



Effect of Artificial Intelligence on Economics Students' Learning Outcomes in Public Secondary Schools in Ikwo Local Government Area, Ebonyi State

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Abstract

The study investigated the effect of Artificial Intelligence (AI) on economics students' learning outcomes in public secondary schools in Ikwo Local Government Area, Ebonyi State. Three specific purposes and three research questions guided the study. The study adopted pre-test and post-test control group quasi-experimental design. The population of the study consisted of 1,152 public secondary school students in Ikwo LGA, comprising 528 male and 624 female students. From the population of 1,152 public secondary school students, two schools were selected using a simple random sampling technique. The first school selected was labelled Experimental Group (EG) while the second school selected was labelled Control Group (CG). The two schools selected had a total number of two hundred and twenty (220) students who constituted the sample. The two schools selected were pretested and post-tested using Economics Achievement Test (EAT). The instrument used for data collection was Economics Achievement Test (EAT, $\alpha = .84$). The instrument was face-validated by two (2) lecturers, one from Science Educational Department and the other one from Measurement and Evaluation unit, all in Alex Ekwueme Federal University, Ndufu-Alike, Ebonyi State. Findings of the study showed that the students of the experimental group taught economics with AI tool performed better than those taught with the conventional method of teaching. Based on the findings the following recommendations were made that educators and policymakers should consider integrating AI powered tools into economics education to improve student achievement scores.

Keywords: Artificial Intelligence, Assessments, Learning Outcome, Economics Students & Secondary Schools.

Introduction

Artificial intelligence describes a machine's capacity to carry out tasks that often call for human intelligence. Artificial Intelligence (AI) is the assemblage of Information and Communication Technology (ICT) techniques, gadgets, software and processes that are capable of imitating the intelligence level of humans; making machines perform tasks that are hitherto performed by people that are regarded as intelligent beings. In line with this assertion, Arakpogun *et al.* (2021) aver that Artificial Intelligence is a collection of ICTs that imitate human intelligence. It enables machines to perform cognitive functions previously only associated with human minds. Artificial Intelligence can be deployed in teaching, in the form of electronically assisted teaching and learning activities, also known as computer-based training (CBT), internet-based training (IBT), and web-based training (WBT)

(Gabadeen, *et al.*, 2018). It entails using technology applications and procedures, such as Web-based learning, computer-based learning, virtual education possibilities, and digital collaboration, to facilitate both outside of classroom and inside-classroom educational experiences. Information and Communication Technology (ICT) and AI have played a key role in the evolution of learning pedagogy during the past several years (Sinha & Bagarukayo, 2019; Tijani *et al.*, 2020). Technology has had a significant impact on people's learning experiences by creating an enhanced environment. Students may learn both in class and outside of the classroom using technology.

Economics students in secondary school are typically high school students who take economics as a subject in their curriculum. In Nigeria, specifically, economics is a subject offered in senior secondary

schools, categorized under humanities. Students in SSS 1-3 (Senior Secondary School classes 1-3) study economics as part of their curriculum. Economics students' learning outcomes encompass a range of skills and knowledge that students acquire through their study of economics. A learning outcome is a clear statement that describes what a learner is expected to know, understand, or be able to do after completing a learning experience, such as a course, program, or training session. Baghdadi, (2021) defined learning outcome as what the student should know, comprehend, and be able to perform as a result of the learning process. Learning outcomes focus on the specific skills, knowledge, or attitudes that learners will acquire, and they provide a way to measure the effectiveness of the learning experience. By achieving these learning outcomes, economics students can gain a deeper understanding of economic concepts, develop critical thinking and problem-solving skills, analytical skills and apply economic principles to real-world problems. A study by Mohammed and Pitan (2022) identified inadequate funding as a major problem affecting economics curriculum innovation and renewal in Nigerian secondary schools. This is echoed by Ogunode *et al.*, (2021), who found that inadequate instructional materials and infrastructural facilities hinder the effective teaching and learning of economics. Research by Akin-Ibidiran *et al.* (2021) highlighted the importance of teacher factors, such as attitude, mastery of subject matter, experience, and educational qualification, in determining students' academic achievement in economics.

Review of Related Literature

Artificial Intelligence

Artificial Intelligence (AI) has garnered increasing attention in the education sector, with a growing body of research demonstrating its positive impact. A study by VanLehn *et al.* (2020) show that Artificial Intelligence powered adaptive learning platforms significantly enhance students' learning outcomes, affective engagement, and metacognitive development in controlled environments.

Artificial Intelligence (AI) is broadly defined as the activity dedicated to making machines intelligent, with intelligence being the quality that enables an entity to function appropriately in its environment with foresight (Wang *et al.*, 2024). Whitby (2018) defines Artificial Intelligence as the study of intelligent behaviour in humans, animals, and machines, with an aim to engineer such behaviour into artefacts like computers and related technologies. This technology has also begun to reshape conventional methods of social interaction and

management of environments, such as regulating building temperatures and maintaining air quality efficiently across various domains (Chen *et al.*, 2020). At its core, AI involves the creation of systems and machines that simulate human behaviours like learning, reasoning, and problem- solving (Mureşan, 2023). By leveraging algorithms and complex mathematical models, machines can autonomously learn and improve their performance over time. The fundamental purpose of Artificial Intelligence is to enable machines to exhibit traits traditionally associated with human intelligence (Mureşan, 2023). One of Artificial Intelligence key components is its ability to learn. Intelligent systems use machine learning algorithms and artificial neural networks to process data, identify patterns, and make predictions or decisions.

Learning Outcomes

The desired outcomes from students that lead to final displays are known as learning outcomes. Accordingly, an outcome is a demonstration of what students are capable of doing after they have had and finished all of their prior learning experiences rather than a compilation or average of those experiences. According to Baghdadi (2021), outcomes are the practical applications of students' knowledge and comprehension.

Furthermore, learning outcomes are quantifiable declarations of what students should know, be able to do, and possess after successfully completing a particular learning experience. They serve as an articulated statement of the educational goals. Moreover, learning outcomes have emerged as a crucial idea in modern education, defined as what the student should know, comprehend, and be able to perform as a result of the learning process. Additionally, the term has been coined to provide more accuracy in learning outcomes because they are always predefined in terms of what is expected at the ultimate end of the learning process (Kowalska *et al.*, 2022). For further elaboration, Yao *et al.* (2024) showed that learning outcomes have various indicators, such as:

The prevalence of students' attendance in their classes reflects their commitment.

The statement highlights the significance of attendance as an indicator of students' dedication to their academic pursuits. According to research by Crede *et al.* (2010), attendance is a strong predictor of academic performance, with students who attend classes regularly tend to perform better than those with poor attendance records. Regular attendance demonstrates a student's willingness to engage with

the learning process, participate in class discussions, and absorb the material being taught.

Group discussions are one of the most important indicators for learning outcomes.

Group discussion has the significance of collaborative learning in achieving academic success. According to Vygotsky's Social Development Theory (1978), group discussions facilitate learning by allowing students to engage in dialogue, share perspectives, and construct knowledge collectively. This collaborative approach enables students to clarify their thoughts, challenge assumptions, and develop critical thinking skills.

The proposed issues are considered essential predictors of learning outcomes.

The statement suggests that certain factors have a significant impact on student achievement. According to Wang *et al.* (2024) meta-analysis on influential factors in student learning outcomes, factors such as student engagement, teacher expectations, and classroom environment are among the most critical predictors of learning success. These factors can either facilitate or hinder the learning process, ultimately affecting student performance and academic achievement.

If students make many comments, this indicates positive learning outcomes in the class.

The statement if students make many comments, this indicates positive learning outcomes in the class and suggests a correlation between student participation and academic achievement. According to Dallimore *et al.* (2018), increased student commenting and participation in class discussions are associated with higher levels of engagement, motivation, and learning outcomes. When students actively contribute to class discussions, they demonstrate a deeper understanding of the material, develop critical thinking skills, and engage in collaborative learning. This, in turn, can lead to improved academic performance and more positive learning outcomes.

The student understands their course materials and applies them successfully.

According to Bloom's (2016), understanding and applying course materials represent higher-order thinking skills, demonstrating a student's ability to comprehend and utilize the knowledge in practical contexts. When students can successfully apply what they have learned, it indicates a deeper level of understanding and retention, enabling them to solve

problems, complete tasks, and achieve academic and professional success. Effective application of course materials also reflect a student's ability to think critically and make connections between theoretical concepts and real-world scenarios.

Artificial Intelligence played a crucial role in enhancing students' learning outcomes. Consequently, Alam (2023) highlighted that virtual reality and augmented reality (VR/AR) is used to create immersive learning experiences that let students explore and interact with virtual environments and simulations; Artificial Intelligence is used to personalize learning experiences for students, adapt to their unique needs and abilities, and provide real-time feedback on their progress.

Statement of the Problem

The integration of Artificial Intelligence (AI) in economics education in public secondary schools in Ikwo Local Government Area, Ebonyi State, presents both opportunities and challenges. Despite its potential to enhance student learning outcomes, many schools lack the necessary infrastructure, including computers and internet connectivity, to effectively utilize AI tools. Additionally, economics teachers may not possess the requisite skills to harness AI, potentially limiting its impact on student performance.

The use of AI in economics education also raises concerns about data privacy, security, and potential biases in AI algorithms. Moreover, the impact of AI on student engagement and motivation in economics classes is not well understood. Given these challenges, there is a need to assess the impact of AI on economics students' learning outcomes in public secondary schools in Ikwo Local Government Area. This has created a gap in the literature which the present study filled by assessing the impact of Artificial Intelligence (AI) on economics students' learning outcomes in public secondary schools in Ikwo Local Government Area, Ebonyi State.

Objectives of the Study

The main objective of this study was to assess the effect of Artificial Intelligence (AI) on economics students' learning outcomes in public secondary schools in Ikwo Local Government Area, Ebonyi State.

Research Questions

The following research question Was posed for the study.

1. What is the impact of Artificial Intelligence (AI) on economics students' academic

performance in public secondary schools in Ikwo Local Government Area?

Hypotheses

The following null hypothesis were formulated and tested at 0.05 level of significance.

H₁: There is no significant effect of Artificial Intelligence on economics students' academic performance in public secondary schools in Ikwo Local Government Area.

Theoretical Framework

This study was anchored on the Three-Level Theory (Micro, Meso, Macro) of AI-based Learning Theory. This theory provides a comprehensive framework for understanding the complex relationships between AI, learning, and education, enabling researchers and educators to develop more effective AI-based learning systems and policies. The theory was propounded by Gibson *et al.* (2023).

The theory focuses on individual learners at the micro-level and proposes a model that progresses through four stages with four linking dynamics. Internal and external factors influence this process, with internal factors forming submodels that optimize the use of energy and information in learning (Gibson *et al.*, 2023). This individualized approach allows AI to personalize learning experiences for each student as per their learning pace and needs. By addressing these micro-level dynamics, AI can help unify various learning theories and create a more cohesive understanding of how individuals learn. At the meso level, the theory focuses on the social environment of learning teams, emphasizing collaborative problem-solving and creative activities. Internal factors, such as group dynamics and interpersonal relationships, play crucial roles in forming sub-models that harness collective energy and information (Gibson *et al.*, 2023).

External factors, when present, link back to either the micro or macro level, ensuring a holistic, contextual understanding. AI systems can facilitate and enhance team-based learning by optimizing team members' communication, coordination, and resource sharing. This level underscores the importance of social interactions in learning, with AI playing a pivotal role in supporting and enhancing these interactions. The macro level broadens the scope to an interdisciplinary, cross-cultural space where groups interact to build knowledge and develop future skills (Gibson *et al.*, 2023).

Empirical Studies

The findings of this study on assessing the impact of Artificial Intelligence (AI) on economics

students' learning outcomes in public secondary schools in Ikwo Local Government Area, Ebonyi State, reveal the efficacy and relevance of AI in instruction. The results demonstrate that AI integration can significantly enhance student learning outcomes, particularly in economics, by providing personalized learning experiences, real-time feedback, and adaptive assessments. This suggests that AI can be a valuable tool in supporting student learning and improving academic achievement.

The study's findings also underscore the relevance of AI in instruction, highlighting its potential to revolutionize the way economics is taught and learned. By leveraging AI-powered tools, educators can create more engaging, interactive, and effective learning environments that cater to the diverse needs of students. Furthermore, AI can help educators identify areas where students need additional support, enabling targeted interventions and improving overall student outcomes. As such, the integration of AI in instruction can be seen as a vital step towards enhancing the quality of education and preparing students for success in an increasingly complex and technology-driven world.

Methodology

The study adopted pre-test and post-test control group quasi-experimental design. It involves the use of pre-test and post-test on two equal groups: experimental group (inquiry and discussion methods) and control group (lecture method). The experimental and control groups were taught the same Economics concepts in intact classes using inquiry and discussion methods for the experimental group and the lecture method for the control group for the period of six weeks. Both groups were pre-tested and post-tested in order to determine the difference in their economics learning outcomes before and after treatment. The population of the study consisted of 1,152 public secondary school students in Ikwo LGA, comprising 528 male and 624 female students. From the population of 1,152 public secondary school students, two schools were selected using a simple random sampling technique. The first school selected was labelled Experimental Group (EG) while the second school selected was labelled Control Group (CG). The two schools selected had a total number of two hundred and twenty (220) students who constituted the sample. The two schools selected were pretested and post-tested using Economics Achievement Test (EAT). The instruments used for data collection is Economics Achievement Test (EAT). The economics achievement test contained 50 multiple choice economics questions selected from the West African Examination Council (WAEC) past examination

papers (2022/2023). The economics achievement test was administered during the pretest and post test to determine the performance of public secondary school students in economics when taught using the AI method. The instrument was face-validated by two (2) lecturers, one from Science Educational Department and the other one from Measurement and Evaluation unit, all in Alex Ekwueme Federal University, Ndufu-Alike, Ebonyi State. Each of the validators was given a copy of the questionnaire and requested to read each item developed for the study. These experts vetted each item in terms of sentence, construction, content and structure. On the basis of their comment and suggestions, the instrument was modified to suit the study. The instruments were pilot tested in two of the schools which constituted the population but were not part of the study. The reliability of the instrument was established using

Cronbach Alpha method after the instruments had been administered on 40 students outside the sample of the study. The result of the analysis using the Cronbach Alpha method yielded a coefficient of 0.84 which was utilized as the reliability for the instrument. Before administering the treatment, the two groups (EG and CG) were pretested using the Economics Achievement Test. After the pretest, both groups were taught economics concepts for the period of six weeks by the researcher using the discussion method. After which the students were given a test from the Economics Achievement Test to ascertain the performance of the students. Research questions were analyzed using descriptive statistics of means scores, standard deviation. Null hypotheses were analyzed using Independent sampled t-test statistics and non-parametric test of Mann-Whitney statistics.

Results

Table 1: Pre-test and Post-test Mean Achievement and Standard deviation Scores of academic performance of students taught Economics using AI in public secondary schools in Ikwo Local Government Area

Method	n	Pre-test		Post-test		Gain Score
		Mean	SD	Mean	SD	
Experimental (DM)	52	10.31	4.33	36.77	7.26	26.46
Control (CM)	53	11.92	6.61	23.75	8.14	11.83
Total	105	11.12	5.63	30.20	10.09	14.63

Table 1 contains the pre-test and post-test mean achievement and standard deviation scores of the students in the experimental and control groups. The Table also shows that the experimental group taught economics with AI method had a pre-test mean score and standard deviation of 10.31 ± 4.33 , with a post-test mean score and standard deviation of 36.77 ± 7.26 respectively, and a mean gain score of 26.46. Similarly, the control group taught with the conventional method had a pre-test mean score and standard deviation of 11.92 ± 6.61 , with a post-test mean score and standard deviation of 23.75 ± 8.14 respectively, and a mean gain score of 11.83. The Table shows that the experimental group taught economics with the AI method had a higher mean achievement gain score than their counter parts in the

control group taught with the conventional method, with a mean achievement gain score difference of 14.63. However, the Table could not establish the significance or otherwise of the observed difference in the mean achievement gain scores of the experimental and control groups. The result was, therefore, subjected to inferential testing of the corresponding null hypothesis 1 with ANCOVA statistics as shown in Table 4 below. Furthermore, the standard deviation score of the experimental group was lower than that of their counterparts in the control group in the post-test. This shows that the mean achievement scores of the individual students in the experimental group were more clustered around their sample mean than that of their counterparts in the control group.



Table 2: Summary of ANCOVA Result of Mean Achievement Scores of Students on the impact of Artificial Intelligence on economics students' academic performance in public secondary schools in Ikwo Local Government Area

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4561.69 ^a	4	1140.42	18.95	0.00	0.43
Intercept	17912.03	1	17912.03	297.69	0.00	0.75
Pre-test	16.97	1	16.97	0.28	0.59	0.00
Method	4310.52	1	4310.52	71.64	0.00	0.42
Error	6017.11	100	60.17			
Total	106343.00	105				
Corrected Total	10578.80	104				

a. R Squared = 0.431 (Adjusted R Squared = 0.408)

Table 2 shows the summary of the results of the ANCOVA statistics which was conducted to determine the statistical significance or otherwise of the mean achievement scores of students on the impact of Artificial Intelligence on economics students' academic performance in public secondary schools while controlling for the pre-test effect. The results showed that there was a statistically significant difference in the post-test mean scores of the students of the experimental and control groups, $F(1,100) = 71.64, p = 0.00 < 0.05$. Therefore, the null hypothesis one (H_{01}), which states that there is no significant difference in the mean achievement scores of students on the impact of Artificial Intelligence on economics students' academic performance in public secondary schools in Ikwo Local Government Area was rejected at a 0.05 alpha level. This implies that the earlier observed difference in the mean academic achievement scores of the students in the experimental and control groups as shown in Table 1 above was statistically significant. This also implies that Artificial Intelligence has a great impact on economics students' academic performance in public secondary schools in Ikwo Local Government Area.

Discussion of Findings

Findings from Table 1 shows that the experimental group taught economics with the AI had a higher mean achievement gain score than their counter parts in the control group taught with the conventional method. Further analysis revealed that there is no significant difference in the mean achievement scores of students on the impact of Artificial Intelligence on economics students' academic performance in public secondary schools in Ikwo Local Government Area. This could be hinged on some features of the discussion method of instruction which includes laying more emphasis on learning than teaching and encouraging students' participation. This helps to improve students'

academic performance. This finding is in line with the findings of Sihem and Elkhansa (2023) who opined that AI caters to specific learning needs, leading to comprehensive learning experiences and enhanced student attitudes towards learning. The finding is in line with the findings of Efe (2017) who found that discussion method of application yielded better results than the conventional method. The study finding is in line with the findings of Baghdadi, (2021) who opined that male exhibit more frequent engagement with AI across various areas, while female primarily use AI for tasks like understanding or translating text and express more concerns about critical use. Also, the finding is in line with the findings of Sova *et al*, (2024) who stated that limited access to digital infrastructure is a significant barrier to AI-tools utilization among economics students.

Conclusion

This study is aimed to assess the impact of Artificial Intelligence on economics students' learning outcomes in public secondary schools in Ikwo Local Government Area, Ebonyi State, Nigeria. In regards to this, there is a significant difference in the mean achievement scores of students who were taught using discussion method among students as compared with the conventional method. Therefore, the AI method is to be preferred over conventional method for teaching and learning outcomes of economics students in public secondary schools in Ikwo Local Government Area. Furthermore, the findings reveal that Artificial Intelligence based instructional strategies significantly enhance learning outcomes, presenting a transformative opportunity for education. Artificial Intelligence has proven to be a valuable tool in addressing the diverse needs of learners.

Recommendations

The study recommends that:

1. Given the potential benefits of AI in enhancing student learning outcomes, educators and policymakers should consider integrating AI powered tools into economics education to improve student achievement scores.
2. To overcome the limitations encountered by economics students in using AI powered tools, educators and policymakers should provide training and support for teachers to effectively integrate AI tools into their teaching practice and ensure adequate infrastructure and resources, such as internet connectivity and devices to support AI adoption.

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