

Artificial Intelligence-Driven Tools as Catalysts for Teaching and Learning Improvement in Economics Education

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Abstract

Artificial intelligence (AI) driven tools ranging from intelligent tutoring systems and learning analytics to generative AI and automated feedback are increasingly shaping teaching and learning across economics education. This paper synthesizes contemporary research and policy guidance to explain how AI functions as a catalyst for instructional effectiveness, learner engagement, differentiation, and assessment, while also examining risks related to bias, privacy, academic integrity, opacity, and educational inequality. Drawing on learning sciences and socio-technical perspectives, the paper proposes a human-centered framework for responsible AI integration across pedagogy, assessment, learner support, teacher professional practice, and governance. It argues that AI yields the greatest educational value when deployed as an augmentative resource that strengthens teacher decision-making and learner self-regulation rather than as a substitute for professional judgment.

Keywords: Artificial Intelligence in Education, Generative AI, Teaching and Learning

Introduction

Artificial intelligence (AI) has evolved from a specialized educational technology into a transformative force shaping teaching, learning, assessment, and curriculum delivery across various disciplines, including economics education. AI driven tools such as intelligent tutoring systems, adaptive learning platforms, learning analytics, automated assessment systems, and generative AI applications are increasingly being adopted to enhance instructional effectiveness and improve students' learning experiences. These technologies provide opportunities for personalized learning,

instant feedback, real time data analysis, and interactive learning environments that support the development of higher order thinking skills essential in economics education (Kasneci *et al.*, 2023).

Economics education aims to equip learners with the knowledge, analytical skills, and decision making abilities required to understand economic principles and apply them to real life situations. However, the teaching and learning of economics continue to face several challenges, including students' difficulty in understanding abstract concepts, interpreting economic graphs and models, analyzing statistical data, and

relating theoretical principles to contemporary economic issues. Conventional teaching approaches often emphasize memorization rather than critical thinking, problem solving, and evidence based reasoning, thereby limiting students' engagement and achievement.

The emergence of AI driven tools presents significant opportunities to address these challenges by transforming how economics is taught and learned. AI powered applications can simplify complex economic concepts through interactive explanations, simulations, visualizations, and personalized instructional support. Generative AI systems can assist learners in interpreting economic theories, solving quantitative problems, analyzing case studies, and generating policy discussions, while learning analytics can provide teachers with insights into students' learning progress and areas requiring intervention. These capabilities have the potential to enhance conceptual understanding, promote learner engagement, and strengthen economic reasoning.

Despite these opportunities, the integration of AI into economics education also raises important concerns regarding algorithmic bias, data privacy, academic integrity, transparency, digital inequality, and over dependence on AI generated content. The educational benefits of AI depend not merely on the availability of technological tools but on their alignment with curriculum objectives, teacher competence, ethical standards, and responsible governance (UNESCO, 2023; OECD, 2023). Consequently, AI should be viewed as a tool

that complements and strengthens teachers' professional judgment rather than replacing their instructional responsibilities.

This paper therefore examines how AI driven tools can serve as catalysts for improving teaching and learning in economics education. Specifically, it explores the major categories of AI applications relevant to economics instruction, analyzes their contributions to teaching effectiveness and students' learning outcomes, evaluates the ethical and implementation challenges associated with their adoption, and proposes practical strategies for their responsible integration into economics education. The paper argues that AI achieves its greatest educational value when employed as a human centred instructional support system that enhances teachers' pedagogical practices while fostering students' critical thinking, problem solving, and economic decision making skills.

Conceptualizing AI Driven Tools in Economics Education

Artificial intelligence driven tools in economics education refer to digital applications that employ machine learning, natural language processing, predictive analytics, and generative artificial intelligence to improve the teaching and learning of economics. These technologies support both teachers and learners by facilitating personalized instruction, automated assessment, interactive learning experiences, and data driven decision making (Kasneci et al., 2023; UNESCO, 2023). Rather than replacing teachers, AI serves as

an instructional partner that enhances classroom effectiveness and students' understanding of economic concepts (Ouyang & Jiao, 2021).

A practical way to understand AI driven tools in economics education is to classify them according to the instructional functions they perform.

- **Adaptive learning and intelligent tutoring systems:** These systems personalize instruction by assessing learners' prior knowledge and providing customized explanations, practice questions, and remedial activities on topics such as demand and supply, elasticity, market structures, national income accounting, and macroeconomic policy. They enable students to progress at their own pace while helping teachers identify areas where additional support is required (OECD, 2023; Luckin, 2017).
- **Automated assessment and feedback tools:** AI powered assessment systems can instantly evaluate objective tests, provide feedback on short answer questions, and identify common misconceptions in economics. Timely and targeted feedback enhances students' conceptual understanding while reducing teachers' workload, particularly in large classrooms (Luckin, 2017; U.S. Department of Education, Office of Educational Technology [OET], 2023).
- **Learning analytics and predictive systems:** Learning analytics tools collect and analyse students' learning data to monitor participation, identify learning gaps, predict academic performance, and support early intervention. In economics education, these tools help instructors determine which concepts learners find most challenging and design appropriate instructional responses based on evidence (OECD, 2023; U.S. Department of Education OET, 2023).
- **Generative AI and conversational assistants:** Applications such as ChatGPT and other large language models can generate explanations, summarize economic theories, develop case studies, create assessment questions, explain economic graphs, and facilitate discussions on current economic issues. When used responsibly, these tools promote inquiry based learning, critical thinking, and independent study while supporting students' economic reasoning and analytical skills (Kasneci et al., 2023; UNESCO, 2023).
- **Teacher productivity and instructional planning tools:** AI applications can assist economics teachers in preparing lesson plans, designing instructional materials, generating classroom activities, creating economic simulations, and developing differentiated learning resources that address learners' diverse abilities. These technologies improve instructional efficiency while allowing teachers to devote more time to learner support and classroom interaction (Daher, 2025; Sperling et al., 2024).

Classifying AI driven tools according to their pedagogical functions enables educators to evaluate their instructional value rather than their technological novelty. Contemporary research suggests that the successful integration of AI into economics education depends not only on technological innovation but also on curriculum alignment, teacher competence, ethical considerations, institutional support, and effective classroom implementation (Ouyang & Jiao, 2021; OECD, 2023; UNESCO, 2023). Consequently, AI should be regarded as a tool for strengthening economics instruction and improving students' analytical thinking, quantitative reasoning, and economic decision making rather than as a replacement for teachers' professional expertise.

How AI Can Improve Teaching and Learning in Economics Education

Artificial intelligence driven tools can significantly enhance the teaching and learning of economics through five major mechanisms that improve instructional effectiveness, learner engagement, critical thinking, and data driven decision making.

- **Improved feedback and assessment:** Timely and constructive feedback is essential for helping students master economic concepts and quantitative techniques. AI powered assessment systems can instantly evaluate quizzes, short answer questions, and objective tests while providing personalized explanations for incorrect responses. These systems enable learners to identify misconceptions relating to

concepts such as opportunity cost, elasticity, inflation, and national income determination, thereby promoting continuous improvement. For teachers, automated assessment reduces marking workload and provides valuable insights into areas where students require additional instructional support (Luckin, 2017; U.S. Department of Education, Office of Educational Technology [OET], 2023).

- **Personalized learning and differentiated instruction:** Students possess different learning abilities, backgrounds, and levels of economic understanding. AI driven adaptive learning systems personalize instruction by recommending learning materials, adjusting the complexity of economic problems, and providing individualized learning pathways. For example, learners struggling with demand and supply analysis may receive additional interactive exercises and graphical demonstrations, while advanced learners can engage with complex topics such as fiscal policy, econometric analysis, or international trade. Such personalization promotes inclusive learning and improves students' academic achievement (OECD, 2023; Kasneci et al., 2023).
- **Development of critical thinking and economic reasoning:** Economics education extends beyond memorizing theories to developing learners' ability to analyse economic problems and make informed decisions. Generative AI

applications can engage students in discussions on current economic issues, generate case studies, compare alternative policy options, and encourage critical evaluation of economic evidence. Rather than providing ready made answers, AI can stimulate inquiry based learning by prompting students to justify their arguments using established economic principles (Kasneci *et al.*, 2023; Ouyang & Jiao, 2021).

➤ **Data driven instructional decision making:**

Learning analytics powered by AI enable economics teachers to monitor students' learning progress, identify difficult topics, and predict learners at risk of poor academic performance. By analysing classroom data, teachers can redesign instructional strategies, organize remedial lessons, and provide targeted interventions that address specific learning needs. AI therefore functions as a decision support system that strengthens teachers' professional judgment rather than replacing it (OECD, 2023; U.S. Department of Education OET, 2023).

➤ **Improved access to authentic economic data and learning resources:**

AI enables students to interact with current economic information, generate statistical summaries, interpret economic indicators, and explore real world datasets from national and international organizations. Generative AI can also simplify complex theories, explain

economic graphs, produce practice questions, and simulate policy debates, making economics more engaging and relevant to contemporary societal issues. However, AI generated information should always be critically evaluated because it may contain factual inaccuracies, bias, or fabricated evidence. Consequently, teachers must guide students in verifying AI generated outputs using credible academic and statistical sources (UNESCO, 2023; Kasneci *et al.*, 2023).

Overall, AI driven tools have considerable potential to transform economics education by supporting personalized instruction, strengthening analytical and quantitative skills, improving assessment practices, and promoting evidence based decision making. Nevertheless, these benefits can only be realized when AI is integrated responsibly, aligned with curriculum objectives, and used to complement rather than replace teachers' professional expertise (Ouyang & Jiao, 2021; UNESCO, 2023).

AI as Augmentation, Not Substitution in Economics Education

Artificial intelligence (AI) should support, not replace, teachers in economics education. While AI can assist with lesson planning, assessment, and content generation, teachers remain essential for explaining economic concepts, promoting critical thinking, and relating theory to real-life situations (Ouyang & Jiao, 2021).

According to Ouyang and Jiao (2021), AI in education can be AI-directed, AI-supported, or AI-empowered. In economics education, AI-supported and AI-empowered approaches are most suitable because they assist teachers while encouraging active student participation. AI can provide personalized explanations, generate practice questions, and supply real-time economic information without replacing the teacher.

AI can also create case studies and simulations on topics such as inflation, unemployment, fiscal policy, and international trade, helping students understand economic concepts through practical examples. However, teachers must verify AI-generated information and ensure that learning activities align with curriculum objectives (Kasneci *et al.*, 2023).

Effective AI integration requires teachers to possess AI literacy, including knowledge of its benefits, limitations, ethical issues, and possible biases. Continuous professional development is therefore necessary to promote responsible AI use in teaching (Daher, 2025; Sperling *et al.*, 2024).

Teachers should use AI to encourage students to analyse data, evaluate policies, and solve real-world economic problems rather than depend on AI-generated answers. This strengthens critical thinking, problem-solving, and economic reasoning (UNESCO, 2023; OECD, 2023).

Overall, AI is most effective when it serves as a teaching assistant that complements teachers' expertise, improves students' understanding, and supports meaningful

learning while keeping human judgment at the centre of economics instruction (Ouyang & Jiao, 2021; UNESCO, 2023).

Generative AI in Economics Education: Instructional Potential and Constraints

Generative artificial intelligence (AI) has transformed teaching and learning, including economics education. Tools such as ChatGPT can explain economic concepts, solve problems, generate case studies, interpret graphs, and support discussions on current economic issues. These features improve students' understanding, analytical thinking, and independent learning (Kasneci *et al.*, 2023; UNESCO, 2023).

In economics education, generative AI helps simplify concepts such as opportunity cost, price elasticity, inflation, fiscal policy, and international trade. It provides instant feedback, alternative explanations, and real-world examples, promoting active and self-paced learning (Kasneci *et al.*, 2023).

Generative AI also supports teachers by assisting with lesson planning, question generation, case study development, and preparation of learning materials. This improves instructional efficiency and allows teachers to focus more on classroom interaction (Daher, 2025; Sperling *et al.*, 2024).

However, there is a difference between using AI to support learning and relying on it to complete assignments. While AI can help students brainstorm ideas, interpret data, and improve writing, overdependence on AI-generated answers may reduce critical

thinking and academic integrity (Mollick & Mollick, 2023; UNESCO, 2023).

Despite its benefits, generative AI has limitations. It may provide inaccurate information, biased analyses, or misleading data. Therefore, students should verify AI-generated content using credible academic and official sources, while teachers should promote responsible and ethical AI use (Kasneji *et al.*, 2023; UNESCO, 2023).

To maximize its value, educational institutions should establish clear policies for AI use and redesign assessments to emphasize reasoning, data analysis, and problem-solving rather than simple reproduction of information. This approach allows generative AI to enhance learning while maintaining academic integrity (U.S. Department of Education, Office of Educational Technology [OET], 2023; UNESCO, 2023).

Conditions for Responsible Adoption of AI in Economics Education

The successful integration of artificial intelligence into economics education requires a comprehensive framework that addresses pedagogical, ethical, technological, and institutional considerations. Because AI applications influence instructional decisions, assessment practices, and students' learning experiences, their implementation should be guided by principles of responsibility, transparency, and equity rather than technological enthusiasm alone (UNESCO, 2023).

- **Privacy and data protection:** AI powered learning systems often collect

sensitive information such as students' learning records, assessment scores, classroom participation, and behavioural data. Economics educators and institutions must ensure that these data are collected, stored, and processed in accordance with established data protection policies. Teachers should avoid uploading confidential student information into AI platforms that do not provide adequate privacy safeguards, while institutions should adopt secure data management practices and establish clear policies governing the use of educational data (UNESCO, 2023; U.S. Department of Education, Office of Educational Technology [OET], 2023).

- **Bias, fairness, and inclusiveness:** AI systems may unintentionally reflect biases contained in their training data, resulting in inaccurate explanations, unfair assessment outcomes, or limited representation of developing economies. In economics education, biased AI outputs may oversimplify economic realities, overlook country specific contexts, or reinforce perspectives that are inconsistent with local economic conditions. Teachers should therefore critically evaluate AI generated content and ensure that instructional materials reflect diverse economic experiences, particularly those relevant to Nigeria and other developing economies (OECD, 2023; UNESCO, 2023).
- **Transparency and accountability:** Effective AI integration requires that both teachers and students understand

how AI systems generate recommendations, explanations, and feedback. Educators should encourage learners to question AI generated responses, verify economic information using authoritative sources, and disclose the use of AI in academic assignments where appropriate. Institutions should also establish clear guidelines defining acceptable AI use in teaching, learning, and assessment to promote transparency and accountability (OECD, 2023; U.S. Department of Education OET, 2023).

- **Academic integrity and assessment validity:** The increasing use of generative AI requires economics educators to redesign assessment practices in ways that promote authentic learning and independent thinking. Assessment activities should emphasize policy analysis, economic data interpretation, case study evaluation, classroom presentations, project based learning, and real world problem solving rather than simple reproduction of factual information. Students should also be required to acknowledge AI assistance where applicable and demonstrate their own understanding of economic concepts (Mollick & Mollick, 2023; UNESCO, 2023).
- **Teacher capacity building and institutional support:** The effective adoption of AI in economics education depends largely on teachers' competence in selecting, evaluating, and integrating AI tools into classroom practice. Continuous professional development

programmes should equip economics educators with AI literacy, ethical awareness, and practical skills for using AI responsibly. Educational institutions should also provide adequate digital infrastructure, technical support, and institutional policies that encourage innovation while safeguarding educational quality (Daher, 2025; Sperling *et al.*, 2024).

- **Regulatory compliance and continuous evaluation:** As governments and educational institutions continue to develop policies governing artificial intelligence, economics educators should ensure that AI applications comply with national and international standards relating to privacy, fairness, accountability, and educational quality. Institutions should periodically evaluate the effectiveness of AI implementation by examining its impact on students' learning outcomes, critical thinking, economic reasoning, and overall instructional quality. Continuous monitoring will ensure that AI remains a tool for educational improvement rather than a source of new inequalities or ethical concerns (European Commission, 2024; OECD, 2023).

Ultimately, responsible AI adoption in economics education requires collaboration among educators, institutional leaders, policymakers, technology developers, and students. When supported by sound governance, ethical practice, and continuous professional development, AI can become a

valuable instructional resource that strengthens economics teaching, promotes meaningful learning, and prepares students to participate effectively in an increasingly digital economy (UNESCO, 2023; Ouyang & Jiao, 2021).

Conclusion

Artificial intelligence driven tools have the potential to significantly transform the teaching and learning of economics by enhancing instructional delivery, promoting personalized learning, strengthening students' analytical and critical thinking skills, and improving assessment practices. Technologies such as adaptive learning systems, learning analytics, intelligent tutoring systems, and generative AI provide innovative opportunities for simplifying complex economic concepts, analyzing real world economic data, and supporting evidence based decision making in the classroom

However, the educational value of AI in economics education depends not on the technology itself but on its effective integration into curriculum delivery, responsible use by educators and students, and alignment with established pedagogical principles. Challenges relating to algorithmic bias, academic integrity, digital inequality, and data privacy must be carefully addressed through appropriate institutional policies, teacher capacity building, and ethical governance.

Overall, AI driven tools can serve as powerful catalysts for improving economic

education when implemented within a human centered framework that preserves teachers' professional judgment while fostering students' economic reasoning, quantitative analysis, problem solving abilities, and informed decision making. Sustainable integration requires continuous professional development, adequate digital infrastructure, curriculum alignment, and regular evaluation to ensure that AI contributes meaningfully to quality economics education and national development.

Recommendations

The recommendations for education stakeholders in Nigeria emphasize an augmentation-oriented approach to AI, where teachers use AI as support rather than a replacement for judgment. School leaders should implement policies on AI use, academic integrity, and data protection aligned with regulatory frameworks and invest in ongoing professional development to enhance AI literacy. Partnerships with universities and startups are encouraged for effective AI deployment, while policymakers should establish governance frameworks and oversight models suitable for the educational context. Future research should prioritize robust, evidence-based studies, and institutions should form interdisciplinary AI-in-education research hubs. Students need guidance on ethical AI use, and public campaigns should foster trust in AI's educational role.

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