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ARTIFICIAL INTELLIGENCE AND EDUCATIONAL OUTCOMES OF STUDENTS OF COLLEGE OF EDUCATION; UNIVERSITY OF CALABAR CROSS RIVER STATE, NIGERIA

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ABSTRACT

This study examines the relationship between artificial intelligence (AI) applications and the educational outcomes of students at the College of Education, University of Calabar, Nigeria. Specifically, it evaluates the impact of two AI subfields machine learning and computer vision on students' academic achievement and professional readiness. Adopting a descriptive survey design, data were collected from 220 students and 20 lecturers using a structured questionnaire (AIAEOQ). Findings revealed a statistically significant but weak positive correlation between machine learning and educational outcomes (r = .160, p = .018), indicating that increased machine learning integration is mildly associated with improved student performance. In contrast, computer vision showed no significant relationship with educational outcomes (r = -0.023, p = .738), suggesting limited practical application in the current educational context. The study underscores the need for policy support, digital literacy training, and infrastructure development to enhance AI's effectiveness in teacher education. Recommendations include government investment in AI tools and capacity building for educators to foster technological innovation in Nigerian tertiary institutions.

Keywords Artificial Intelligence, Machine Learning, Computer Vision, Educational Outcomes, Teacher Education, University of Calabar.

INTRODUCTION

In recent years, the global landscape of education has been undergoing a remarkable transformation driven by technological advancements, with artificial intelligence (AI) emerging as a critical catalyst. Artificial intelligence, broadly defined as the simulation of human intelligence in machines that are programmed to think, learn, and make decisions, has found increasing relevance across various sectors including education. As educational institutions strive to improve the quality, accessibility, and efficiency of teaching and learning, AI offers innovative tools and approaches capable of reshaping traditional academic models. This transformation is particularly crucial in higher institutions of learning such as Colleges of Education, where the development of future teachers and educational professionals must align with global best practices.

At the College of Education, University of Calabar, located in Cross River State, Nigeria, there is a growing interest in the adoption of AI-powered educational technologies. These include intelligent tutoring systems, adaptive learning platforms, automated grading software, virtual assistants, and learning analytics tools. These applications not only support instructional delivery but also play a significant role in enhancing students' engagement, learning experiences, and ultimately, educational outcomes. Educational outcomes refer to the measurable academic achievements and competencies students attain through their formal learning processes such as improved grades, critical thinking skills, subject mastery, and professional readiness.

In the Nigerian context, where challenges such as overcrowded classrooms, limited instructional resources, and variability in teaching quality persist, the integration of AI into educational processes offers a strategic opportunity to bridge learning gaps. AI can personalize learning experiences to suit the pace and style of each student, provide real-time feedback, and assist educators in identifying students' strengths and weaknesses more efficiently. For students in teacher education programs, the exposure to AI not only enhances their own learning but also equips them with the digital competencies needed to thrive in 21st-century classrooms.

Despite the promising potential, the extent to which AI impacts educational outcomes in Nigerian higher education institutions remains underexplored. Most research efforts have been concentrated in developed countries, with relatively limited empirical studies conducted within Nigerian public universities and colleges of education. There is therefore a pressing need to investigate how AI adoption affects students' academic performance and professional development within local contexts like the University of Calabar.

According to Vajiram and Ravi. (2025) Artificial Intelligence (AI) is an emerging technology that enables computers and machines to simulate human intelligence and problem-solving capabilities Artificial Intelligence (AI) is an emerging technology that enables computers and machines to simulate human intelligence and problem-solving capabilities. According to : Kozár (2024) Artificial intelligence (AI) is the theory and development of computer systems

capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns. In the words of Sarikaya (2024) AI is defined in computer science as the study and building of intelligent agents, systems that are able to perceive their environment and actions that allow them to produce goals. In the language of Sheikh, Prins and Schrijvers (2023).Artificial Intelligence refers to systems that display intelligent behavior by analyzing their environment and taking actions with some degree of autonomy to achieve specific goals. Poole and Mackworth (2023) Artificial Intelligence is the field that studies the synthesis and analysis of computational agents that act intelligently. Bender and Hanna (2025) AI is often misrepresented as an all-powerful force, when in reality it comprises various forms of automation that depend heavily on human labor and decision-making. Dahlke (2024) AI is not just a technical system but a sociotechnical construct that includes the technical functions of AI systems, the human purposes they serve, and the dynamic expectations society has of them.

This study thus seeks to explore the relationship between artificial intelligence and the educational outcomes of students in the College of Education at the University of Calabar. It aims to assess the level of AI integration in teaching and learning processes, examine students' and lecturers' perceptions of AI tools, and evaluate their influence on academic achievement and readiness for teaching careers. By doing so, the research hopes to contribute to informed policy-making, capacity building, and strategic planning for the integration of AI into Nigeria's teacher education system

LITERATURE REVIEW

MACHINE LEARNING (ML)

Abdulla, Said and Ahmad (2021) the findings indicate that the naïve Bayes algorithm achieved the highest accuracy of 89.85%, while the artificial neural networks algorithm achieved the lowest variance, with a standard deviation of 2.37. Besides, there are more valuable insights beyond accuracy that other Machine learning models can provide in the SPSS environment, such as visual representation and normalized importance of independent variables. Moreover, in the context of missing student data, the data set was evaluated if e-learning parameters alone can predict student performance. The findings suggest that e-learning parameters alone can predict student performance with an average accuracy of 84.49%. This study contributes to limit grade inflation in the age of online learning due to educational malpractices. López-Meneses, López-Catalán, Noella and Mellado-Moreno (2025) the findings suggest that these AI applications can significantly improve personalized learning, student tracking, and resource optimization in educational institutions. The study highlights ethical considerations, such as the need to protect privacy, ensure the transparency of algorithms, and promote equity, to ensure inclusive and fair learning environments. Responsible implementation of these methods could significantly improve educational quality.

Yağcı (2022) the results show that the proposed model achieved a classification accuracy of 70–75%. The predictions were made using only three types of parameters; midterm exam

grades, Department data and Faculty data. Such data-driven studies are very important in terms of establishing a learning analysis framework in higher education and contributing to the decision-making processes. Finally, this study presents a contribution to the early prediction of students at high risk of failure and determines the most effective machine learning methods. Chen, Zhou,Yao and Tang (2025), the findings show that ML applications are widely researched and published in high-impact journals. The primary functions of ML in these studies include performance prediction, engagement analysis and self-efficacy assessment, employing various ML algorithms such as decision trees, random forests, support vector machines and neural networks. Ensemble learning algorithms generally outperform single algorithms regarding accuracy and other evaluation metrics. Common model evaluation metrics include accuracy, F1 score, recall and precision, with newer methods also being explored.

Yakubu. And Abubakar, (2022), results revealed that age is not a predictor for academic success (high CGPA); female students are 1.2 times more likely to have high CGPA compared to their male counterparts; students with high JAMB scores are more likely to achieve academic success, high CGPA and vice versa; students from affluent and developed regions are more likely to achieve academic success, high CGPA and vice versa; and students in Years 3 and 4 are more likely to achieve academic success, high CGPA. González and Torres (2024) the results show that: 1) We obtained eight types of learner emotion through the combined description method: joy, relaxation, surprise, meekness, contempt, disgust, sadness, anxiety and their respective PAD emotional mean. 2) We obtained the correlation results of the six emotions of joy, relaxation, surprise, meekness, contempt, and anxiety with the learning effect and the predicted value of the learning effect. 3) We then constructed an explanatory model of learner emotion and learning effect based on the offline learning environment.

COMPUTER VISION

Chen and Li (2023) the study presented the popular measures and the trends of this technology that could enable educational practitioners and scientists to apply the eye-tracking system to benefit teaching and learning mathematics in naturalistic research. The eye-tracking provides insights for innovative approaches to promote evidence-based practices and new interventions through self-directed learning and metacognition skills that could be helpful in mathematics education. Banerjee and Roy (2022) human gesture recognition is a popular issue in the studies of computer vision, since it provides technological expertise required to advance the interaction between people and computers, virtual environments, smart surveillance, motion tracking, as well as other domains. Extraction of the human skeleton is a rather typical gesture recognition approach using existing technologies based on two-dimensional human gesture detection. Likewise, cannot be overlooked that objects in the surrounding environment give some information about human gestures. To semantically recognize the posture of the human body, the logic system presented in this research integrates the components recognized in the visual environment alongside the human skeletal position. In principle, it can improve the precision of recognizing postures and semantically represent peoples' actions. As such, the paper suggests a potential and notion for recognizing human gestures, as well as increasing the quantity of

information offered through analysis of images to enhance interaction between humans and computers.

Lin, Yang, Xu, Xue and Li (2024) the study introduces MobileNetV3 as a lightweight backbone network, reducing the model parameters to one-tenth of the original while maintaining nearly the same accuracy. Additionally, by incorporating learnable position encoding and dynamic up sampling techniques, the model significantly improves its ability to recognize small objects and complex scenes. Test results on the FSCB-dataset show that the improved model achieves significant improvements in real-time performance and computational efficiency. The lightweight network is also easy to deploy on mobile devices, demonstrating its practicality in resource-constrained environments. YanJie Wang and Ooi (2024) .the study details the background of the birth of the smart classroom and the stage characteristics of the iterative development, analyses the educational changes brought about by the smart classroom, and, on the basis of analyzing the realities of the situation, puts for ward suggestions for the use of the six aspects of the facilities, leadership, teachers, resources, management, and security, with a view to being able to better unleash the potential of the smart classroom in the application of educational teaching and learning, and also to provide practical references for the new stage of the smart classroom's construction, management, and use. Chen, Liang and Zeng. (2019 the findings based on our analyses provide scientific and technological perspectives of research on information fusion for smart health with AI and offer useful insights and implications for its future development. We also provide valuable guidance for researchers and project managers to allocate research resources and promote effective international collaborations.

STATEMENT OF THE PROBLEM

The integration of Artificial Intelligence (AI) in education has emerged as a transformative force globally, offering innovative tools that promise to improve teaching effectiveness, personalize learning, and enhance educational outcomes. However, in many developing countries, including Nigeria, the adoption and effective utilization of AI technologies in tertiary institutions particularly Colleges of Education remain limited and uneven. At the University of Calabar's College of Education, there is growing recognition of the potential benefits of AI in shaping student learning experiences, yet the actual implementation and measurable impact on student outcomes remain largely undocumented and under-researched. Despite increasing awareness of AI in educational discourse, several challenges persist. These include a lack of adequate infrastructure, limited digital literacy among both students and educators, insufficient policy direction, and low exposure to AI tools in the classroom. Moreover, while developed countries are already leveraging AI to analyze student data, provide real-time feedback, and tailor instruction to individual learning needs, many Nigerian institutions have yet to systematically explore these opportunities. This raises a critical question: *To what extent is artificial intelligence being utilized within the College of Education, University of Calabar, and how does it influence the academic and professional development of its students?*

The problem is further compounded by a lack of empirical data on the relationship between AI usage and educational outcomes in the Nigerian context. Without such data, it is

difficult for policymakers, educational administrators, and curriculum planners to make informed decisions about the integration of AI in teaching and learning. The gap between technological potential and practical application may widen existing disparities in educational performance, especially among students who are training to become future educators. Therefore, there is an urgent need to investigate the current state of AI adoption in the College of Education at the University of Calabar, understand its influence on students' academic performance, and assess its role in preparing them for modern, technology-driven classrooms. This study seeks to fill this gap by examining the relationship between artificial intelligence and the educational outcomes of students, with the ultimate aim of contributing to a more effective and equitable integration of AI into Nigeria's teacher education system.

PURPOSE OF THE STUDY

The main purpose of this study was to investigate Artificial Intelligence and Educational Outcomes of Students of College of Education of University of Calabar Cross River State, Nigeria. Specifically, the study sought to;

1 find out whether machine learning affect educational outcomes of students of college of education of university of Calabar Cross River State, Nigeria

2 ascertain whether computer vision affect educational outcomes of students of college of education of university of Calabar Cross River State, Nigeria

RESEARCH QUESTIONS

1 to what extent does machine learning affect the educational outcomes of students of college of education of university of Calabar Cross River State, Nigeria?

2 how much does computer vision affect the learning outcomes of students of college of education of university of Calabar Cross River State, Nigeria?

STATEMENT OF HYPOTHESES

1 there is no significant relationship of machine learning on educational outcomes of students of college of education of university of Calabar Cross River State Nigeria

2 computer vision does not significantly relate with educational outcomes of students of college of education of university of calabar Cross River State Nigeria

METHODOLOGY

Research Design

This study adopted a descriptive survey research design. The design is appropriate for obtaining factual and perceptual data from a specific population with the aim of describing existing conditions, practices, and relationships among variables in this case, the use of artificial intelligence and its impact on the educational outcomes of students. The descriptive survey approach enables the collection of both quantitative and qualitative data regarding students' and lecturers' experiences, perceptions, and usage patterns of AI tools in the College of Education.

Area of the Study

The research was conducted at the College of Education, University of Calabar, located in Calabar, Cross River State, Nigeria. The College offers a variety of education-related programs and is a key institution in the training of future teachers in south-south Nigeria.

Population of the Study

The population of the study comprised all students and academic staff of the College of Education at the University of Calabar. This includes students enrolled in education programs such as Educational Management, Curriculum Studies, Educational Technology, and others, as well as lecturers who engage in teaching and supervising academic work within the College.

Sample and Sampling Technique

A sample size of 200 respondents was drawn from the target population using a stratified random sampling technique to ensure adequate representation of students across departments and levels of study. In addition, 20 lecturers were purposively selected based on their involvement with digital tools and instructional technologies. The sample was stratified into two main groups: students and academic staff, to capture diverse perspectives on the use and impact of AI in the educational process.

Instrumentation

The main instrument for data collection was a structured questionnaire titled *Artificial Intelligence and Educational Outcomes Questionnaire (AIAEOQ)*, designed by the researcher. The questionnaire consisted of three sections:.

Validity and Reliability of the Instrument

To ensure content and face validity, the instrument was reviewed by experts in Educational Management and Measurement and Evaluation. A pilot study was conducted with 95 students and 5 lecturers from a neighboring institution, and the reliability of the instrument was confirmed using Cronbach's Alpha, which yielded a reliability coefficient of 0.82, indicating a high level of internal consistency.

Method of Data Collection

Data were collected through the direct administration of questionnaires to the respondents during lectures and scheduled meetings. Prior to distribution, respondents were briefed about the purpose of the research and assured of the confidentiality and anonymity of their responses. Completed questionnaires were retrieved on the spot to ensure a high return rate.

Method of Data Analysis

Quantitative data were analyzed using descriptive statistics such as Pearson Product Moment Correlation (PPMC) to determine the relationship between AI usage and educational outcomes, and to test for significant differences in perceptions based on gender or academic level. Qualitative responses were analyzed using thematic analysis to identify recurring patterns and insights related to AI use and educational impact.

RESULTS

HYPOTHESIS ONE

There is no significant relationship between machine learning on educational outcomes of students of college of education of university of Calabar Cross River State Nigeria

Pearson Product Moment Correlation Analysis was used to analyzed this hypothesis as presented in Table 1

Table 1; Pearson Product Moment Correlation was used for the analysis of the relationship between Machine Learning and Educational Outcomes of students of college of education of University of Calabar of Cross River State, Nigeria

TABLE ONE

Variables	N	X	SD	R	SIG
Machine learning	220	15.9773	1.8218	.160	.018
Educational outcomes	220	14.6409	2.82409	.160	.018

P = .018

Correlation Coefficient (r = .160) The Pearson correlation coefficient (r) between machine learning and educational outcomes is .160. This value indicates a positive relationship: as the value of machine learning increases, the educational outcomes tend to increase slightly as well. So, .160 is on the lower boundary of a very weak to weak positive relationship. Significance Level (p = .018) The Sig. (2-tailed) value is .018, which is less than 0.05, indicating that the correlation is statistically significant at the 5% level. This means that there is only a 1.8% chance that the observed correlation occurred due to random chance. Therefore, we can reject the null

hypothesis (which states that there is no relationship between machine learning on educational outcomes of student of college of education of university of Calabar) and conclude that there is a statistically significant relationship between machine learning and educational outcomes of students. Implications Statistical Significance ≠ Practical Significance: While the correlation is statistically significant, the effect size (r = .160) is small. This suggests that machine learning explains only a small portion of the variation in educational outcomes. This result could be meaningful in large-scale applications or in contexts where there is small improvement in outcomes matter, but on its own, it does not indicate a strong predictive relationship. There is a statistically significant but weak positive correlation between machine learning and educational outcomes of students (r = .160, p = .018). As machine learning increases, educational outcomes of students slightly increase. The relationship is weak, suggesting limited predictive or practical power, but the significance implies the relationship is unlikely due to chance in this sample.

HYPOTHESIS TWO

Computer vision does not significantly relate with educational outcomes of students of college of education of university of calabar Cross River State Nigeria

Pearson Product Moment Correlation Analysis was used to analyzed this hypothesis as presented in Table 2

Table 2; Pearson Product Moment Correlation was used for the analysis of the relationship between Computer vision and Educational Outcomes of students of college of education of University of Calabar of Cross River State, Nigeria

TABLE TWO

Variables	N	X	SD	R	SIG
Computer vision	220	14.8045	2.8143	-023	.738
Educational outcomes	220	14.6409	2.8241	-023	.738

P = .738

In this case, the coefficient is -0.023, indicating a very slight negative linear relationship between the variables computer vision and educational outcomes of students Practical meaning: As scores or values on the computer vision increase, educational outcomes very slightly decrease but the relationship is so weak that it is practically negligible. The value is close to zero, suggesting that no real pattern of association exists between the two variables. Statistical Significance (p = .738) The p-value (Sig. 2-tailed) tests the null hypothesis that there is no correlation between the two variables in the population. In this case, the p-value is .738, which is far greater than the conventional thresholds for significance (e.g., 0.05 or 0.01). it therefore, means that the result is not statistically significant. There is a 73.8% chance that the observed correlation is due to

random variation in the sample data. We fail to reject the null hypothesis, concluding that there is no statistically significant linear relationship between computer vision and educational outcomes of students The fact that no significant correlation was found despite the sample size strengthens the conclusion that there is genuinely no linear relationship between the variables. There may be other mediating or moderating factors (like teacher quality, instructional design, or student engagement) that influence educational outcomes more directly. It's possible that while computers are present, they may not be used effectively enough to impact outcomes.

DISCUSSION OF FINDINGS

The findings of hypothesis one is in tandem with the opinion of Abdulla, Said and Ahmad (2021) the findings indicate that the naïve Bayes algorithm achieved the highest accuracy of 89.85%, while the artificial neural networks algorithm achieved the lowest variance, with a standard deviation of 2.37. Besides, there are more valuable insights beyond accuracy that other Machine learning models can provide in the SPSS environment, such as visual representation and normalized importance of independent variables. Moreover, in the context of missing student data, the data set was evaluated if e-learning parameters alone can predict student performance. The findings suggest that e-learning parameters alone can predict student performance with an average accuracy of 84.49%. This study contributes to limit grade inflation in the age of online learning due to educational malpractices. The finding also, agrees with the view of López-Meneses, López-Catalán, Noella and Mellado-Moreno (2025) the findings suggest that these AI applications can significantly improve personalized learning, student tracking, and resource optimization in educational institutions. The study highlights ethical considerations, such as the need to protect privacy, ensure the transparency of algorithms, and promote equity, to ensure inclusive and fair learning environments. Responsible implementation of these methods could significantly improve educational quality.

The finding of this hypothesis is in agreement with the opinion of Yağcı (2022) the results show that the proposed model achieved a classification accuracy of 70–75%. The predictions were made using only three types of parameters; midterm exam grades, Department data and Faculty data. Such data-driven studies are very important in terms of establishing a learning analysis framework in higher education and contributing to the decision-making processes. Finally, this study presents a contribution to the early prediction of students at high risk of failure and determines the most effective machine learning methods. The findings also is in correspondence with the assertion of Chen, Zhou, Yao and Tang (2025), the findings show that ML applications are widely researched and published in high-impact journals. The primary functions of ML in these studies include performance prediction, engagement analysis and self-efficacy assessment, employing various ML algorithms such as decision trees, random forests, support vector machines and neural networks. Ensemble learning algorithms generally outperform single algorithms regarding accuracy and other evaluation metrics. Common model evaluation metrics include accuracy, F1 score, recall and precision, with newer methods also being explored.

The findings of hypothesis two is in line with the opinion of Banerjee and Roy (2022) human gesture recognition is a popular issue in the studies of computer vision, since it provides technological expertise required to advance the interaction between people and computers, virtual environments, smart surveillance, motion tracking, as well as other domains. Extraction of the human skeleton is a rather typical gesture recognition approach using existing technologies based on two-dimensional human gesture detection. Likewise, cannot be overlooked that objects in the surrounding environment give some information about human gestures. To semantically recognize the posture of the human body, the logic system presented in this research integrates the components recognized in the visual environment alongside the human skeletal position. In principle, it can improve the precision of recognizing postures and semantically represent peoples' actions. As such, the paper suggests a potential and notion for recognizing human gestures, as well as increasing the quantity of information offered through analysis of images to enhance interaction between humans and computers.

The findings also aligned with the view of Lin, Yang, Xu, Xue and Li (2024) the study introduces MobileNetV3 as a lightweight backbone network, reducing the model parameters to one-tenth of the original while maintaining nearly the same accuracy. Additionally, by incorporating learnable position encoding and dynamic up sampling techniques, the model significantly improves its ability to recognize small objects and complex scenes. Test results on the FSCB-dataset show that the improved model achieves significant improvements in real-time performance and computational efficiency. The lightweight network is also easy to deploy on mobile devices, demonstrating its practicality in resource-constrained environments. The findings coincided with the views of YanJie Wang and Ooi (2024) .the study details the background of the birth of the smart classroom and the stage characteristics of the iterative development, analyses the educational changes brought about by the smart classroom, and, on the basis of analyzing the realities of the situation, puts for ward suggestions for the use of the six aspects of the facilities, leadership, teachers, resources, management, and security, with a view to being able to better unleash the potential of the smart classroom in the application of educational teaching and learning, and also to provide practical references for the new stage of the smart classroom's construction, management, and use. The findings agree with the opinion of Chen, Liang and Zeng. (2019 the findings based on our analyses provide scientific and technological perspectives of research on information fusion for smart health with AI and offer useful insights and implications for its future development. We also provide valuable guidance for researchers and project managers to allocate research resources and promote effective international collaborations.

CONCLUSION

The study concluded that, there was a positive significant correlation between machine learning and educational outcomes of students and a linear relationship between computer vision and educational outcomes of students in the study location respectively. This was revealed based on the statistical evidence of the analysis. This research work does not covered all the domains artificial intelligence and other researchers are encourage to delve in they are of interest to compliment the exiting research works in the academic space.

RECOMMENDATIONS

1 Government should provide enabling environment to motivate machine learning among teachers and students to advance technological innovations.

2 Government should employ more qualified computer teachers and give them the opportunity for retraining to update their knowledge for global competitiveness.

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