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Impact of learning analytics on academic performance in entrepreneurship education

Isaac Gbadegesin[a1], Educational Technology, University of Ilorin, Nigeria.

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Abstract

This study examines the integration of learning analytics into entrepreneurship education in higher institutions, addressing the lack of technology-driven pedagogical approaches in the field. The research responds to the need for innovative strategies to equip students with entrepreneurial competencies relevant to contemporary labor market demands. The objective was to assess the effectiveness of a learning analytics package, implemented through an online assessment platform, in improving academic performance. A pre-test and post-test design was applied to thirty students from fifteen faculties, with results analyzed to determine changes in achievement levels. Findings indicated substantial performance gains and confirmed the potential of learning analytics to foster personalized and adaptive learning experiences. However, increased variability in student outcomes revealed the necessity of strengthening digital infrastructure and enhancing educator capacity. The study underscores that learning analytics can play a pivotal role in advancing entrepreneurship education and preparing graduates for competitive and dynamic economic environments.

Keywords: Academic performance; adaptive learning; entrepreneurship education; learning analytics; technology integration.

* ADDRESS FOR CORRESPONDENCE: Isaac Gbadegesin, Educational Technology, University of Ilorin, Nigeria
E-mail address: isaacdaramade@gmail.com

1. INTRODUCTION

In Nigerian higher education, the relationship between entrepreneurship education and learning analytics remains underexplored, despite both being crucial for economic development. The need for entrepreneurship education has gained urgency, given that Nigeria must create at least three million new jobs annually to address unemployment (Yatu et al., 2018). Integrating technology, particularly learning analytics, into entrepreneurship curricula presents an innovative approach to enhancing entrepreneurial training (Duan, 2025; Liu et al., 2025). Learning analytics, as an information and communication technology (ICT) tool, provides educators with valuable insights to tailor teaching methods and improve student experiences, thereby boosting educational outcomes (Muhammad et al., 2019; Grimaldi et al., 2025). The incorporation of ICT tools in higher education, especially in entrepreneurship education, is critical for developing entrepreneurial skills and competencies (Zeynalov & Doğantan, 2025). These tools facilitate not only lecture delivery but also knowledge sharing, collaboration, and networking through online platforms (Kumazhege, 2024; Omorede et al., 2025). By providing access to essential resources, ICT creates a learning environment conducive to innovation and skill development, making it easier for students to thrive in entrepreneurial ventures (Özarallı & Rivenburgh, 2016).

One of the most powerful ICT tools in education is learning analytics, which involves the systematic collection and analysis of data about learners and their contexts. This data-driven approach enables educators to understand student behaviors, learning processes, and outcomes more clearly, allowing them to make informed decisions to enhance the learning experience (Virgili, 2019). Learning analytics leverages large datasets generated by educational activities, providing real-time feedback that helps adapt teaching strategies to meet individual student needs (Roberts et al., 2016). The growing body of research on learning analytics highlights its numerous benefits for students and educators alike. It helps capture detailed learning behaviors, allowing instructors to adjust their teaching approaches based on data-driven insights (Godsk et al., 2018). This facilitates a more student-centered learning environment, where feedback is personalized and timely, enabling educators to identify students at risk and offer targeted support (Ifenthaler, 2017). By analyzing data related to engagement, performance, and participation, educators can identify patterns that inform decisions regarding curriculum design and teaching methodologies, fostering a more adaptive and personalized learning environment (Clark et al., 2020; Starbird et al., 2025).

In Nigerian higher education, the integration of learning analytics into entrepreneurship education holds significant potential. Entrepreneurship education aims to equip students with the skills needed to create and manage successful businesses, but traditional teaching methods may not align with the dynamic, data-driven nature of today's business environment (Okolocha & Nwadiani, 2015). Learning analytics helps bridge this gap by providing insights into students' entrepreneurial capabilities and offering feedback on areas that need improvement (Eze et al., 2020). For instance, by analyzing student engagement in entrepreneurial projects, instructors can identify strengths and weaknesses and design targeted interventions to address learning gaps (Sadewo et al., 2018). Learning analytics also fosters a practical, hands-on approach to entrepreneurship education. As students tackle real-world business challenges, learning analytics provides immediate feedback on their performance, enabling them to reflect and adjust their strategies. This reflective learning process is crucial for developing problem-solving and critical-thinking skills, both of which are essential for entrepreneurial success (Ukpe, 2023). Despite the potential of learning analytics, challenges remain in its implementation within Nigerian higher institutions. One significant issue is the impracticality of individualized learning processes, as noted by Eze et al., (2018). While personalized ICT tools have been proposed to address these challenges, the adoption of learning analytics in entrepreneurship education remains limited, partly due to a lack of awareness and technical expertise among educators (James, 2024). Furthermore, successful integration requires robust Learning Management Systems (LMS) capable of processing large datasets and providing real-time analysis, an area where many Nigerian institutions face resource constraints (Eneanya, 2023).

These challenges can be overcome with strategic investments in ICT infrastructure and educator training. By building the necessary infrastructure and providing the tools educators need to use learning analytics

effectively, Nigerian higher institutions can unlock the full potential of this technology in entrepreneurship education. This would not only improve student learning outcomes but also enhance the overall quality of education (Banihashem et al., 2018). Thus, the integration of learning analytics into entrepreneurship education offers Nigerian higher institutions a powerful tool for improving student engagement, learning outcomes, and the overall effectiveness of entrepreneurial training. By providing data-driven insights into student learning behaviors and academic performance, learning analytics enables a more personalized and adaptive approach to education, making it more relevant to the modern economy's demands (West et al., 2016). As Nigeria continues to address its pressing unemployment challenges, entrepreneurship education, supported by learning analytics and ICT tools, will play a critical role in preparing students with the skills necessary for economic growth and innovation. To fully harness its potential, further research and investment in learning analytics are essential (Muhammad et al., 2019).

1.1. Purpose of study

This study aims to investigate the impact of learning analytics on academic performance in entrepreneurship education at a selected Nigerian university, specifically the study aims to: 1) assess learners' prior understanding of entrepreneurship education by analyzing various students' strengths and weaknesses, 2) investigate the effect does the learning analytics package has on the academic performance of students.

2. METHODS AND MATERIALS

2.1. Participants

The target population consisted of undergraduates from 15 faculties offering the entrepreneurship course (GSE 202) at the selected university. To ensure a representative sample, stratified random sampling was used. The population was divided into 15 strata based on faculty, and two students from each stratum were randomly selected to create a diverse and unbiased sample.

2.2. Research instruments

Two primary instruments were employed in this study: the Learning Analytical Package (LAP) and the GSE 202 test, administered both as a pre-test and post-test. The LAP, which is the edulastic application, tracked student interactions with course materials, including login duration, time spent on specific activities, participation, and assignment submission. These metrics allowed the researchers to gauge engagement and performance in an online learning environment. The GSE 202 test, consisting of 10 multiple-choice questions, was used to assess academic performance before and after exposure to the LAP, enabling a comparative analysis of student progress.

2.2.1. Validation and reliability of instruments

The research instruments were subjected to validation and reliability testing. The rating scale questionnaire was validated by three Educational Technology lecturers, while the LAP was reviewed by two Educational Technology lecturers and two data analysts. After adjustments, the LAP was pilot-tested on three students, yielding a high reliability index of 0.94, as determined by Kendall’s Coefficient of Concordance. The GSE 202 test was validated through the test-retest method, producing a Pearson correlation coefficient of 0.71, indicating acceptable reliability. Feedback from 10 lecturers and technologists further validated the study’s instruments, with Cronbach’s Alpha yielding reliability indices of 0.72 and 0.73.

2.3. Data collection procedure

Data collection spanned six weeks and was conducted by strict ethical guidelines to protect participant anonymity. An introductory letter from the Department of Educational Technology informed students about the research and secured voluntary participation. A pre-test was administered during the first week to assess baseline knowledge. In the second and third weeks, course content on entrepreneurial innovation was delivered through the Learning Management System (LMS). Week four introduced formative assessments and interactive tools to enhance engagement. In the fifth and sixth weeks, student performance and engagement

were analyzed using the LAP, and educational technology experts evaluated the LAP's effectiveness in the GSE 202 course. The instructional approach was based on the Diffusion of Innovation (DOI) model.

2.4. Ethical considerations

The study followed ethical standards, including obtaining informed consent, ensuring confidentiality, and safeguarding participant rights. The research adhered to multiculturalism and non-discrimination policies, and approval was secured from the institutional review board to ensure the protection of participants. Any conflicts of interest were addressed, and the study aimed to contribute positively to educational practices.

2.5. Data analysis technique

Data were analyzed using descriptive statistics such as mean scores, frequency counts, and percentages to answer research questions. Hypotheses were tested using ANOVA at a 0.05 significance level, with SPSS 25 software facilitating the analysis.

3. RESULTS

3.1. Demographic information

Table 1 below presents demographic information on GSE 202 students involved in the research study. Out of the 35 students sampled for this study (100%), 30 respondents (86%) completed both the research pretest and posttest. Two students were selected from each of the 15 faculties offering GSE 202 as a course in the study area and were exposed to the instructional package. The research study included a total population of 15 males (50%) and 15 females (50%).

Table 1:
Distribution of the students based on the faculties

Faculty	Number of Students Selected	Average Score for Pre-Test (%)	Average Score for Post-Test
Faculty of Management Science	2	50	79
Faculty of Arts	2	42	85
Faculty of Social Science	2	38	88
Faculty of Education	2	46	82
Faculty of Life Science	2	48	76
Faculty of Physical Science	2	36	89
Faculty of Engineering and Technology	2	52	83
Faculty of Law	2	40	80
Faculty of Communication and Information Science	2	54	87
Faculty of Agriculture	2	44	90
Faculty of Pharmaceutical Science	2	39	77
College of Health Sciences	2	49	81
Faculty of Environmental Science	2	41	84
Faculty of Veterinary Medicine	2	47	91
Total	**30**	**45%**	**83%**

Table 1 presents a detailed analysis of the pretest and posttest scores for each faculty involved in the study. Across the 15 faculties included, two students were selected from each, totaling 30 students overall. The pretest scores reflect the initial academic performance of students before exposure to the instructional package, while the posttest scores indicate their performance after receiving the intervention.

Faculty of Management Science started with an average pretest score of 50%, which notably increased to 79% in the posttest phase. The Faculty of Arts began with a pretest average of 42%, showing substantial improvement with a posttest average of 85%. The Faculty of Social Science recorded a pretest average of 38%, significantly improving to 88% post-intervention. The Faculty of Education started with a pretest average of 46%, achieving a posttest average of 82%. The Faculty of Life Science began at 48% in the pretest and showed a moderate increase to 76% in the posttest. Faculty of Physical Science started with a pretest average of 36%,

making a remarkable improvement to 89% in the posttest. The Faculty of Engineering and Technology began at 52% in the pretest, achieving an average of 83% in the posttest. The Faculty of Law started with a pretest average of 40%, achieving an average of 80% in the posttest. Faculty of Communication and Information Science started with an average pretest score of 54%, achieving an average posttest score of 87%. The Faculty of Agriculture began with a pretest average of 44%, achieving a posttest average of 90%. The Faculty of Pharmaceutical Science began at 39% in the pretest and showed a moderate increase to 77% in the posttest. The College of Health Sciences started with a pretest average of 49%, achieving an average posttest score of 81%. The Faculty of Environmental Science began at 41% in the pretest, achieving an average of 84% in the posttest. The Faculty of Veterinary Medicine started with a pretest average of 47%, achieving an average of 91% in the posttest. Overall, the results indicate varying levels of initial performance across faculties, with all showing significant improvement after the instructional intervention. The overall average pretest score across all faculties was 45%, and the posttest average was 83%, underscoring the effectiveness of the instructional package in enhancing students' academic understanding and performance across diverse academic disciplines.

3.2. Research Question 1: How can learners' prior understanding of entrepreneurship education be assessed by analyzing their strengths and weaknesses?

Figure 1

Bar chart analysis of pre-test question

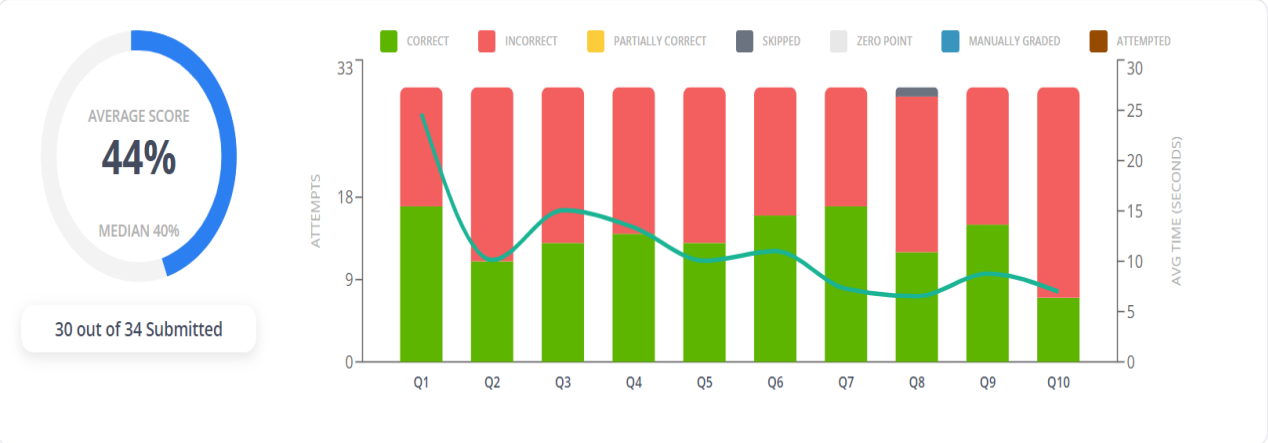


Table 2

Question analysis table

Question	Average Score	Performance	Average Time Spent (Seconds)
1. **What is the primary driving force of entrepreneurship in the contemporary global economy?**	50%		18
2. **Which economist is known for describing entrepreneurship as the ability to break away from routine and create marketable contributions to the economy?**	45%		12
3. **What is the common thread that runs through various definitions of entrepreneurship?**	55%		9
4. **Which of the following is NOT an essential characteristic of an entrepreneur according to the lecture notes?**	52%		10
5. **Why is a positive outlook important for entrepreneurs?**	48%		11
6. **What does the term "system-oriented" mean in the context of entrepreneurship**	49%		9
7. **What is the significance of diversity in fostering innovation in entrepreneurship?**	42%		8
8. **What is the key role of the incubation stage in the creative process?**	40%		7
9. **Why is the ability to adapt to market trends and emerging technologies crucial for entrepreneurs?**	44%		10

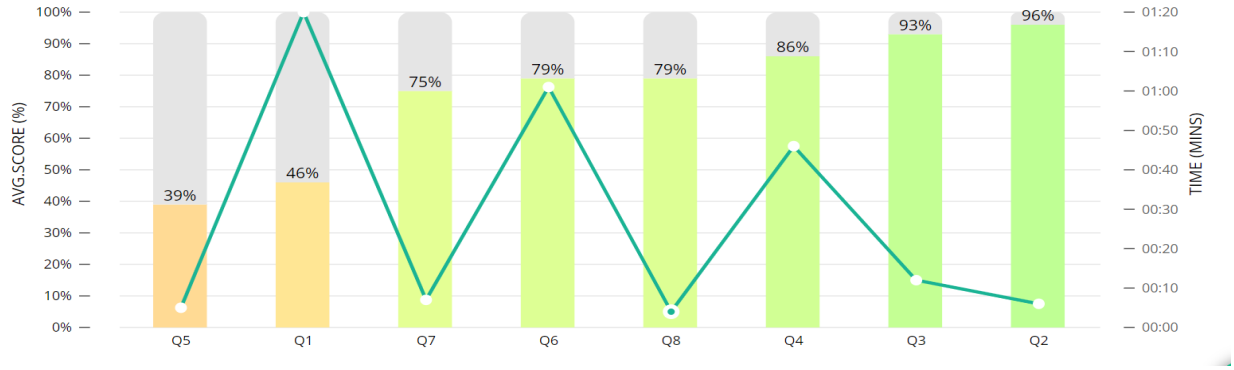
10.	**What is the primary goal of business model innovation in entrepreneurship?**	45%	11

The analysis of the pretest results highlighted that Question 3 was the easiest (Figure 1), with an average score of 55% and a short response time of 9 seconds, indicating student confidence (Table 2). Conversely, Questions 7 and 8 were the most challenging, with scores of 42% and 40% and minimal time spent (8 and 7 seconds), reflecting difficulty and lower confidence. Question 1, with a 50% score and 18 seconds of response time, showed moderate difficulty. The data suggest a correlation between question difficulty, time spent, and performance. Post-intervention, including lectures and instructional videos, aimed to address these challenges and improve scores. Formative results were collected and analyzed. Formative result was gathered at this stage and recorded as seen in Figure 2.

3.3. Research Question 2: What effect does the learning analytics package have on the academic performance of students?

Figure 2

Formative assessment bar chart



As seen in Figure 2, Question 5 (Q5) recorded the lowest average score of 39%, indicating that students found this question particularly difficult. Interestingly, it contrasts with Question 1 (Q1), which also had a relatively low average score of 46%, suggesting moderate difficulty, though slightly less challenging than Q5. On the other hand, Question 2 (Q2) stands out as the easiest, with the highest average score of 96%, followed closely by Question 3 (Q3) at 93%. This indicates that students found these questions the most straightforward, achieving high accuracy.

Questions 7 (Q7), 6 (Q6), and 8 (Q8) exhibit average scores around the 75-79% range, showing a moderate level of difficulty. However, the scores for Question 8 drop significantly to 79% despite being surrounded by higher scores, which could suggest an unexpected challenge within the context of this test. Interestingly, the time data shows that students spent the longest time on Question 5 and the least time on Question 2, correlating with the difficulty of Q5 and the ease of Q2. The line graph further visualizes the fluctuations in average scores across the questions, clearly depicting the rise and fall in students' performance relative to each question's difficulty. This chart effectively highlights formative assessment, showing an improvement in students' responses.

Figure 3

Bar chart analysis of post-test question

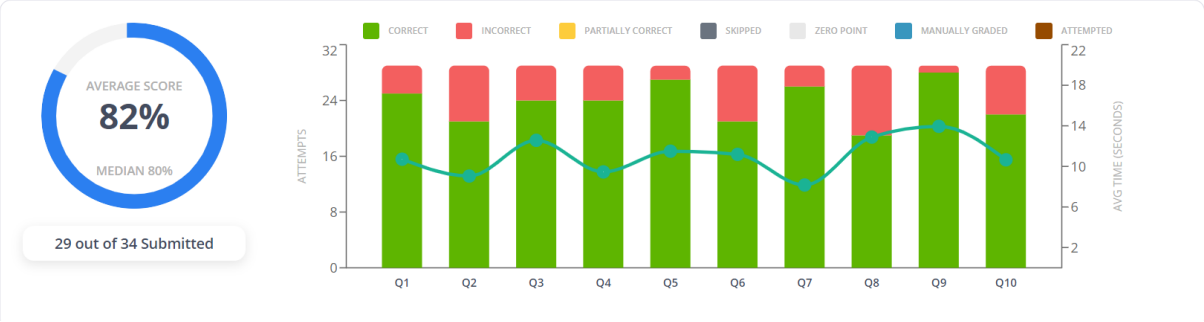


Table 3

Mean gain scores after the treatment

	Mean	S.D.	Mean Gain
Pre-test	45.00	4.82	38
Post-test	82.00	9.04	

The data, as shown in Figure 3 and Table 3, reveal a significant improvement in student performance post-intervention. The mean score rose from 45.00 in the pre-test to 82.00 in the post-test, indicating a 37-point gain. However, the standard deviation increased from 4.82 to 9.04, suggesting greater variability in scores among students. With 29 of 34 students completing the post-test, engagement was high. While most questions were answered correctly, some still posed challenges, and time management remained consistent. Overall, the intervention was effective in enhancing understanding but also highlighted areas needing further support.

3.4. Hypothesis testing

The following hypotheses were tested at a 0.05% level of significance

Ho_1: There is no significant effect of the learning analytics package on the academic performance of GSE 202 students based on faculty.

Table 4

ANOVA analysis of the significant effect of the learning analytics package on the academic performance based on the faculties

Source	Sum of Squares	Df	Mean Square	F	Sign.(2tailed)	Remark
Between Groups	10862.71	13	835.59	25.36	0.0000002	Ho_1 Rejected
Within Groups	461.25	14	32.95			
Total	11323.96	27				

Table 4 shows the ANOVA analysis of the significant effect of the learning analytics package on the academic performance of GSE 202 students based on faculty. F =25.36 , p=.000(p<0.05). Therefore, there is a significant effect of the learning analytics package on the academic performance based on the faculty. This shows that the significant value (.000) was less than the alpha value (0.05); therefore, by implication, the null hypothesis was rejected and the hypothesis was established as: there was a significant effect of the learning analytics package on the academic performance based on faculties.

4. DISCUSSION

The results of the present study align closely with findings in the existing literature regarding the integration of learning analytics into entrepreneurship education. Yatu et al. (2018) highlight the critical role of entrepreneurship education in addressing unemployment challenges in Nigeria, emphasizing the necessity of innovative approaches such as learning analytics to improve program effectiveness. The observed improvement in academic performance following the application of the Learning Analytical Package (LAP)

supports the assertions of Roberts et al. (2016), who report that learning analytics enable educators to make evidence-based adjustments to instructional strategies, leading to improved student outcomes.

The significant increase in post-test scores, from an average of 45% to 83%, reflects the results of Muhammad et al. (2019), who argue that ICT tools such as learning analytics enhance the learning process by offering real-time feedback and personalized learning pathways. Similarly, the findings corroborate the insights of Godsk et al. (2018), who observe that learning analytics facilitate a more student-centered pedagogical approach by enabling the identification of individual strengths and weaknesses. In the present study, the LAP revealed specific entrepreneurship concepts that posed difficulties for learners, which were subsequently addressed through targeted instructional interventions. This outcome is consistent with Ifenthaler (2017), who asserts that learning analytics supports timely feedback, allowing for focused support to students at risk of academic underperformance.

Challenges related to individualized learning processes, noted by Eze et al. (2018), were also evident, as reflected in the increased variability of post-test scores. Consistent with Banihashem et al. (2018), such variability underscores the need for continued investment in ICT infrastructure and educator capacity-building to maximize the potential of learning analytics in Nigerian higher education..

5. CONCLUSION

This study demonstrates the significant impact of integrating Learning Analytics Packages (LAP) into entrepreneurship education. The marked improvement in students' academic performance, with a mean gain of 37 points from pre-test to post-test, highlights the effectiveness of using data-driven tools to enhance learning outcomes. Learning analytics provided valuable insights into students' engagement, strengths, and weaknesses, enabling more personalized and adaptive teaching approaches. By tracking student behaviors and academic progress in real time, educators were able to tailor instructional methods to address gaps in understanding, ultimately leading to improved performance across all faculties.

However, challenges such as the variability in post-test scores suggest that while learning analytics is effective, its implementation requires careful consideration. As noted in the literature, issues like technical infrastructure, educator training, and the scalability of individualized learning approaches are still major barriers in Nigerian higher education.

Investment in information and communication technology (ICT) infrastructure is essential for the successful integration of learning analytics into Nigerian higher education. Universities should prioritize the development and deployment of robust Learning Management Systems (LMS) capable of processing large datasets. Such systems would facilitate comprehensive data collection and analysis, enabling the provision of real-time feedback and timely instructional interventions that can enhance student performance and engagement.

Educator training is equally critical to maximizing the benefits of learning analytics. Professional development programs should be implemented to equip educators with the necessary skills to interpret learning analytics data, design personalized teaching strategies, and apply ethical guidelines in the handling of student information. Strengthening educator capacity in these areas would ensure the effective and responsible use of learning analytics in diverse instructional contexts.

Further research is required to examine the long-term effects of learning analytics on student achievement, motivation, and engagement. Future studies should also investigate strategies for addressing the challenges associated with individualized learning within large-scale educational environments. Such research would contribute to the development of scalable and sustainable models for integrating learning analytics into higher education systems.

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Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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