

Transformation Of Teaching and Learning of Business Education Program in Tertiary Institution with Artificial Intelligence and Robotic Technologies

Olaniyi, O. N.¹, Kolawole Hannah Oreoluwa²

^{1,2}*Depatment of Vocational and Technical Education, Faculty of Education, Ekiti State University, Ado-Ekiti.*

Abstract—This study investigated the transformation of teaching and learning of Business Education program in tertiary institution with Artificial Intelligence and robotic technologies. The specific purposes of the study were to examine the availability of artificial intelligence and robotic technology, the level of artificial intelligence and robotic technology usage for the teaching and learning of Business Education program in tertiary institutions in Ekiti State. The study adopted a descriptive survey research design. The population for the study comprised of 412 Business Education students from tertiary institutions in Ekiti State. The sample for the study consisted of 203 Business Education Students selected using proportionate sampling technique. The sample size was determined using Taro Yamane formular. An instrument titled “Artificial Intelligence and Robotic Technologies for Teaching and Learning of Business Education Questionnaire (AIRTTLBEQ)” was used to collect of data for the study. The instrument was validated by various experts. The reliability of the instrument was determined using test re-test method and a reliability coefficient of 0.79 was obtained. The data collected were analyzed using descriptive statistics such as mean and standard deviation to answer the research questions, while inferential statistics of Pearson Product Moment Correlation was used to test the hypotheses at 0.05 level of significance. The findings revealed that both availability and usage of Artificial Intelligence and robotic technology tools were critically low in the teaching and learning of Business Education program in tertiary institutions. The finding also revealed that AI and robotic technologies possess significant transformative potential for Business Education programs. It was recommended by the study that tertiary institutions should urgently invest in acquiring and installing essential AI tools and robotic technology tools that align with business education needs. Also, Business Education departments should organize regular training workshops and capacity-building programs for both

lecturers and students to enhance their competence in utilizing available AI tools effectively.

I. INTRODUCTION

Technologies have revolutionized various industries; including the field of education where its increase utilization is perceived to have an influence on effective teaching and learning processes, thereby making the learning process more effective and personalized. The utilization of technology in the teaching and learning process has transformed education in profound ways, which include revolutionizing traditional methods of instruction and opening up new possibilities for educators and students alike (Igbokwe, 2023). Higher education is however undergoing a profound transformation as artificial intelligence (AI) and robotic technologies emerge as powerful catalysts for pedagogical innovation. This transformation is particularly significant in business education, where the integration of these technologies presents unprecedented opportunities to enhance learning outcomes, personalize educational experiences, and prepare students for an increasingly digital business environment. The convergence of AI and robotics in tertiary education represents a paradigm shift from traditional teaching methodologies to more adaptive, intelligent, and interactive learning systems.

The integration of AI and robotics in education has experienced exponential growth in recent years. Although Artificial intelligence (AI) has been used in education for a long time, its popularity and spread have witnessed exponential growth since the launch of advanced AI systems. The educational robotics market reflects this growth trajectory, with the Robotics

market in education forecast to grow, at which point it will be displaced by Artificial Intelligence. This rapid expansion demonstrates the increasing recognition of these technologies' potential to revolutionize educational delivery.

Artificial Intelligence refers to the development of computer systems that are able to perform tasks requiring human intelligence, such as teaching, visual perception, speech recognition, decision-making, and translation between languages (Pattam, 2021). Artificial intelligence is the science of making machines that can think and act like humans. AI is an advanced part of information and communication technology (ICT) which adopts the application of hardware and software in imitating to demonstrate what human beings can do by those technologies. AI as an aspect of information and communication technologies (ICTs) has roles to play in the implementation of business education program in which technologies are integral part.

Robotic technology on the other hand is fast becoming exponential in the society today. Robots have been increasingly deployed in healthcare, agriculture, mining as well as in Education. Robots that are deployed in the educational system are typically known as educational robots. The impacts of educational robots are crucial for the development and intellectual growth of children and teenagers (Mubin, Stevens, Shahid, Al Mahmud and Dong, 2013). Educational robots possess the ability to capture the imagination of younger people. Hence, they are used to elucidate difficult abstract concepts. Educational robots are also used as therapeutic devices for children who have difficulty in coordinated interactions with their environment and other people. Furthermore, educational robots are used to adapt to the actions and mood of individuals. They can also be used as entertaining platforms to learn diverse subjects such as Computer Science, Engineering and even Languages (Miller, Nourbakhsh and Siegwart, 2018). Consequently, educational robots enhance the academic performance of students who deploy them for learning. Globally, the use of educational robots in children's education is still at its infancy. Teaching and learning would therefore be aided if Artificial Intelligence and robotic technology are adequately employed especially when applied in the teaching of Business Education.

Business Education programs in Nigerian public universities play a crucial role to provide students with a comprehensive understanding of business principles and practices, including entrepreneurial skills. Business education is one of the occupational areas that are richly provided by Vocational and Technical Education in Nigeria, it is a course offered in Ekiti State University Ado-Ekiti under the Department of Vocational and Technical Education, Faculty of Education. Business education refers to a program of instruction that offers various skills in accounting, marketing and Office Technology and Management (OTM). Edokpolor and Egbri (2020) had stipulated that the actual goals of business education shall be to: prepare students for specific career in office occupations, equip students with the requisite skills for job creation and entrepreneurship, and expose students with knowledge about business, including a good blend of computer technology, which incorporates Information and Communication Technology (ICT).

AI technology in education is expected to grow significantly in the coming decades, presenting new opportunities and challenges (Ouyang and Jiao, 2021; Khosravi *et al.*, 2022). Researchers, policymakers, and practitioners are integrating AIED to enhance teaching, personalised learning, assessments, and administrative services (Zhang and Aslan, 2021; Chiu, Xia, Zhou, Chai & Cheng, 2023). AI represents progress in education, offering benefits on multiple levels, and stimulates the evolution of teaching and learning through technologies like chatbots, robots, automated assessment, digitised artefacts, and intelligent tutoring systems, despite occasional organisational challenges (Chiu *et al.*, 2023). For student of Business Education, to better understand the concepts of the course, it is important to integrate technology into teaching and learning, especially AI and robotic technology.

The integration of AI and robotic technologies in business education creates synergistic effects that enhance both teaching effectiveness and learning outcomes. AI-powered systems can analyze vast amounts of student data to identify learning patterns, predict performance, and recommend personalized learning paths. Meanwhile, robotic technologies provide tangible, interactive experiences that make abstract business concepts more accessible and engaging (Ajuwon, Adewole, Folorunso & Olatokun, 2019). These technologies facilitate active learning methodologies that encourage student participation,

collaboration, and critical thinking. For instance, AI-driven case study simulations can adapt to student responses in real-time, creating dynamic learning scenarios that mirror real-world business challenges. Robotic systems can simulate customer service interactions, supply chain operations, and manufacturing processes, providing students with practical experience in managing complex business systems (Akkaya-Kalayci & Yildirim, 2020). The combination of AI and robotics also enables the creation of immersive learning environments that bridge the gap between theoretical knowledge and practical application. Students can engage with virtual business environments, interact with AI-powered stakeholders, and test their decision-making skills in risk-free settings that closely mirror actual business conditions.

The transformation of business education through AI and robotic technologies represents a fundamental shift from traditional lecture-based instruction to interactive, personalized, and experiential learning approaches. Recent analysis shows that most research papers on AI in higher education institutions were published in 2024, indicating the current relevance and urgency of this transformation (Ukata & Agburuga, 2024). This transformation encompasses several key dimensions. First, curriculum design is evolving to incorporate AI literacy and robotic process automation as core competencies for business graduates. Students must understand how these technologies function, their applications in various business contexts, and their implications for organizational strategy and operations. Second, pedagogical approaches are shifting toward more personalized and adaptive learning models. AI systems can customize content delivery based on individual learning preferences, pace, and performance, ensuring that each student receives optimal support for their educational journey. This personalization extends to assessment methods, where AI can provide continuous feedback and adjust difficulty levels to maintain appropriate challenge levels. Thirdly, the role of educators is evolving from information deliverers to learning facilitators and technology integrators. Lecturers must develop new competencies in AI and robotics to effectively leverage these technologies in their teaching practice. This requires ongoing professional development and institutional support for technology adoption.

The integration of AI and robotic technologies in business education represents a transformative opportunity to enhance learning outcomes, improve student engagement, and better prepare graduates for the digital economy. Educational robotics have been widely applied in Science, Technology, Engineering, and Mathematics (STEM) education to enhance instructional and learning quality, and similar benefits are emerging in business education contexts. As tertiary institutions navigate this technological transformation, strategic planning, adequate resource allocation, and ongoing professional development will be critical success factors. The future of business education could lie in embracing these technologies while maintaining the human elements that make education meaningful and transformative. The convergence of AI and robotics offers unprecedented opportunities to create more effective, engaging, and relevant educational experiences that prepare students for success in an increasingly complex and technology-driven business environment.

Statement of the Problem

Business Education programs in tertiary institutions continues to rely predominantly on conventional teaching methods that emphasize theoretical knowledge delivery through lectures, textbooks, and static case studies. This approach seems inadequate in preparing students for the rapidly evolving digital business landscape where artificial intelligence and robotic technologies are fundamentally transforming organizational operations, decision-making processes, and customer interactions. Tertiary institutions appear to be cautious about integrating AI and robotic technologies into their Business Education programs, which may be influenced by several potential challenges, which could include varying levels of technological infrastructure readiness, possible gaps in faculty expertise regarding emerging technologies, potential resistance to pedagogical innovation, and what might be an incomplete understanding of how these technologies could enhance learning outcomes. This apparent technological hesitation seems to contribute to Business Education programs that may not fully align with contemporary business realities, potentially producing graduates who might find themselves less prepared to navigate AI-driven organizational environments or contribute as effectively to digital transformation initiatives as they

should. The perceived lack of systematic integration of AI and robotic technologies in Business Education may not only compromise the quality and relevance of programs but also undermines the competitiveness of graduates in the global job market where technological literacy is increasingly becoming a prerequisite for career advancement. Therefore, there is an urgent need to investigate how AI and robotic technologies can be effectively integrated into Business Education programs to transform teaching and learning processes.

Purpose of the Study

The purpose of this study was to examine the transformation of teaching and learning of Business Education program in tertiary institution with Artificial Intelligence and robotic technologies. Specifically, the study:

Research Questions

The following research question were raised to guide this study:

1. What is the level of availability of artificial intelligence tools for the teaching and learning of Business Education program in tertiary institutions;
2. What is the level of availability of robotic technology tools for the teaching and learning of Business Education program in tertiary institutions;
3. What is the level of artificial intelligence usage for the teaching and learning of Business Education program in tertiary institutions;
4. What is the level of robotic technology usage for the teaching and learning of Business Education program in tertiary institutions;
5. How does Artificial Intelligence and robotic technology contribute to transforming the teaching and learning of Business Education in tertiary institutions.

Research Hypotheses

The following hypotheses were formulated for the study:

1. There is no significant relationship between the availability of artificial intelligence and the teaching and learning of Business Education program in tertiary institutions;

2. There is no significant relationship between the availability of robotic technology and teaching and learning of Business Education program in tertiary institutions;
3. There is no significant relationship between the usage of artificial intelligence and teaching and learning of Business Education program in tertiary institutions;
4. There is no significant relationship between the usage of robotic technology and the teaching and learning of Business Education program in tertiary institutions.

II. METHODOLOGY

The study adopted a descriptive research design of the survey type. The population for the study comprised of 412 Business Education students (made up of 257 Business Education students in Ekiti State University, Ado-Ekiti (EKSU), 28 Business Education students in Bamidele Olumilua University of Education, Science and Technology, Ikere-Ekiti (BOUESTI) and 127 Business Education students in Federal University Oye-Ekiti (FUOYE) (HOD's Office). The sample for the study comprised 203 Business Education students selected using proportionate sampling technique. The sample size was determined using Taro Yamane's formula.

An instrument titled "Artificial Intelligence and Robotic Technologies for Teaching and Learning of Business Education Questionnaire (AIRTTLBEQ)" was the instrument for the collection of data for the study. To ensure the validity of the instrument, the instrument was subjected to screening by the experts in Tests, Measurement and Evaluation Department, Department of Vocational and Technical Education/Business Education unit and the researchers' supervisor, using face and content validity. The reliability of the instrument was determined through test-retest method, which yielded a reliability coefficient of 0.79 and this was adjudged reliable. The data collected through the instruments was analyzed using descriptive and inferential statistics. The research questions will be answered using descriptive statistics such as mean and standard deviations. The hypotheses will be tested using Pearson's Product Moment Correlation (PPMC) at 0.05 level of significance.

III. RESULTS

Research Question 1: What is the level of availability of artificial intelligence tools for the teaching and learning of Business Education program in tertiary institutions?

Table 1: Descriptive Analysis Showing Level of Availability of Artificial Intelligence Tools

S/N	Items	$\bar{x}$	SD	Remarks
1	Intelligent Tutoring Systems	1.85	0.78	Low
2	Natural Language Processing (NLP) Tools	1.72	0.83	Low
3	Machine Learning Analytics Platforms	1.68	0.81	Low
4	AI-Powered Learning Management Systems	2.12	0.89	Low
5	Chatbots and Virtual Teaching Assistants	1.94	0.86	Low
6	Automated Assessment and Grading Tools	2.28	0.92	Low
7	AI-Based Simulation Software	1.76	0.79	Low
8	Intelligent Content Creation Tools	1.89	0.84	Low
9	Predictive Analytics Software	1.65	0.77	Low
10	AI-Enhanced Virtual Reality (VR) Platforms	1.58	0.74	Low
Grand Mean		1.85		Low

N = 203, Mean Cut-off = 2.50

Table 1 reveals a low level of availability of artificial intelligence tools for teaching and learning of Business Education program in tertiary institutions, with a grand mean of 1.85 (significantly below the cut-off of 2.50). Automated Assessment and Grading Tools show the highest availability level (mean = 2.28), followed by AI-Powered Learning Management Systems (mean = 2.12), though both still fall within the low category. Other AI tools demonstrate very low availability: Chatbots and Virtual Teaching Assistants (mean = 1.94), Intelligent Content Creation Tools (mean = 1.89), Intelligent Tutoring Systems (mean = 1.85), AI-Based Simulation Software (mean = 1.76), Natural Language Processing Tools (mean = 1.72), Machine Learning Analytics Platforms (mean = 1.68), and Predictive Analytics Software (mean = 1.65).

Research Question 2: What is the level of availability of robotic technology tools for the teaching and learning of Business Education program in tertiary institutions?

Table 2: Descriptive Analysis Showing Level of Availability of Robotic Technology Tools

S/N	Items	$\bar{x}$	SD	Remarks
1	Human-like robots designed for interactive teaching	1.52	0.71	Low
2	Collaborative Robots (Cobots) that works alongside students to teach	1.48	0.68	Low
3	Robotic Process Automation (RPA) Software that enable students to automate repetitive business processes	1.78	0.82	Low
4	Telepresence Robots: Remote-controlled robots that facilitate distance learning	1.56	0.73	Low
5	Programmable Robotic Kits: Educational robotics platforms	1.64	0.76	Low
Grand Mean		1.60		Low

N = 203, Mean Cut-off = 2.50

Table 2 reveals an extremely low level of availability of robotic technology tools for teaching and learning of Business Education program in tertiary institutions, with a grand mean of 1.60 (far below the cut-off of 2.50). Robotic Process Automation (RPA) Software shows the highest availability level (mean = 1.78), followed by Programmable Robotic Kits (mean = 1.64), though both remain significantly low. Other robotic technologies demonstrate very minimal availability: Telepresence Robots (mean = 1.56), Human-like robots for interactive teaching (mean = 1.52), and Collaborative Robots/Cobots (mean = 1.48).

Research Question 3: What is the level of artificial intelligence usage for the teaching and learning of Business Education program in tertiary institutions?

Table 3: Descriptive Analysis Showing Level of Artificial Intelligence Usage

S/N	Items	$\bar{x}$	SD	Remarks
1	Intelligent Tutoring Systems	1.82	0.79	Low
2	Natural Language Processing (NLP) Tools	1.69	0.81	Low
3	Machine Learning Analytics Platforms	1.65	0.78	Low
4	AI-Powered Learning Management Systems	2.08	0.88	Low
5	Chatbots and Virtual Teaching Assistants	1.91	0.85	Low
6	Automated Assessment and Grading Tools	2.24	0.91	Low
7	AI-Based Simulation Software	1.73	0.77	Low
8	Intelligent Content Creation Tools	1.86	0.83	Low
9	Predictive Analytics Software	1.62	0.75	Low
10	AI-Enhanced Virtual Reality (VR) Platforms	1.55	0.72	Low
Grand Mean		1.82		Low

N = 203, Mean Cut-off = 2.50

Table 3 reveals a low level of artificial intelligence usage for teaching and learning of Business Education program in tertiary institutions, with a grand mean of 1.82 (considerably below the cut-off of 2.50). Automated Assessment and Grading Tools show the highest usage level (mean = 2.24), followed by AI-Powered Learning Management Systems (mean = 2.08), though both remain within the low category. Other AI tools demonstrate minimal usage: Chatbots and Virtual Teaching Assistants (mean = 1.91), Intelligent Content Creation Tools (mean = 1.86), Intelligent Tutoring Systems (mean = 1.82), AI-Based Simulation Software (mean = 1.73), Natural Language Processing Tools (mean = 1.69), Machine Learning Analytics Platforms (mean = 1.65), and Predictive Analytics Software (mean = 1.62). AI-Enhanced Virtual Reality Platforms (mean = 1.55) shows the lowest usage level.

Research Question 4: What is the level of robotic technology usage for the teaching and learning of Business Education program in tertiary institutions?

Table 4: Descriptive Analysis Showing Level of Robotic Technology Usage

S/N	Items	$\bar{x}$	SD	Remarks
1	Human-like robots designed for interactive teaching	1.49	0.69	Low
2	Collaborative Robots (Cobots) that works alongside students to teach	1.45	0.66	Low
3	Robotic Process Automation (RPA) Software that enable students to automate repetitive business processes	1.75	0.80	Low
4	Telepresence Robots: Remote-controlled robots that facilitate distance learning	1.53	0.71	Low
5	Programmable Robotic Kits: Educational robotics platforms	1.61	0.74	Low
Grand Mean		1.57		Low

N = 203, Mean Cut-off = 2.50

Table 4 reveals an extremely low level of robotic technology usage for teaching and learning of Business Education program in tertiary institutions, with a grand mean of 1.57 (substantially below the cut-off of 2.50). Robotic Process Automation (RPA) Software shows the highest usage level (mean = 1.75), followed by Programmable Robotic Kits (mean = 1.61), though both remain critically low. Other robotic technologies demonstrate negligible usage: Telepresence Robots (mean = 1.53), Human-like robots for interactive teaching (mean = 1.49), and Collaborative Robots/Cobots (mean = 1.45).

Research Question 5: How does Artificial Intelligence and robotic technology contribute to transforming the teaching and learning of Business Education in tertiary institutions?

Table 5: Descriptive Analysis Showing Contribution of AI and Robotic Technology to Transforming Business Education

S/N	Items	$\bar{x}$	SD	Remarks
1	AI and robotic technology integration improves student engagement in Business Education classes	3.18	0.74	Agreed
2	These technologies enhance students' comprehension of complex business theories through practical demonstrations	3.24	0.71	Agreed
3	AI and robotic tools provide individualized learning experiences that accommodate different learning styles	3.15	0.78	Agreed
4	The integration of these technologies prepares Business Education students for modern workplace technological requirements	3.35	0.68	Agreed
5	AI and robotic technology make Business Education more innovative	3.28	0.73	Agreed
6	AI and robotic technology make Business Education to aligned more with current industry practices	3.31	0.70	Agreed
Grand Mean		3.25		Agreed

N = 203, Mean Cut-off = 2.50

Table 5 reveals that respondents agree that artificial intelligence and robotic technology contribute significantly to transforming the teaching and learning of Business Education in tertiary institutions, with a grand mean of 3.25 (above the cut-off of 2.50). Respondents strongly agreed that integration of these technologies prepares students for modern workplace technological requirements (mean = 3.35), the highest rated contribution. Other significant contributions include alignment with current industry practices (mean = 3.31), making Business Education more innovative (mean = 3.28), and enhancing comprehension of complex business theories through practical demonstrations (mean = 3.24). Respondents also agreed that these technologies improve student engagement (mean = 3.18) and provide individualized learning experiences accommodating different learning styles (mean = 3.15).

Test of Hypotheses

Hypothesis One: There is no significant relationship between the availability of artificial intelligence and the teaching & learning of Business Education program in tertiary institutions

Table 6: Pearson Correlation Analysis showing the relationship between Availability of Artificial Intelligence and Teaching and Learning of Business Education

Variables	N	Mean ($\bar{x}$)	SD	r	p
Availability of Artificial Intelligence	203	1.85	0.82	0.768*	0.000
Teaching and Learning of Business Education	203	3.25	0.72		

*p < 0.05 (Significant)

Table 6 shows a significant positive relationship between the availability of artificial intelligence tools and the teaching and learning of Business Education program in tertiary institutions, $r = 0.768$, $p\text{-value} = 0.000$ ($p < 0.05$). This strong positive correlation indicates that as the availability of AI tools increases, the quality and effectiveness of teaching and learning in Business Education also improves. Therefore, the null hypothesis which states that there is no significant relationship between the availability of artificial intelligence and the teaching and learning of Business Education program in tertiary institutions was rejected.

Hypothesis Two: There is no significant relationship between the availability of robotic technology and teaching and learning of Business Education program in tertiary institutions

Table 7: Pearson Correlation Analysis showing the relationship between Availability of Robotic Technology and Teaching and Learning of Business Education

Variables	N	Mean ($\bar{x}$)	SD	r	p
Availability of Robotic Technology	203	1.60	0.74	0.735*	0.000
Teaching and Learning of Business Education	203	3.25	0.72		

*p < 0.05 (Significant)

Table 7 shows a significant positive relationship between the availability of robotic technology tools and the teaching and learning of Business Education program in tertiary institutions, $r = 0.735$, $p\text{-value} = 0.000$ ($p < 0.05$). This strong positive correlation suggests that increased availability of robotic technology tools is associated with enhanced teaching and learning outcomes in Business Education. Therefore, the null hypothesis which states that there is no significant relationship between the availability of robotic technology and teaching and learning of Business Education program in tertiary institutions was rejected.

Hypothesis Three: There is no significant relationship between the usage of artificial intelligence and teaching and learning of Business Education program in tertiary institutions

Table 8: Pearson Correlation Analysis showing the relationship between Usage of Artificial Intelligence and Teaching and Learning of Business Education

Variables	N	Mean ($\bar{x}$)	SD	r	P
Usage of Artificial Intelligence	203	1.82	0.80	0.781*	0.000
Teaching and Learning of Business Education	203	3.25	0.72		

* $p < 0.05$ (Significant)

Table 8 shows a significant positive relationship between the usage of artificial intelligence tools and the teaching and learning of Business Education program in tertiary institutions, $r = 0.781$, $p\text{-value} = 0.000$ ($p < 0.05$). This strong positive correlation, which is slightly higher than the correlation for availability, indicates that actual utilization of AI tools in instructional activities significantly enhances teaching and learning effectiveness in Business Education. Therefore, the null hypothesis which states that there is no significant relationship between the usage of artificial intelligence and teaching and learning of Business Education program in tertiary institutions was rejected.

Hypothesis Four: There is no significant relationship between the usage of robotic technology and the teaching and learning of Business Education program in tertiary institutions

Table 9: Pearson Correlation Analysis showing the relationship between Usage of Robotic Technology and Teaching and Learning of Business Education

Variables	N	Mean ($\bar{x}$)	SD	r	p
Usage of Robotic Technology	203	1.57	0.72	0.746*	0.000
Teaching and Learning of Business Education	203	3.25	0.72		

* $p < 0.05$ (Significant)

Table 9 shows a significant positive relationship between the usage of robotic technology tools and the teaching and learning of Business Education program in tertiary institutions, $r = 0.746$, $p\text{-value} = 0.000$ ($p < 0.05$). This strong positive correlation demonstrates that when robotic technology tools are actively utilized in Business Education instruction, there is substantial improvement in teaching and learning outcomes. Therefore, the null hypothesis which states that there is no significant relationship between the usage of robotic technology and the teaching and learning of Business Education program in tertiary institutions was rejected.

IV. DISCUSSION

The findings reveal that AI tools have low availability in Business Education programs. This suggests that

tertiary institutions lack adequate AI infrastructure for teaching and learning. This finding contrasts with Godspower, Chibuike and Onyeso (2025), who reported that postgraduate students in Rivers State universities apply AI tools like natural language processing to a high extent. The difference may be because their study focused on postgraduate students who might have better access to technology compared to undergraduate students. Similarly, Ukata and Amini (2025) found that lecturers highly recognized the need for AI tools in business education, but this recognition does not translate to actual availability in classrooms, which supports the current study's findings of low availability.

The study shows extremely low availability of robotic technology tools. This means robotic tools are almost completely absent in Business Education programs.

This finding aligns with the gap identified in previous studies that did not examine robotic technology integration. Sukardi, Risfendra, and Doni (2024) demonstrated high effectiveness of robotic technology in vocational education through their meta-analysis, but their study focused on international contexts. The current findings suggest that Nigerian tertiary institutions are far behind in adopting robotic technologies compared to the global trends shown in Sukardi *et al* (2024) international study.

AI usage in Business Education is low. The pattern mirrors availability levels, indicating that students and lecturers cannot use what is not available. This finding contradicts Godspower, Chibuike and Onyeso (2025), who reported high usage of AI applications among postgraduate students. However, it supports Ukata and Agburuga (2024), who identified high challenges in AI application by lecturers, suggesting that even when some AI tools exist, implementation difficulties prevent effective usage. Surugiu, Grădinaru and Surugiu (2024) found that learners were unfamiliar with most AI tools except basic ones, which explains the low usage found in this study.

Robotic technology usage is extremely low, reflecting the severe shortage in availability. This finding extends beyond what previous studies examined, as most reviewed studies did not investigate robotic technology usage in business education. While Sukardi *et al.* (2024) proved robotic technology's effectiveness in improving learning outcomes internationally, the current study reveals that Nigerian institutions are not yet utilizing these technologies. This creates a significant gap between what research shows is effective and what is actually practiced in Nigerian Business Education programs.

Despite low availability and usage, respondents agreed that AI and robotic technologies significantly contribute to transforming Business Education, with a grand mean of 3.25. This finding strongly supports Ukata and Amini (2025), who concluded that AI integration would transform business education positively and develop employability skills. It also aligns with Surugiu *et al.* (2024), who found that learners appreciate AI's benefits in education. The finding reveals an interesting paradox: students recognize the transformative potential of these technologies even though they rarely experience them, suggesting awareness has grown through external sources like media and industry trends.

The significant positive relationship ($r = 0.768$) between AI availability and teaching and learning of Business Education confirms that increased access to AI tools directly improves educational outcomes. This finding supports Ukata and Amini (2025), who concluded that including AI in business education would transform the program positively and develop employability skills among learners. The strong correlation validates their recommendation for AI inclusion in business education curriculum. However, given the low availability identified in Table 1, this relationship suggests that even small improvements in AI tool availability could yield substantial benefits for teaching and learning effectiveness.

The strong positive relationship between robotic technology availability and teaching and learning revealed that robotic tools significantly enhance Business Education when available. This finding aligns with Sukardi *et al.* (2024), whose meta-analysis revealed that robotic technology has a high effect size on student learning outcomes in vocational education. Their finding that robotics fosters computational thinking, creativity, and teamwork skills supports the current study's evidence of positive impact.

The significant positive relationship between AI usage and teaching and learning, which is slightly higher than the availability correlation, indicates that actual utilization of AI tools is more important than mere availability. This finding supports Godspower *et al.* (2025), who found that postgraduate students applying natural language processing, data analysis, and predictive analytics experienced enhanced learning capabilities. It also validates Surugiu *et al.* (2024), who emphasized the need to increase AI use in education so students can capitalize on AI tools in business education.

The strong positive relationship between robotic technology usage and teaching and learning confirms that when robotic tools are actively used, they substantially improve educational outcomes. This finding reinforces Sukardi *et al.* (2024), who demonstrated that robotic technology serves as an effective pedagogical instrument in vocational education contexts. While Ukata and Agburuga (2024) identified high challenges in technology application that prevent usage, the current finding shows that overcoming these challenges to enable actual usage produces significant teaching and learning improvements.

V. CONCLUSION

Sequel to the findings of the study, it was concluded that both availability and usage of Artificial Intelligence and robotic technology tools were critically low in the teaching and learning of Business Education program in tertiary institutions. Despite these deficiencies, technologies possess significant transformative potential for Business Education programs. While students recognize the transformative capacity of these technologies to enhance engagement, improve comprehension, provide personalized learning, and prepare them for modern workplace requirements, the severe shortage of technological infrastructure prevents them from experiencing these benefits.

RECOMMENDATIONS

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

1. Tertiary institutions should urgently invest in acquiring and installing essential AI tools for Business Education programs.
2. Government and institutional authorities should establish dedicated funding mechanisms specifically for procuring robotic technology tools that align with business education needs.
3. Business Education departments should organize regular training workshops and capacity-building programs for both lecturers and students to enhance their competence in utilizing available AI tools effectively.
4. Institutions should develop practical implementation guidelines and integrate robotic technology applications into Business Education curriculum to ensure active utilization beyond mere availability.
5. Stakeholders should leverage students' recognition of technology benefits by creating awareness campaigns and demonstration sessions that showcase AI and robotic technology applications in modern business environments.
6. Policy makers should prioritize incremental improvements in AI and Robotic technology tool availability, as the strong correlation indicates that even modest increases will significantly enhance teaching and learning outcomes.

7. Business Education programs should incorporate mandatory AI and Robotic tools application components into course assessments to encourage consistent usage and practical engagement with available tools.

REFERENCES

- [1] P. M. Ajuwon, K. S. Adewole, E. T. Folorunso, and W. M. Olatokun, "Artificial Intelligence in Higher Education: Applications, Opportunities, and Challenges," in *Handbook of Research on Recent Advancements in Intelligent Communication Application*, Hershey, PA, USA: IGI Global, 2019, pp. 38–66.
- [2] T. Akkaya-Kalayci and S. Yildirim, "Ethics of Artificial Intelligence in Education: A Literature Review," *Journal of Educational Technology & Society*, vol. 23, no. 3, pp. 84–99, 2020.
- [3] T. K. Chiu, T. J. Lin, and K. Lonka, "Artificial Intelligence in Education: Progress and Challenges," *Computers and Education: Artificial Intelligence*, vol. 4, Art. no. 100044, 2023.
- [4] J. E. Edokpolor and J. N. Egbri, "Business Education in Nigeria for Value Reorientation: A Strategic Approach for Poverty Alleviation and National Development," *Journal of Educational Research and Review*, vol. 5, no. 3, pp. 41–48, 2017.
- [5] C. Godspower, E. Chibuike, and P. Onyeso, "Application of Artificial Intelligence in Business Education Program for Enhanced Learning Capabilities of Postgraduate Students in Rivers State Universities," *Journal of Business Education Research*, 2025.
- [6] I. C. Igbokwe, "Application of Artificial Intelligence (AI) in Educational Management," *International Journal of Scientific and Research Publications*, vol. 13, no. 3, pp. 300–307, 2023.
- [7] H. Khosravi, S. B. Shum, G. Chen, M. Chen, and S. Knight, "Artificial Intelligence in Education: A Review and Bibliography," *International Journal of Artificial Intelligence in Education*, vol. 32, no. 4, pp. 1072–1133, 2022.
- [8] D. P. Miller, I. R. Nourbakhsh, and R. Siegwart, "Robots for Education," in *Field and Service Robotics*, 2018, pp. 1283–1301.

- [9] O. Mubin, C. J. Stevens, S. Shahid, A. Al Mahmud, and J. J. Dong, "A Review of the Applicability of Robots in Education," *Journal of Technology Education and Learning*, vol. 1, p. 13, 2013.
- [10] F. Ouyang and P. Jiao, "Artificial Intelligence in Education: The Three Paradigms," *Computers & Education*, vol. 167, Art. no. 104184, 2021.
- [11] A. Pattam, "Artificial Intelligence, Defined in Simple Terms," 2021.
- [12] S. Sukardi, R. Risfendra, and W. Doni, "Effectiveness of Robotic Technology in Vocational Education: A Meta-Analysis," *International Journal of Vocational Education and Training*, vol. 2, pp. 23–30, 2024.
- [13] C. Surugiu, C. Grădinaru, and M. R. Surugiu, "Artificial Intelligence in Business Education: Benefits and Tools," *Amfiteatru Economic*, vol. 26, no. 65, pp. 241–258, 2024.
- [14] P. F. Ukata and V. Agburuga, "Challenges Lecturers Faced and Solutions to the Application of Artificial Intelligence (AI) in Teaching Business Education Courses in Rivers State Tertiary Institutions," 2024.
- [15] P. F. Ukata and V. Agburuga, "Challenges Lecturers Faced and Solutions to the Application of Artificial Intelligence (AI) in Teaching Business Education Courses in Rivers State Tertiary Institutions," 2024.
- [16] P. F. Ukata and M. C. Amini, "Exploring the Power of Artificial Intelligence (AI) for Improving the Teaching of Business Education Courses in Government Tertiary Institutions in Rivers State," *Research Journal of Mass Communication and Information Technology*, vol. 11, no. 1, pp. 73–89, 2025.
- [17] Y. Zhang and B. Aslan, "Artificial Intelligence and Learning Effectiveness," *Computers & Education*, vol. 172, Art. no. 104289, 2021.