraduate students' academic success in Nigerian universities because they improve learners' ability to access, process, and utilize educational resources effectively. Furthermore, Olugbade et al. (2025) observed that digital pedagogical competence contributes substantially to improved instructional delivery and learner engagement among both male and female participants, while reducing gender disparities in educational achievement. Therefore, the present finding suggests that when assessment items are systematically arranged and supported with strong digital pedagogical competencies, undergraduate students are more likely to attain improved academic outcomes regardless of gender differences.

Conclusion

From findings the study concluded that undergraduates performed better and preferred the randomized form of item selection mix as their digital pedagogical competency was found to be a strong predictor of effective learning outcomes, with competencies in digital content creation, online assessment and interactive learning platforms contributing significantly to students' academic success. The study further concluded that integrating diverse assessment strategies with robust digital pedagogical skills is essential for improving the quality of teaching and learning in Nigerian tertiary institutions.

Recommendations

From the conclusion made in the study, the following recommendations were put forth:

1. Stakeholders like Vice-Chancellors, Commissioners of Education among others should invest more in capacity-building programmes for lecturers, promote the adoption of adaptive digital assessment tools, and develop policies that support innovative and inclusive assessment practices.
2. More training programmes should be organised by the University management and Educational parastatals in the State Ministries for academics on how to conduct effective item selection mix process effectively in tertiary institutions.
3. School management should always provide free internet facilities in schools so that both teachers and students can indulge in practical exercises from time to time.

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