

CONSTRAINTS TO EFFICIENT USE OF MACHINE LEARNING IN TEACHING BUSINESS EDUCATION COURSE CONTENT IN NIGERIAN UNIVERSITIES

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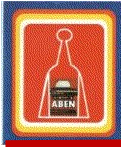
Abstract

*The study investigated the constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities. Three research questions guided the study, along with three corresponding null hypotheses tested at the 0.05 level of significance. A survey research design was adopted, and the study area comprised all the universities in Cross River State. The population consisted of 52 Business Education lecturers across the three universities in the state. Data were collected using a structured questionnaire titled **Constraints to Efficiently Using Machine Learning in Teaching Business Education Course Content (CEUMLTBECC)**, which contained 15 items validated by three experts. The reliability of the instrument was established using the Cronbach Alpha method, which yielded a coefficient of 0.93, indicating that the instrument was reliable for the study. The mean and standard deviation were used to answer the research questions, while an independent t-test was employed to test the null hypotheses at the 0.05 level of significance. The findings revealed that financial constraints, human resource and skills constraints, and institutional and administrative constraints significantly influence the efficient use of machine learning in teaching business education course content in Nigerian universities. Furthermore, there was no significant difference between the mean ratings of male and female Business Education lecturers regarding the identified constraints. Based on these findings, it was recommended, among other things, that institutions should explore partnerships with private technology firms and non-governmental organizations to secure financial resources and technical support. Such collaborations can help reduce the costs associated with adopting machine learning technologies through grants, donations, or subsidized access to technology.*

Key words: Constraints, Machine Learning, Teaching, Business Education, Course Content .

Introduction

The rapid advancement of technology in the 21st century has revolutionized multiple sectors, with education being among the most significantly impacted. Within this digital transformation, machine learning (ML)—a critical subset of artificial intelligence (AI)—has emerged as a powerful tool capable of transforming traditional teaching and learning processes. ML involves the use of algorithms and statistical models that enable computer systems to learn from data, recognize patterns, and make decisions with minimal human intervention. In education, this technology holds the potential to personalize learning experiences, predict student performance, automate administrative tasks, and provide data-driven insights for curriculum development (Baker & Inventado, 2014). By analyzing vast amounts of educational data, ML can identify students' strengths, weaknesses, and learning preferences, thereby enabling educators to design tailored instruction to meet diverse needs. Furthermore, ML facilitates adaptive learning systems, intelligent



tutoring, and innovative pedagogical strategies that enhance student engagement and outcomes (Chen, Huang & Hu, 2020).

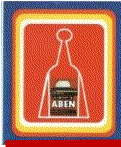
In business education, the application of machine learning can extend beyond instructional personalization to include curriculum innovation, student performance analysis, and efficiency in course delivery. For instance, adaptive platforms can customize learning paths for students in areas such as entrepreneurship, finance, and marketing, while predictive analytics can support early identification of students at risk of underperforming. Similarly, ML tools can help optimize resource allocation, improve assessment methods, and address systemic challenges such as overcrowded classrooms and inadequate staffing (Chen, Zou, Cheng & Xie, 2020). This aligns with the argument that business education must be continuously updated with digital competencies that prepare graduates for the evolving global workforce (Onwubuya, Amobi & Atah, 2025; Olom & Atah, 2025).

Despite its transformative potential, the integration of ML into teaching and learning in Nigeria remains limited. Several barriers hinder its widespread adoption, particularly in business education curricula. Financial limitations, inadequate digital infrastructure, insufficient technical expertise, and institutional resistance represent the most significant challenges (Ibrahim, 2018; Adewale & Oyewole, 2022). Moreover, issues related to data availability and management further complicate effective adoption. Since machine learning relies heavily on large, structured datasets, the absence of reliable and relevant educational data in Nigerian universities poses a critical obstacle (Oladokun, Adeoye & Salami, 2021). Recent studies underscore that digital-based reforms in higher education often struggle due to institutional rigidity and limited resources, reflecting a broader gap between potential and practice in ML adoption (Regina, Uju, Atah & Idike, 2024; Atah et al., 2023a).

One of the most pressing challenges is the digital divide. Many Nigerian universities—especially those in rural areas—lack access to reliable internet services, modern computing facilities, and adequate power supply (Eze, Chinedu-Eze & Bello, 2019). These infrastructural deficiencies reduce both students' and lecturers' ability to utilize ML technologies effectively. Furthermore, acquiring and maintaining ML systems, including both hardware and specialized software, often proves prohibitively expensive for institutions already struggling with underfunded budgets (Mbah, Nnadi, Nwachukwu & Onoh, 2017). This financial burden directly limits investment in sustainable digital infrastructures and the long-term integration of ML into curriculum delivery (Atah, Akeke, Ajuluchukwu, Aderibigbe, Wonah, Udayi, Nwannunu et al., 2023).

A second constraint lies in the shortage of human resources and technical skills. Integrating ML into education requires expertise in both pedagogy and data science, yet this dual skill set is scarce within the Nigerian university system (Adewale & Oyewole, 2022). Most business educators are not sufficiently trained in using ML tools, which restricts their capacity to incorporate them into teaching methodologies. This gap is worsened by the absence of professional development programs focused on AI and ML in higher education (Ibrahim, 2018). As highlighted in studies, limited training opportunities prevent educators from leveraging ML for content delivery, student assessment, and adaptive learning (Ingwe, Abang & Atah, 2025; Chukwurah, Ben, Atah, Wonah, Idike & Ingwe, 2023). Consequently, Nigerian universities risk lagging behind in producing graduates adequately equipped for a technology-driven business environment.

Beyond financial and human capacity issues, institutional and administrative barriers play a major role in restricting ML adoption. Many institutions demonstrate resistance to adopting new technologies due to concerns about cost implications, disruption of traditional teaching methods, and skepticism about the long-term effectiveness of ML tools (Otu, Ogala, Akputu & Atah, 2024). Institutional bureaucracy often slows decision-making processes, delaying the approval and implementation of digital reforms. Additionally, administrative attitudes that prioritize immediate



operational concerns over long-term innovation foster reluctance to invest in disruptive technologies (Akeke, Atah, Undie, Ajuluchukwu, Ikpi, Kolo, Eleng & Ben, 2023). This institutional inertia undermines efforts by individual educators who may wish to integrate ML in their teaching practices.

Ethical concerns and data privacy considerations add yet another layer of complexity. The use of student data to train machine learning models raises questions about privacy, consent, and potential misuse of personal information (Floridi, Taddeo & Turilli, 2020). Without robust policies and regulatory frameworks, institutions risk compromising student confidentiality. Moreover, inequities in access to ML resources can exacerbate existing social and educational inequalities, as only well-resourced institutions and students may benefit from its advantages (Alabi & Atah, 2024 ; Ochui, Idike & Atah, 2024; Akeke, Atah, Ushie & Ingwe, 2024).

Given these realities, this study examines the constraints hindering the efficient use of machine learning in teaching business education content in Nigerian universities. The constraints are broadly categorized into financial, human resource and skills, and institutional/administrative dimensions. Financial constraints involve the high cost of procuring and sustaining ML technologies. Human resource and skills constraints stem from the lack of technical expertise and inadequate training opportunities for educators. Institutional and administrative constraints arise from bureaucratic hurdles, resistance to change, and weak digital policies (Atah & Alabi, 2025; Uju, Asuo, Chukwurah & Atah, 2024). Understanding these challenges provides a foundation for developing strategies to overcome them and for promoting the efficient integration of ML into Nigerian business education curricula.

Ultimately, while machine learning holds the promise of transforming business education by offering personalized learning, predictive analytics, and adaptive instructional strategies, its successful integration in Nigeria requires targeted investment, capacity building, supportive policies, and ethical safeguards. By addressing these barriers, Nigerian universities can harness ML's transformative potential to produce future-ready graduates capable of navigating a dynamic, technology-driven global economy

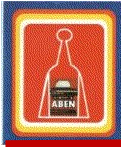
Statement of the Problem

The integration of machine learning (ML) in teaching business education courses in Nigerian universities holds great potential for improving teaching effectiveness and student outcomes. However, several significant constraints hinder its efficient use. First, many universities, especially in rural areas, lack adequate technological infrastructure, such as reliable internet connectivity and modern computer systems, necessary for implementing ML tools. Additionally, there is a shortage of skilled educators with both pedagogical and technical proficiency in machine learning, compounded by a lack of professional development opportunities. Financial limitations also pose a challenge, as the high cost of acquiring and maintaining ML technologies exceeds the budgets of many institutions. Furthermore, resistance to technological change among educators and administrators, coupled with concerns about disrupting traditional teaching methods, impedes the adoption of ML. Lastly, the unavailability of relevant, structured, and digitized student data limits the ability to develop accurate ML models tailored to business education. Addressing these constraints is critical to unlocking the full potential of machine learning in enhancing business education in Nigerian universities.

Research Questions

The study was guided by the following research questions:

1. What are the financial constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities?



2. What are the human resource and skills constraints to efficiently using machine learning in teaching business education course content in Nigerian universities?
3. What are the institutional and administrative constraints to efficiently using machine learning in teaching business education course content in Nigerian universities?

Research Hypotheses

Three null hypotheses were formulated to guide the study and tested at the 0.05 level of significance.

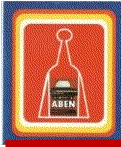
1. There is no significant difference in the mean responses of male and female business education lecturers on the financial constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.
2. A significant difference does not exist in the mean responses of male and female business education lecturers on human resources and skills constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities.
3. There is no significant difference in the mean responses of male and female business education lecturers to the institutional and administrative constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.

Methodology

The study adopted a survey research design. According to Ali (2018) and Nworgu (2015), a survey design is one in which a group of people or items is studied by collecting and analyzing data from only a fraction of the entire population, thereby making it possible to generalize findings to the whole group. This design was considered appropriate for the present study because it enabled the researcher to gather data directly from respondents on the constraints to efficiently using machine learning in teaching business education course content. The study area comprised all the universities in Cross River State, Nigeria, where Business Education is offered. The population consisted of 52 Business Education lecturers across the three universities in the state. The instrument for data collection was a structured questionnaire titled **Constraints to Efficiently Using Machine Learning in Teaching Business Education Course Content (CEUMLTBECC)**. The instrument contained 15 items developed by the researchers after a comprehensive review of relevant literature. To ensure validity, the draft instrument was subjected to review by three experts—two from Business Education and one from Educational Measurement and Evaluation in University of Calabar. Their corrections and suggestions were incorporated before the final version was produced. The reliability of the instrument was established through a pilot test using the Cronbach Alpha method, which yielded a coefficient of 0.93. This value falls within the acceptable reliability range suggested by Uzoagulu (2011), who stated that coefficients between 0.94 and 1.00 indicate high reliability. Hence, the instrument was adjudged suitable for the study. The questionnaire was structured on a four-point Likert scale, with response options of **Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1)**. This scale facilitated the quantification of responses for statistical analysis. For data collection, three trained research assistants helped in administering the questionnaire to the respondents. Out of the 52 copies distributed, all 52 were successfully retrieved, representing a 100% return rate.

The data collected were analyzed using weighted mean and standard deviation to answer the research questions, while an independent t-test was employed to test the null hypotheses at the 0.05 level of significance.

Decisions on the research questions were made using the lower and upper limits of the mean based on a four-point scale as follows:



- Strongly Agree (SA) 50-4.00
- Agree (A) 50 -3.49
- Disagree (D) 50 -2.49
- Strongly Disagree (SD) 50-1.49

The standard deviation was used to determine the homogeneity or otherwise of the opinions of the respondents. The independent t-test statistics of no significant difference were used to test the null hypotheses. The significant value (at 2-tail) was compared with the 05 level of significance at the appropriate degree of freedom. The null hypothesis was not rejected where the significant value was less than the 05 level of significance value at an appropriate degree of freedom; otherwise, the null hypothesis was rejected.

Results of the findings

The results of the study obtained were presented in Tables based on the research questions and hypotheses that guided the study.

Research Question 1

What are the financial constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities?

Table 1: Mean ratings and standard deviation of the financial constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities

Sl N	Items on Constraints	Male Lecturers N=38		Female Lecturers N=14		Overall		Decision
		\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	\bar{X}_G	SD _G	
1	High Cost of Technology Acquisition	3.94	0.51	3.71	0.67	3.82	0.51	Agree
2	Maintenance and Upgrades Costs	3.77	0.62	3.83	0.56	3.61	0.62	Agree
3	Limited Budget Allocation	3.84	0.61	3.62	0.62	3.71	0.61	Agree
4	Cost of Training and Development	3.72	0.55	3.74	0.63	3.58	0.76	Agree
5	Resource Constraints	3.81	0.67	3.63	0.75	3.85	0.55	Agree
Cluster Mean/SD		3.82	0.59	3.70	0.65	3.71	0.61	Agree

X = Mean; SD = Standard Deviation; N = Number of respondents

The analysis of the data presented in Table 1 above shows that the respondents agree with items 1–5, with a mean rating between 3.82 and 3.70, respectively. This means that the identified items are the financial constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities. The items have a cluster mean of 3.71 and a standard deviation of 0.61. The low level of standard deviation shows that the respondents are homogenous in their responses to the items as the financial constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities.

Research Question 2

What are the human resource and skills constraints to efficiently using machine learning in teaching business education course content in Nigerian universities?

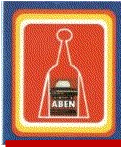


Table 2: Mean ratings and standard deviation of the respondents on the human resource and skills constraints to efficiently using machine learning in teaching business education course content in Nigerian universities

S/N	Items on Human Resource and Skills Constraints	Male lecturers N=38		Female lecturers N=14		Overall		Decision
		\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	\bar{X}_G	SD _G	
6	Shortage of Skilled Personnel	3.41	0.96	3.87	0.45	3.34	0.81	Agree
7	Insufficient Training Programs	3.43	0.71	3.76	0.55	3.57	0.62	Agree
8	Lack of Pedagogical Expertise	3.57	0.76	3.87	0.51	3.64	0.72	Agree
9	Difficulty in Recruiting Qualified Staff.	3.61	0.78	3.42	0.63	3.55	0.82	Agree
10	Limited Research and Development Capacity	3.71	0.70	3.78	0.42	3.73	0.64	Agree
Cluster Mean/SD		3.55	0.78	3.74	0.51	3.57	0.72	Agree

X = Mean; SD = Standard Deviation; N = Number of respondents

The analysis of the data presented in Table 2 above shows that the respondents agree with items 6–10, with a mean rating between 3.55 and 3.74, respectively. This means that the identified items are the human resource and skills constraints to efficiently using machine learning in teaching business education course content in Nigerian universities. The items have a cluster mean of 3.57 and a standard deviation of 0.72. The low level of standard deviation shows that the respondents are homogenous in their responses to the items as the human resource and skills constraints to efficiently using machine learning in teaching business education course content in Nigerian universities.

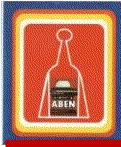
Research question 3

What are the institutional and administrative constraints to efficiently using machine learning in teaching business education course content in Nigerian universities?

Table 3: Mean ratings and standard deviation of the respondents on the institutional and administrative constraints to efficient use of machine learning in teaching business education course content in Nigerian universities

S/N	Items on Institutional and Administrative Constraints	Male lecturers N=38		Female lecturers N=14		Overall		Decision
		\bar{X}_1	SD ₁	\bar{X}_2	SD ₂	\bar{X}_G	SD _G	
11	Resistance to Technological Change	3.81	0.55	3.66	0.61	3.83	0.54	Agree
12	Bureaucratic Bottlenecks	3.63	0.61	3.77	0.55	3.61	0.60	Agree
13	Lack of Institutional Support	3.56	0.49	3.62	0.60	3.55	0.62	Agree
14	Inconsistent Policies	3.51	0.58	3.61	0.63	3.50	0.71	Agree
15	Fragmented Decision-Making	3.82	0.55	3.63	0.71	3.60	0.55	Agree
Cluster Mean/SD		3.67	0.55	3.66	0.62	3.61	0.60	Agree

The analysis of the data presented in Table 3 above shows that the respondents agree with items 11–15, with a mean rating between 3.67 and 3.62, respectively. This means that the identified items are the institutional and administrative constraints to efficiently using machine learning in teaching business education course content in Nigerian universities. The items have a



cluster mean of 3.61 and a standard deviation of 0.60. The low level of standard deviation shows that the respondents are homogenous in their responses to the items as the institutional and administrative constraints to efficiently using machine learning in teaching business education course content in Nigerian universities.

Hypothesis 1

There is no significant difference in the mean responses of male and female business education lecturers on the financial constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.

Table 4: Summary of t-test analysis of mean responses of male and female business education lecturers on the financial Constraints to Efficient Use of Machine Learning in Teaching Business Education Course Content in Nigerian Universities

Variables	N	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	Decision
Male	38	0.832	50	0.389	0.8511	.8421	NS
Female	14						

The result of t-test analysis in Table 4 shows that the t-value at 0.05 level of significant and 50 degree of freedom for the 5 items is 0.832 with a significant value of 0.389. Since the significant value of 0.0.389 is more than the 0.05 level of significance the null hypothesis is not significant. This means that there is no significant difference in the mean responses of male and female business education lecturers on the financial constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.

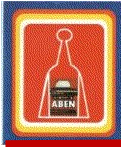
Hypothesis 2

A significant difference does not exist in the mean responses of male and female business education lecturers on human resources and skills constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities.

Table 5: Summary of t-test analysis of mean rating of male and female business education lecturers on Human Resource and Skills Constraints to Efficient Use of Machine Learning in Teaching Business Education Course Content in Nigerian Universities.

Variables	N	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	Decision
Male	38	1.324	50	0.523	0.762	0.80474	NS
Female	14						

The result of t-test analysis in Table 5 shows that the t-value at 0.05 level of significant and 70 degree of freedom for 10 items is 1.324 with a significant value of 0.762. Since the significant value of 0.762 is more than the 0.05 level of significant, the null hypothesis is not significant. This means that A significant difference does not exist in the mean responses of male and female



business education lecturers on human resources and skills constraints to the efficient use of machine learning in teaching business education course content in Nigerian universities.

Hypothesis 3

There is no significant difference in the mean responses of male and female business education lecturers to the institutional and administrative constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.

Table 6: Summary of t-test analysis of mean rating of male and female business education lecturers on the Institutional and Administrative Constraints to Efficient Use of Machine Learning in Teaching Business Education Course Content in Nigerian Universities.

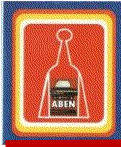
Variables	N	t	df	Sig. (2tailed)	Mean Difference	Std. Error Difference	Decision
Male	38	1.321	50	0.541	0.576	0.9821	NS
Female	14						

The result of t-test analysis in Table 6 shows that the t-value at 0.05 level of significant and 50 degree of freedom for 5 items is 1.321 with a significant value of 0.576. Since the significant value of 0.576 is more than the 0.05 level of significant, the null hypothesis is not significant. This means that There is no significant difference in the mean responses of male and female business education lecturers to the institutional and administrative constraints to efficient use of machine learning in teaching business education course content in Nigerian universities.

Discussion of Findings

The Findings on Financial Constraints to Efficient Use of Machine Learning in Teaching Business Education Course Content in Nigerian Universities

The findings of this study were discussed in relation to the research questions and null hypotheses that guided the investigation. In relation to financial constraints, the study revealed that numerous financial challenges hinder the efficient use of machine learning (ML) in teaching business education course content in Nigerian universities. Among the major constraints are inadequate funding for acquiring necessary ML infrastructure, high costs associated with maintenance and updates of ML systems, and the lack of investment in long-term technological development. These financial barriers limit the ability of educational institutions to adopt and utilize ML technologies effectively. The study aligns with the work of Muhammad, Asma, and Munnaza (2015), who identified financial difficulties as a major constraint to technology adoption in education. In particular, the high costs involved in integrating advanced educational technologies such as ML into the curriculum have left many institutions unable to meet the growing demands of the digital age. Similarly, Ezeilo and Mbah (2019) noted that financial limitations in the education sector often result in outdated technology infrastructure and lack of access to modern tools required for teaching and learning. This observation is consistent with the findings of this study, which indicated that the lack of financial investment prevents Nigerian universities from fully utilizing ML tools to enhance business education teaching. Further supporting these findings, Odigbo (2014) highlighted that the utilization of technology in education often depends on the institution's ability to fund not just the initial setup but also the ongoing maintenance of these systems. Without sufficient financial resources, educators are unable to procure the necessary software, hardware, and internet connectivity to integrate machine learning effectively.

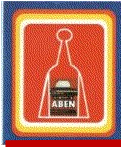


The findings of this study showed that financial constraints significantly influence the adoption and use of ML in teaching, thus limiting opportunities for students to engage in personalized learning experiences and real-time data analysis that machine learning affords. In terms of the null hypothesis related to financial constraints, the study revealed that there was no significant difference in the opinions of business education teachers regarding financial constraints across different gender groups. This indicates a consensus among educators, regardless of gender, that financial barriers are a key hindrance to the successful implementation of ML technologies in Nigerian universities. This finding suggests that financial challenges are pervasive and equally felt by all stakeholders in the educational system, reinforcing the urgency of addressing funding issues to facilitate the effective use of ML in teaching. The implication of these findings is that without adequate financial support, Nigerian universities will continue to struggle with adopting cutting-edge educational technologies like machine learning. Institutions need to prioritize funding for technological infrastructure and ongoing maintenance to keep pace with global educational trends. Additionally, alternative funding models, such as partnerships with technology companies or government interventions, may be necessary to alleviate these financial constraints and enable institutions to make significant progress in integrating ML into business education courses.

The Human Resource and Skills Constraints to Efficient Use of Machine Learning in Teaching Business Education Course Content in Nigerian Universities.

The findings regarding human resource and skills constraints in the efficient use of machine learning (ML) in teaching business education course content at Nigerian universities revealed significant barriers, primarily stemming from the lack of skilled personnel and expertise in machine learning and related technologies. Educators are often ill-equipped with the necessary technical knowledge and pedagogical skills to integrate ML effectively into the teaching process. This challenge echoes similar issues observed in the utilization of ICT in education. Human resource constraints, such as the limited availability of qualified teaching staff trained in machine learning, are a recurring theme. Many lecturers in business education lack the necessary background in artificial intelligence (AI), data science, and ML, hindering their ability to apply these advanced technologies in their teaching practices. This aligns with Onyebuchi (2015), who noted that inadequate training and support for teachers in utilizing technology severely impacts their ability to integrate ICT, and by extension, ML, into the classroom.

Additionally, the lack of continuous professional development opportunities further exacerbates the gap, preventing educators from staying updated with the latest advancements in ML. The respondents also highlighted poor recruitment practices, where unqualified staff members are employed, compounding the problem. This misalignment between the demand for skilled personnel and the available workforce limits the effectiveness of ML integration. The lack of adequate training and preparation programs for teachers, coupled with institutional inertia, results in a workforce unprepared to leverage machine learning tools to enhance teaching and learning. Moreover, the study confirmed that both male and female educators shared similar views on the constraints posed by human resource and skills shortages, as evidenced by the null hypothesis results. This uniformity in perception suggests a widespread recognition of the issue across gender lines, indicating that the problem is systemic rather than isolated to specific groups. The findings highlight the urgent need for capacity building and skill development among educators. To overcome these challenges, Nigerian universities must invest in comprehensive training programs and professional development initiatives, ensuring that educators are equipped with the necessary technical and pedagogical skills to effectively use ML in teaching. By addressing the human resource and skills constraints, universities can significantly enhance the integration of machine

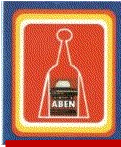


learning into business education, ultimately improving the quality of instruction and student outcomes.

The institutional and administrative constraints to efficient use of machine learning in teaching business education course content in Nigerian universities

The findings on institutional and administrative constraints to the efficient use of machine learning (ML) in teaching business education course content in Nigerian universities highlights significant barriers that impede the integration of advanced technologies in educational practices. These constraints, as identified by the study, include lack of administrative will, insufficient funding, inadequate policy frameworks, poor infrastructure, and mismanagement of resources. A major finding relates to the lack of administrative will and commitment to supporting the adoption of machine learning in teaching. Many universities do not prioritize the integration of AI and ML technologies into their curricula due to limited institutional leadership in technological advancements (Oladokun et al., 2021). This aligns with Onyebuchi (2015), who noted that the lack of strong administrative support often prevents institutions from implementing ICT effectively, and similar patterns are observed with ML technologies. Administrative hesitation may stem from concerns about the cost and the potential disruption of traditional teaching methods, as well as an unclear understanding of the benefits of ML in enhancing teaching and learning outcomes. Furthermore, insufficient funding is a critical institutional challenge. Machine learning technologies require significant financial investment for the procurement of modern hardware, software, and maintenance, which many Nigerian universities lack. Eze et al. (2019) pointed out that the financial limitations in Nigerian tertiary institutions make it difficult for them to invest in modern technology infrastructure, including high-speed internet, data storage, and ML systems. This lack of funding prevents institutions from acquiring the necessary tools to support effective ML use in education.

The findings also highlighted issues related to poor infrastructure. Many Nigerian universities lack the foundational ICT infrastructure, such as reliable internet connectivity and adequate computer systems, that ML systems require to function efficiently (Chen et al., 2020). This echoes findings from Ezeilo and Mbah (2019), who reported that poor infrastructure is one of the most significant barriers to ICT utilization in educational institutions. Without robust digital infrastructure, machine learning cannot be effectively deployed in teaching business education courses, leaving educators and students with limited access to these resources. Moreover, the mismanagement of institutional funds and resources exacerbates these constraints. Misallocation or inadequate supervision of budgetary allocations for technology investments leads to ineffective use of the resources that are available. This finding is consistent with Onyebuchi (2015), who argued that administrative mismanagement often results in the failure to maintain ICT facilities, a pattern that is likely mirrored in the use of ML technologies. Institutional policies and mandates for adopting ML in the curriculum are also often lacking. Institutions may not have clear policies in place to encourage or require the use of ML in teaching. According to Adewale and Oyewole (2022), the absence of institutional mandates regarding the integration of new technologies such as ML hampers innovation and prevents educators from fully utilizing these tools in their teaching practices. Without structured guidelines, educators may hesitate to incorporate ML due to uncertainties about its role in their teaching responsibilities. The study revealed no significant differences between the views of male and female educators regarding institutional and administrative constraints, which suggests a shared understanding of these barriers regardless of gender. This consensus points to the systemic nature of the problem, emphasizing that the constraints are widespread and universally recognized by educators. Conclusively, the institutional and administrative constraints to the efficient use of ML in teaching business education courses in



Nigerian universities are deeply entrenched. Addressing these challenges requires significant institutional reforms, including increased funding, stronger administrative support, and better resource management. Universities need to develop clear policies that encourage the integration of ML into their teaching practices and provide the necessary infrastructure and training to support this transition. By doing so, institutions can unlock the potential of machine learning to enhance the quality of business education and prepare students for the digital economy.

Conclusion

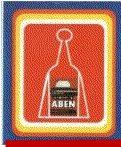
The evaluation of constraints to the efficient use of machine learning (ML) in teaching business education course content at Nigerian universities reveals several significant barriers that must be addressed to harness the full potential of this technology. The study highlights that financial constraints, such as the high costs associated with acquiring and maintaining ML technologies, pose a substantial challenge. Many institutions operate with limited budgets, which impedes their ability to invest in the necessary hardware, software, and professional development resources. Additionally, human resource and skills constraints further exacerbate the issue. There is a notable shortage of skilled personnel with expertise in machine learning and data science, coupled with insufficient training programs for educators, hindering the effective integration of ML tools into the curriculum.

Institutional and administrative constraints also play a crucial role in impeding the adoption of machine learning. Resistance to technological change among educators and administrators, along with bureaucratic hurdles, creates obstacles to implementing innovative teaching tools. This resistance is often rooted in a preference for traditional teaching methods and a lack of institutional support for new technologies. Moreover, bureaucratic bottlenecks slow down the approval and execution processes necessary for integrating ML into business education. Addressing these constraints requires a multifaceted approach. Financial support and investment in technological infrastructure must be prioritized, alongside the development of targeted training programs to equip educators with the necessary skills. Institutions must also foster a culture of innovation and openness to new technologies, streamlining administrative processes to facilitate the adoption of machine learning. By overcoming these barriers, Nigerian universities can enhance their teaching methods, improve student outcomes, and stay competitive in an increasingly digital and data-driven educational landscape. The integration of machine learning into business education has the potential to revolutionize how course content is delivered, making it more personalized and effective, ultimately contributing to the advancement of education in Nigeria.

Recommendations

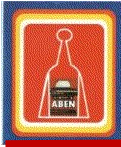
Based on the findings of this study, the following recommendations were made:

1. Institutions should explore partnerships with private technology firms and non-governmental organizations to secure financial resources and technical support. These partnerships can help reduce the costs associated with adopting machine learning technologies through grants, donations, or subsidized access to technology.
2. Institutions should invest in training programs to equip educators with the necessary skills and knowledge to integrate machine learning in teaching business education. This can be achieved through workshops, seminars, online courses, and collaborations with industry experts.
3. Administrative processes for approving and implementing new technologies should be streamlined. By reducing bureaucratic delays, universities can more quickly adopt machine learning tools and integrate them into teaching processes.

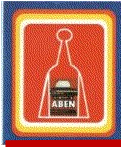


References

- Adewale, A., & Oyewole, A. (2022). Institutional policies on the adoption of ICT in Nigerian higher education. *Journal of Educational Technology*, 1(5), 1-11.
- Adewale, T., & Oyewole, O. (2022). Adoption of machine learning in education: Challenges and prospects in the Nigerian context. *Journal of Educational Technology*, 19(3), 112-128.
- Agor, R. A., Uju, N. O., Atah, C. A., & Idike, I. M. (2024). Digital-based learning and the sustainability of business education programmes among College of Education lecturers in Cross River State. *Journal of International Cooperation and Development*, 7(20), 67-78. doi:10.36941/jicd-2024-0008
- Akeke, M. N. G., Atah, C. A., Undie, S. P., Ajuluchukwu, N. E., Ikpi, I. O., Kolo, I., Eleng, E., & Ben, A. O. (2023). Electronic infrastructure and the sustainable development of business education programmes in the 21st Century. *Academic Journal of Interdisciplinary Studies*, 12(5), 321. doi:10.36941/ajis-2023-0147
- Akeke, M. N. G., Atah, C. A., Ushie, P. U., & Ingwe, M. O. (2024). Utilization of online tools and business education lecturers' job productivity in Cross River State. *Association Business Educators of Nigeria*, 11(2), 398-408.
- Alabi, E. B., & Atah, C. A. (2024). The role of artificial intelligence in enhancing content delivery in business education: A 21st-century approach. *Journal of Association of Vocational and Technical Educators of Nigeria (JAVTEN)*, 29(3), 267-277.
- Atah, C. A., & Alabi, E. B. (2024). Digital-based learning and the sustainability of office technology and management education (OTM) among tertiary institutions lecturers in Bayelsa State. *Journal of Business and African Economy*, 10(1), 73-83. doi:10.56201/jbae.v10.no1.jan.2024.pg73.83
- Atah, C. A., & Alabi, E. B. (2025). Assessing the preparedness of business education graduates for success in a digitally-driven economy in the 21st Century. *International Journal of Economics and Business Management*, 11(3), 267-277. doi:10.56201/ijebm.vol.11.no3.2025.pg267.277
- Atah, C. A., & Alabi, E. B. (2025). Virtual reality (VR) in office technology and management training for business education students in Nigeria. *International Journal of Education and Development*. University of Uyo.
- Atah, C. A., Akeke, M. N. G., Ajuluchukwu, E. N., Aderibigbe, S. A., Wonah, F. A., Udayi, E. A. O., Nwannunu, B., Olabisi, B. C., Anthony, G. B., Ititim, D. U., Godwin, B. U., Nnaji, E. S., Ben, A. O., & Ogbache, M. M. (2023). Digitalization of business education curriculum for the 21st Century for global relevance in Nigeria. *Journal of Innovation*, 74(5), 1457-1466. Retrieved from <https://journal-innovations.com/>
- Atah, C. A., Akeke, N. G. M., Ushie, G. B., Nwannunu, B. I., Anthony, G., Olabisi, B. C., Nnaji, E. S., Udayi, E. A. A. O., Wonah, F. A., Aderibigbe, S. A., Anthony, O. B., & Ajuluchukwu, E. N. (2023). Analysis of e-learning platform utilization and business education curriculum content delivery in River State Universities (RSU), Nigeria. *Journal of Innovation*, 74(5), 1476-1491. Retrieved from <https://journal-innovations.com/>
- Atah, C. A., Idike, I. M., Godwin, R. Y., Isaac, K., Ititim, D. U., Okpe, O. M., & Ochui, M. O. (2023). Modern e-technologies and academic staff job productivity in Nigerian Colleges of Education. *Mediterranean Journal of Social Sciences*, 14(4), 51-60. doi:10.36941/mjss-2023-0024
- Baker, R. S., & Inventado, P. S. (2014). Educational data mining and learning analytics. In J. A. Larusson & B. White (Eds.), *Learning analytics* (pp. 61-75). Springer.



- Bessong, E. B., Atah, C. A., & Ititim, D. U. (2022). Extent of ICT and office management among bursary staff in Universities in Cross River State. *Developing Economy Journal*, 1(8), 1-6. Retrieved from <https://cirdjournal.com/index.php/dej/issue/view/230>
- Chen, L., Huang, R., & Hu, Y. (2020). Infrastructure challenges in implementing ICT in education: Evidence from developing countries. *International Journal of Educational Research*, 1(3), 44-53.
- Chen, X., Zou, D., Cheng, G., & Xie, H. (2020). Trends and features of educational technology: A review of machine learning research in education. *British Journal of Educational Technology*, 51(2), 464-479.
- Chukwurah, M. U., Ben, A. O., Atah, C. A., Wonah, F. A., Idike, I. M., & Ingwe, M. O. (2023). Digital skills required for the sustainability of small-scale businesses in Nigeria. *Mediterranean Journal of Social Sciences*, 14(6), 67-77. doi:10.36941/mjss-2023-0037
- Eze, A. N., & Azu, N. O. (2017). Strategies considered effective for teaching job skills in tertiary institutions by business educators in Adamawa and Taraba States, Nigeria. *Journal of Technology and Vocational Education*, 2(1), 94-107.
- Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2019). Factors influencing the adoption of ICT for teaching and learning among business educators in higher educational institutions in Nigeria. *Education and Information Technologies*, 24(2), 1225-1246.
- Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2019). The adoption of ICT technologies in Nigerian universities: Challenges and prospects. *International Journal of Education Development*, 21(3), 24-43.
- Ezeilo, A. E., & Mbah, C. O. (2019). Teachers' perception on the availability and extent of utilization of e-learning facilities in teaching students in Orumba South L.G.A of Anambra State. *Multi-Disciplinary Journal of Academic Excellence*, 19(1), 98-111.
- Ezeilo, J., & Mbah, F. (2019). Barriers to ICT integration in Nigerian higher education institutions. *Journal of Information Technology Education*, 13(2), 8-21.
- Floridi, L., Taddeo, M., & Turilli, M. (2020). The ethics of artificial intelligence: Challenges and opportunities for the digital society. *AI & Society*, 35(2), 355-362.
- Ibrahim, J. (2018). Barriers to integrating machine learning in higher education: The case of Nigerian universities. *Nigerian Journal of Education and Technology*, 13(2), 89-98.
- Ingwe, M. O., Abang, M. B., & Atah, C. A. (2025). Leveraging virtual reality technology for innovative business education in Nigerian higher institutions. *KIU Journal of Education*, 5(1), 167-171.
- Mbah, C. O. (2012). *Technical competencies needed by mechanical students in technical colleges for employment in Enugu State* (Unpublished B.Sc. project report). Department of Technology and Vocational Education, Faculty of Education, ESUT.
- Mbah, C. O., & Umurhurhu, E. B. (2016). Improving the teaching learning of computer aided drafting and designing (CADD) for effective skill development in Nigerian tertiary institutions. *International Technology Research Journal (INTERJ)*, 4(1), 24-29.
- Mbah, C. O., Nnadi, K. J., Nwachukwu, C. C., & Onoh, C. E. (2017). Alternative funding strategies for repositioning technology education for sustainable skill development and economic development of South-East States of Nigeria. *Journal of Technology and Vocational Education*, 2(1), 177-189.
- Muhammad, T. A., Asma, S., & Munnaza, A. (2015). Teachers' perception and needs towards the use of e-learning in teaching of physics at secondary level in Pakistan. *American Journal of Educational Research*, 3(8), 1045-1051.
- Nwosu, B., Bessong, E. B., & Atah, C. A. (2022). Availability and utilization of Zoom technologies in teaching and learning of business education in tertiary institutions in Cross River State.



- Academic Journal of Current Research*, 9(10), 152-161. Retrieved from <https://cirdjournal.com/index.php/ajcr/article/view/956>
- Ochui, M. O., Idike, I. M., & Atah, C. A. (2024). Electronic learning and academic performance of business education students in University of Calabar. *Journal of Association Business Educators of Nigeria*, 11(1), 334-340.
- Okoye, K. R. E., & Okwelle, P. C. (2013). Technical and Vocational Education and Training (TVET) in Nigeria and energy development, marketing and national transformation. *Journal of Education and Practice*, 4(14), 134-138.
- Oladokun, T., Adedokun, O., & Adewusi, A. (2021). Financial barriers to the implementation of machine learning technologies in Nigerian universities. *Journal of Educational Management*, 17(4), 91-119.
- Oladokun, V., Adeoye, A., & Salami, J. (2021). The role of data in the effective adoption of AI in education: Lessons from Nigerian universities. *International Journal of AI in Education*, 27(1), 105-120.
- Olom, P., & Atah, C. A. (2025). Utilization of artificial intelligence on instructional preparation by business educators in Cross River State. *Mediterranean Journal of Social Sciences*, 16(1), 92-102. doi:10.36941/mjss-2025-0008
- Onwubuya, U. N., Amobi, C. M., & Atah, C. A. (2025). Integration of machine learning as correlate of Core Curriculum and Minimum Academic Standards (CCMAS) implementation for business education in South-East, Nigeria. *Journal of International Cooperation and Development*, 8(1), 29-38. doi:10.36941/jicd-2025-0003
- Onyebuchi, U. (2015). Administrative challenges in the utilization of ICT for teaching and learning in Nigerian universities. *African Journal of Educational Research*, 15(6), 198-211.
- Onyebuchi, V. C. (2015). *Challenges in the application of e-learning in teaching and learning among secondary schools in Nkanu West L.G.A of Enugu State* (Unpublished B.Sc. project report). Department of Science and Computer Education, ESUT.
- Otu, F. E., Ogala, C. S., Akputu, M. O., & Atah, C. A. (2024). Utilization of AI tools in the content delivery of CCMAS in Nigerian universities. *International Journal of Education and Evaluation*, 10(5), 367-378.
- Uju, O. N., Asuo, H. V., Chukwurah, M. U., & Atah, C. A. (2024). Adoption and utilization of digital skills for maximum productivity among university graduates in Nigeria. *World Journal of Innovation and Modern Technology*, 8(4), 96-107.