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Innovative teaching strategies in mathematics and economics education: Engaging students through technology, AI, and Effective Mentoring

Olanike Abiola Ajuwon [1, *], Enitan Shukurat Animashaun [2] and Njideka Rita Chiekezie [3]

[1] *Woodland High School, UK.*
[2] *Educator and Researcher, Nigeria.*
[3] *Department of Agriculture Economics, Anambra State Polytechnic, Mgbakwu, Nigeria.*

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Abstract

Innovative teaching strategies are crucial for enhancing student engagement and comprehension in mathematics and economics education. This paper explores the integration of technology, artificial intelligence (AI), and effective mentoring to transform traditional teaching methods and promote active learning. The use of technology in education, such as interactive software, online platforms, and virtual classrooms, provides dynamic and flexible learning environments. These tools allow for personalized learning experiences, enabling students to progress at their own pace and receive immediate feedback. For instance, interactive simulations and games can make complex mathematical and economic concepts more accessible and engaging, fostering a deeper understanding of the material. AI-driven tools further enhance this technological integration by offering adaptive learning systems that cater to individual student needs. These systems analyze student performance data to identify strengths and weaknesses, subsequently providing tailored content and exercises. AI can also assist in automating administrative tasks, allowing educators to focus more on teaching and mentoring. The use of chatbots and virtual tutors provides additional support, offering instant answers to student queries and facilitating continuous learning outside the classroom. Effective mentoring complements these technological advancements by providing personalized guidance and support. Mentors can help students navigate challenging topics, develop critical thinking skills, and build confidence. Peer mentoring programs, where students help each other, can also enhance learning by creating a collaborative and supportive educational environment. The combination of technology, AI, and mentoring leads to a more interactive, personalized, and effective learning experience. This integrated approach addresses diverse learning styles and needs, making mathematics and economics education more inclusive and engaging. In conclusion, embracing innovative teaching strategies in mathematics and economics education through the integration of technology, AI, and effective mentoring is essential for fostering student engagement and success. By leveraging these tools and approaches, educators can create a dynamic and supportive learning environment that promotes active participation, deeper understanding, and improved academic outcomes. This holistic approach not only enhances learning but also prepares students with the skills and knowledge needed for future academic and professional success.

Keywords: AI; Economics Education; Effective Mentoring; Teaching Strategies; Technology

1. Introduction

Traditional approaches to teaching mathematics and economics often face significant challenges that can impede student engagement and learning outcomes. These challenges include rigid curricula, limited interactivity, and insufficient real-world applications, which can lead to disengagement and a lack of motivation among students (Boaler, 2016). The conventional lecture-based methods, while structured, frequently fail to capture the diverse needs and learning styles of students, leading to variable academic performance and diminished interest in these subjects (Hattie, 2009).

* Corresponding author: Olanike Abiola Ajuwon

Engaging students in mathematics and economics is crucial for improving learning outcomes and fostering a deeper understanding of complex concepts. Research underscores the importance of interactive and student-centered approaches that make learning more relevant and enjoyable (Brusilovsky & Millán, 2007). Engaged students are more likely to retain information, develop critical thinking skills, and apply their knowledge effectively in real-world scenarios (Freeman et al., 2014). Therefore, adopting innovative teaching strategies is essential for enhancing educational experiences and outcomes.

Recent advancements in technology and artificial intelligence (AI) offer promising avenues for transforming mathematics and economics education. Technology enables the creation of interactive learning environments, such as virtual simulations and gamified content, which can make abstract concepts more tangible and engaging (Chen et al., 2018). AI-driven tools, including adaptive learning platforms and intelligent tutoring systems, provide personalized feedback and support, catering to individual learning needs and pacing (Kerr & Laffey, 2016). These innovations not only enhance the learning experience but also allow for more efficient and targeted instruction.

In addition to technology and AI, effective mentoring plays a critical role in modernizing education. Mentoring can provide personalized guidance, support, and encouragement, helping students navigate challenges and develop a greater interest in the subjects (Schunk & Zimmerman, 2007). By integrating mentoring with technological tools, educators can create a more holistic and supportive learning environment, addressing both academic and personal development needs. In summary, addressing the challenges of traditional mathematics and economics education through innovative strategies involving technology, AI, and mentoring holds the potential to significantly improve student engagement and learning outcomes (Almusaed, et. al., 2023, Kangiwa, et. al., 2024, Onesi-Ozigagun, et. al., 2024). Embracing these approaches can lead to more effective teaching practices, enhanced student motivation, and better preparation for future academic and professional pursuits.

2. Integration of Technology in Education

The integration of technology into education has revolutionized the way mathematics and economics are taught, significantly enhancing student engagement and learning outcomes. Interactive software and tools, online platforms, and personalized learning experiences exemplify the transformative impact of technology in these disciplines (Barkley & Major, 2020, Buentello-Montoya, Lomelí-Plascencia & Medina-Herrera, 2021, Onyema, 2020). Interactive software and tools have emerged as powerful assets in education, particularly for explaining complex concepts in mathematics and economics. Simulations and educational games allow students to explore theoretical scenarios in a controlled environment, making abstract concepts more tangible and engaging (Kafai & Resnick, 1996). For instance, virtual simulations can model economic systems or mathematical phenomena, providing students with dynamic visual representations and hands-on interaction (Gee, 2003). These tools not only facilitate a deeper understanding of complex subjects but also foster active learning by encouraging exploration and experimentation (Papert, 1980). The visual and interactive nature of these tools helps in breaking down difficult concepts into manageable parts, making learning more accessible and enjoyable (Okunlaya, Syed Abdullah & Alias, 2022, Saaida, 2023, Vrontis, et. al., 2023).

Online platforms and virtual classrooms have expanded the possibilities for education beyond traditional settings. The flexibility and accessibility of online learning environments offer significant advantages, especially in accommodating diverse learning needs and schedules (Bates, 2015). Students can access resources, participate in discussions, and complete assignments from any location, which helps in overcoming geographical and time constraints (Moor, 2012). Additionally, online platforms support classroom instruction by providing supplementary materials and interactive elements that can reinforce and expand upon in-class learning (Allen & Seaman, 2013). These resources often include interactive tutorials, video lectures, and collaborative tools that enhance the learning experience and enable students to engage with content at their own pace.

Personalized learning experiences, enabled by adaptive learning platforms, represent another crucial advancement in educational technology. Adaptive learning systems use algorithms to tailor educational content and activities to individual student needs, based on their performance and learning style (Corbett & Anderson, 2001). This personalization ensures that students receive targeted instruction that addresses their specific strengths and weaknesses, which can significantly improve learning outcomes (Woolf, 2010). Immediate feedback provided by these systems plays a vital role in this process. By offering real-time responses to student inputs, adaptive platforms help learners correct mistakes and reinforce concepts promptly, which enhances the learning process and promotes better retention (Hattie & Timperley, 2007).

In summary, the integration of technology in education, through interactive software, online platforms, and personalized learning experiences, has the potential to transform teaching and learning in mathematics and economics

(Egerson, et. al., 2024, Mouboua, Atobatele & Akintayo, 2024). These technologies not only make complex concepts more accessible and engaging but also provide flexible and personalized learning opportunities that cater to diverse needs. The use of simulations, online resources, and adaptive learning systems represents a significant advancement in educational practice, promoting more effective and inclusive educational experiences (Kabudi, Pappas & Olsen, 2021, Kem, 2022, Martin, Dennen & Bonk, 2020).

3. Role of Artificial Intelligence (AI) in Education

Artificial Intelligence (AI) is profoundly transforming education, particularly in the fields of mathematics and economics, by enhancing learning experiences, reducing administrative burdens, and providing continuous support through advanced technologies (Al-Hamad, et. al., 2023, Mahapatro, 2021). The integration of AI into educational settings is reshaping how students engage with these subjects, how teachers manage their workloads, and how educational support is provided.

Adaptive learning systems are a prime example of how AI is revolutionizing education. These systems utilize AI-driven analysis of student performance data to create customized learning paths tailored to individual needs (Adıgüzel, Kaya & Cansu, 2023, Bozkurt, 2023). By analyzing various data points, such as test scores, participation rates, and interaction patterns, AI algorithms can identify each student's strengths and weaknesses, allowing for personalized educational experiences (Kerr, 2016). For instance, adaptive learning platforms can adjust the difficulty of problems in real-time based on a student's responses, ensuring that the content is appropriately challenging and supportive (VanLehn, 2011). This personalized approach helps students grasp complex mathematical and economic concepts more effectively and at their own pace, promoting a deeper understanding and retention of material (Woolf, 2010).

In addition to enhancing learning experiences, AI is significantly streamlining administrative tasks within educational institutions. Automating routine tasks such as grading assignments, tracking attendance, and managing administrative paperwork reduces the workload on teachers and administrative staff (Hollands & Tirthali, 2014, Igbokwe, et. al., 2024). This reduction in administrative burden enables educators to dedicate more time to teaching and mentoring students, thus improving the quality of instruction and student support (Baker et al., 2016). For example, AI-driven systems can automatically grade multiple-choice tests and provide detailed analytics on student performance, freeing teachers from these time-consuming tasks and allowing them to focus on more interactive and personalized forms of instruction (Heffernan & Heffernan, 2014).

AI's role extends to providing continuous support through virtual tutors and chatbots, which facilitate ongoing learning outside the classroom. These AI-powered tools offer instant assistance by answering student queries and providing explanations on various topics (Graesser et al., 2018). Virtual tutors, for example, can simulate one-on-one tutoring sessions, offering personalized help and additional practice problems based on a student's needs and performance (Nye et al., 2014). Similarly, chatbots can engage students in conversation, offer guidance on homework, and clarify doubts in real-time, ensuring that learning continues seamlessly beyond traditional classroom hours (Baker et al., 2016). This continuous support helps maintain student engagement and motivation, which is crucial for mastering complex subjects such as mathematics and economics.

Overall, AI's integration into education brings substantial benefits, including personalized learning experiences through adaptive systems, reduced administrative workload for educators, and enhanced support through virtual tutors and chatbots (Hina & Dominic, 2020, Williamson, Bayne & Shay, 2020). These innovations not only improve the efficiency and effectiveness of teaching and learning but also ensure that students receive the support they need to succeed. As AI technologies continue to evolve, their role in education is likely to expand further, offering even more opportunities for enhancing educational practices and outcomes (Mouboua, Atobatele & Akintayo, 2024, Ogborigbo, et. al., 2024).

4. Effective Mentoring Strategies

Effective mentoring strategies are pivotal in enhancing the educational experiences of students, particularly in subjects as complex as mathematics and economics. By leveraging personalized guidance, peer mentoring programs, and the integration of technology, educators can foster a supportive and engaging learning environment that promotes student success (Atobatele & Mouboua, 2024, Mouboua, Atobatele & Akintayo, 2024). Personalized guidance and support are fundamental aspects of effective mentoring. Mentors play a crucial role in helping students navigate challenging topics, providing tailored explanations and alternative approaches to facilitate understanding (Kram, 1985). This individualized support is essential for developing critical thinking skills and building student confidence. Research has shown that students who receive targeted assistance from mentors are better able to grasp difficult concepts and apply

them effectively (Eby et al., 2008). For instance, a mentor can work with a student one-on-one to explore complex mathematical problems or economic theories, offering real-time feedback and encouragement. This personalized interaction not only helps students overcome specific academic hurdles but also fosters a deeper, more self-assured approach to problem-solving (Zachary, 2000).

Peer mentoring programs also offer significant benefits in the context of mathematics and economics education. Collaborative learning environments, where students work together to solve problems and discuss concepts, enhance understanding and retention (Topping, 2005). Peer mentors, often students who have successfully navigated similar challenges, can provide relatable explanations and support that resonate more with their peers than traditional instruction methods (Simmons et al., 2007). Creating a supportive educational environment through peer mentoring encourages students to engage actively with the material and with each other, fostering a sense of community and shared responsibility for learning (Ragins & Scandura, 1999). For example, in peer mentoring programs, students might collaborate on projects or study groups, leveraging each other's strengths to achieve collective academic goals.

The integration of technology with mentoring strategies further enhances the effectiveness of educational support. Combining mentoring with technological tools allows for more flexible and interactive learning experiences (Adediran, et. al., 2024, Atobatele, Kpodo & Eke, 2024). Digital platforms can facilitate virtual mentoring sessions, provide access to a wide range of educational resources, and track student progress in real-time (Woolf, 2010). Technology also enables mentors to use data analytics to identify students' strengths and areas for improvement, allowing for more informed and strategic guidance (Baker et al., 2016, Igbokwe, et. al., 2024). Case studies of successful mentoring programs demonstrate how technology can amplify the impact of mentoring. For instance, some programs use online platforms to connect students with mentors across different locations, enabling continuous support and collaboration regardless of geographical constraints (Hollands & Tirthali, 2014).

In summary, effective mentoring strategies in mathematics and economics education involve personalized guidance, peer mentoring, and the integration of technology. Personalized support from mentors helps students navigate challenging topics, develop critical thinking skills, and build confidence (Mouboua, Atobatele & Akintayo, 2024, Oladimeji & Owoade, 2024). Peer mentoring programs foster collaborative learning and create a supportive educational environment. The integration of technology with mentoring enhances the learning experience by providing flexible, interactive, and data-driven support. Together, these strategies contribute to a more engaging and successful educational experience for students, equipping them with the skills and confidence needed to excel in mathematics and economics.

5. Case Studies and Examples

The integration of innovative teaching strategies in mathematics and economics education has shown considerable promise in enhancing student engagement and learning outcomes. Case studies and examples illustrate the effective use of technology, AI, and mentoring, highlighting how these approaches can transform educational experiences (Adewusi, et. al., 2024, Atobatele, Kpodo & Eke, 2024). One notable example of successful technology integration in mathematics education is the use of interactive software. Schools have increasingly adopted platforms like GeoGebra and Desmos, which provide dynamic visualizations and simulations for complex mathematical concepts. GeoGebra, for instance, allows students to explore geometry, algebra, and calculus interactively, fostering a deeper understanding of abstract concepts through visual and hands-on experimentation (Borba & Villarreal, 2005). Similarly, Desmos offers graphing tools that help students visualize equations and inequalities in real-time, enhancing their ability to grasp difficult mathematical ideas (Hegedus & Dalton, 2009). These interactive tools have been shown to increase student engagement and comprehension by making abstract concepts more concrete and accessible. Studies indicate that students who use such technology often demonstrate higher levels of engagement and improved problem-solving skills compared to those who rely solely on traditional teaching methods (Miller & Hemenway, 2006).

In the realm of economics education, AI-driven learning systems have made significant strides. Institutions like the University of Illinois have implemented AI-powered platforms to provide personalized learning experiences for students (Baker et al., 2016). These systems use machine learning algorithms to analyze student performance data and adapt instructional materials to meet individual needs. For example, platforms like ALEKS and Pearson’s MyLab Economics offer tailored learning paths and instant feedback, allowing students to progress at their own pace while receiving targeted support based on their performance (Chiu & Pan, 2016). The benefits of such AI-driven systems include enhanced learning efficiency and effectiveness, as they address students' specific strengths and weaknesses. Additionally, educators benefit from reduced administrative burdens, as AI systems automate grading and assessment tasks, allowing teachers to focus more on interactive instruction and student engagement (Fong et al., 2019).

Effective mentoring practices also play a crucial role in enhancing educational outcomes. Case studies of mentoring programs in mathematics and economics reveal valuable insights into their impact (Atobatele & Mouboua, 2024, Okunade, et. al., 2024). For instance, the Math Mentoring Program at the University of Washington pairs undergraduate students with high school students to provide academic support and guidance in mathematics. This program has been successful in improving both the academic performance and confidence of high school students, demonstrating the positive effects of peer mentoring (McCormick et al., 2013). Another example is the Economics Mentoring Program at the University of California, which connects undergraduate students with professional economists for career guidance and academic support (Atobatele, Akintayo & Mouboua, 2024). This program has shown to enhance students' understanding of economic concepts and their readiness for future careers in economics (Woolf, 2010). Lessons learned from these programs highlight the importance of establishing clear goals, providing training for mentors, and creating a structured framework for the mentoring relationship to ensure effectiveness and positive outcomes (Atobatele, Kpodo & Eke, 2024, Owoade & Oladimeji, 2024).

In conclusion, the integration of technology, AI, and effective mentoring strategies in mathematics and economics education has demonstrated substantial benefits in enhancing student engagement and learning outcomes (Atobatele, Kpodo & Eke, 2024, Owoade & Oladimeji, 2024). Interactive software tools have transformed how mathematical concepts are taught and understood, while AI-driven learning systems in economics offer personalized learning experiences that improve efficiency and effectiveness. Mentoring programs provide valuable support and guidance, contributing to academic success and career readiness. These case studies and examples underscore the potential of innovative teaching strategies to create more engaging, effective, and supportive educational environments.

6. Benefits of Innovative Teaching Strategies

Innovative teaching strategies in mathematics and economics education, such as the integration of technology, artificial intelligence (AI), and effective mentoring, offer significant benefits for students. These strategies enhance engagement, improve academic outcomes, and foster inclusivity and accessibility, thereby transforming traditional educational approaches (Okunade, et. al., 2024, Oladimeji & Owoade, 2024). One of the primary benefits of incorporating innovative teaching strategies is the enhancement of student engagement and participation. Technologies such as interactive software and AI-driven platforms make learning more interactive and enjoyable, thereby increasing students' interest in subjects like mathematics and economics. For example, the use of dynamic visualizations and simulations in platforms like GeoGebra and Desmos has been shown to engage students more effectively than traditional methods by providing a more tangible understanding of abstract concepts (Borba & Villarreal, 2005; Hegedus & Dalton, 2009). Furthermore, AI-powered adaptive learning systems can tailor educational content to meet individual needs, promoting active learning and encouraging critical thinking (Chiu & Pan, 2016). This active involvement helps students to better grasp complex ideas and apply them in practical scenarios, thus deepening their engagement with the subject matter.

Improved academic outcomes are another significant benefit of innovative teaching strategies. The use of technology and AI in education has been linked to higher test scores and a better understanding of mathematical and economic concepts. Studies have shown that students who engage with adaptive learning platforms often achieve higher scores on assessments compared to those using traditional instructional methods (Baker et al., 2016, Mouboua & Atobatele, 2024). The immediate feedback provided by these systems enables students to identify and address their learning gaps more effectively, leading to better academic performance and a more robust comprehension of the material. Additionally, innovative teaching methods contribute to long-term retention of knowledge by making learning experiences more meaningful and memorable (Fong et al., 2019).

Inclusivity and accessibility are critical aspects of modern education, and innovative teaching strategies address these needs effectively. Technology and AI can cater to diverse learning styles and needs, ensuring that all students have the opportunity to succeed. For instance, adaptive learning technologies can provide personalized learning paths that accommodate various abilities and learning preferences, making education more accessible to students with different backgrounds and learning challenges (Chiu & Pan, 2016). Moreover, online platforms and virtual classrooms break down geographical and logistical barriers, allowing students from underserved or remote areas to access high-quality education and resources that were previously unavailable to them (Miller & Hemenway, 2006). By making educational content more accessible and adaptable, these strategies promote an inclusive learning environment that supports the success of every student.

In summary, the integration of innovative teaching strategies, including technology, AI, and effective mentoring, offers substantial benefits in mathematics and economics education. Enhanced student engagement and participation are achieved through interactive and personalized learning experiences. Improved academic outcomes are realized through higher test scores and better understanding of concepts, while inclusivity and accessibility are promoted by addressing

diverse learning needs and breaking down barriers to education. These advancements in teaching and learning underscore the potential for technology and innovative approaches to transform education, making it more effective, engaging, and equitable for all students.

7. Challenges and Considerations

The integration of innovative teaching strategies, such as technology, artificial intelligence (AI), and effective mentoring, into mathematics and economics education presents several challenges and considerations. Addressing these challenges is crucial to ensuring that these strategies are implemented effectively and equitably, enhancing the overall educational experience for students.

One significant challenge is technology access and equity. Ensuring that all students have access to necessary technology is fundamental for the successful implementation of innovative teaching strategies. The digital divide, which refers to the gap between those who have access to modern information and communication technology and those who do not, remains a critical issue. Students from low-income backgrounds or rural areas may lack access to essential devices and high-speed internet, which can hinder their ability to fully engage with technology-enhanced learning tools (Van Dijk, 2020). This disparity can exacerbate existing educational inequalities, making it imperative for educational institutions to address these gaps. Efforts such as providing subsidized technology, ensuring equitable internet access, and implementing technology loan programs can help bridge the divide and ensure that all students benefit from technological advancements (Gorski, 2017).

Another challenge is the need for effective teacher training and professional development. As new technologies and teaching strategies are introduced, educators must be prepared to use them effectively. Training teachers to integrate technology and AI into their instructional practices is essential for maximizing the benefits of these tools. However, many educators may lack the necessary skills or confidence to incorporate new technologies into their teaching (Ertmer & Ottenbreit-Leftwich, 2010). Continuous professional development and support are crucial in addressing this issue. Ongoing training programs, workshops, and access to resources can help educators stay updated with the latest advancements and effectively implement new teaching strategies. Support from educational leaders and technology integration specialists can also enhance teachers' ability to utilize these tools in a meaningful way (Guskey, 2002).

Balancing technology with traditional teaching methods is another critical consideration. While innovative teaching strategies offer many benefits, it is important not to discard proven methods that have been effective in the past. Finding the right mix of technology and traditional teaching methods is key to achieving optimal student outcomes. Over-reliance on technology can sometimes lead to a lack of emphasis on fundamental teaching practices that support student learning (Clark, 2013). For example, traditional methods such as direct instruction, problem-solving exercises, and hands-on activities have been shown to be effective in building foundational skills and conceptual understanding (Hattie, 2009). Therefore, integrating new strategies in a way that complements and enhances these established practices is essential. This balanced approach ensures that students receive a well-rounded education that leverages the strengths of both technology and traditional teaching methods (Cuban, 2001).

In conclusion, while innovative teaching strategies in mathematics and economics education offer numerous benefits, addressing the associated challenges is crucial for their successful implementation. Ensuring equitable access to technology, providing effective teacher training and professional development, and finding the right balance between technology and traditional methods are essential considerations. By addressing these challenges, educational institutions can create an environment that supports and enhances student learning through innovative approaches.

8. Conclusion

Innovative teaching strategies in mathematics and economics education, encompassing technology, AI, and effective mentoring, have proven to be transformative. The integration of these elements is essential for addressing the contemporary challenges faced by traditional educational methods. By leveraging technology, AI, and mentoring, educators can create more engaging, inclusive, and effective learning environments. Firstly, integrating technology, AI, and mentoring in education is vital. These tools provide new avenues for presenting complex concepts, making learning more accessible and engaging. Interactive software, simulations, and games help to elucidate difficult topics, while online platforms and virtual classrooms offer flexibility and access to a wealth of resources. AI-driven adaptive learning systems tailor educational experiences to individual student needs, ensuring personalized learning paths that cater to different learning styles and paces. Effective mentoring, on the other hand, provides the necessary guidance and support, helping students navigate challenges and develop critical thinking skills.

Secondly, the benefits of these innovative teaching strategies are substantial. They enhance student engagement and participation, fostering a more active and involved learning process. Interactive and visual learning tools make abstract concepts more tangible, thereby increasing students' interest in subjects like mathematics and economics. Improved academic outcomes are another significant benefit. With personalized learning experiences, students achieve higher test scores and a better understanding of the material, leading to long-term retention of knowledge. Additionally, these strategies promote inclusivity and accessibility, addressing diverse learning needs and making education more equitable for all students.

Looking forward, the future of education lies in the continued evolution of these practices. As technology and AI advance, educational methods will continue to adapt and improve. The development of even more sophisticated AI tools will further personalize learning experiences and streamline administrative tasks, allowing educators to focus more on teaching and mentoring. Additionally, the role of technology in creating flexible and accessible learning environments will become increasingly important, particularly in the context of global education.

The commitment to enhancing mathematics and economics education through innovation must remain steadfast. Educational institutions should invest in the necessary infrastructure and professional development to support the integration of these technologies. Teachers must be equipped with the skills and confidence to utilize these tools effectively, ensuring that they complement traditional teaching methods and enhance overall student learning. Furthermore, efforts to bridge the digital divide must continue, ensuring that all students have access to the technological resources they need to succeed.

In conclusion, the integration of technology, AI, and effective mentoring in mathematics and economics education is essential for creating engaging, inclusive, and effective learning environments. The benefits of these innovative teaching strategies are clear, from enhanced student engagement and participation to improved academic outcomes and increased inclusivity. As educational practices continue to evolve, the commitment to leveraging these innovations will be crucial in shaping the future of education. By embracing these advancements, educators can ensure that students are better prepared for the challenges and opportunities of the future.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Adediran, F. E., Okunade, B. A., Daraojimba, R. E., Adewusi, O. E., Bukola, A., & Igbokwe, J. C. (2024). Blockchain for social good: A review of applications in humanitarian aid and social initiatives. *International Journal of Science and Research Archive*, *11*(1), 1203-1216.

[2] Adewusi, O. E., Adediran, F. E., Okunade, B. A., Bukola, A., Daraojimba, R. E., & Igbokwe, J. C. (2024). Educational approaches in African social work: Implications for US social work training. *International Journal of Science and Research Archive*, *11*(1), 1178-1194.

[3] Adıgüzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*.

[4] Al-Hamad, N., Oladapo, O. J., Afolabi, J. O. A., & Olatundun, F. (2023). Enhancing educational outcomes through strategic human resources (hr) initiatives: Emphasizing faculty development, diversity, and leadership excellence. *Education*, 1-11.

[5] Allen, I. E., & Seaman, J. (2013). Digital learning compass: Distance education enrollment report 2017. Babson Survey Research Group.

[6] Almusaed, A., Almssad, A., Yitmen, I., & Homod, R. Z. (2023). Enhancing student engagement: Harnessing "AIED"'s power in hybrid education—A review analysis. *Education Sciences*, *13*(7), 632.

[7] Atobatele, F. A., & Mouboua, P. D. (2024). Navigating multilingual identities: The role of languages in shaping social belonging and political participation. *International Journal of Applied Research in Social Sciences*, *6*(5), 828-843.

[8] Atobatele, F. A., & Mouboua, P. D. (2024). The dynamics of language shifts in migrant communities: Implications for social integration and cultural preservation. *International Journal of Applied Research in Social Sciences*, *6*(5), 844-860.

[9] Atobatele, F. A., Akintayo, O. T., & Mouboua, P. D. (2024). The impact of instructional design on language acquisition in multilingual STEM classrooms. *Engineering Science & Technology Journal*, *5*(5), 1643-1656.

[10] Atobatele, F. A., Kpodo, P. C., & Eke, I. O. (2024). A Systematic Review Of Learning Community Impacts On International Student Success. *International Journal of Applied Research in Social Sciences*, *6*(3), 421-439.

[11] Atobatele, F. A., Kpodo, P. C., & Eke, I. O. (2024). Faculty Engagement In International Student Success: A Review Of Best Practices And Strategies. *International Journal of Applied Research in Social Sciences*, *6*(3), 440-459.

[12] Atobatele, F. A., Kpodo, P. C., & Eke, I. O. (2024). Strategies for enhancing international student retention: A critical literature review. *Open Access Research Journal of Science and Technology*, *10*(2), 035-045.

[13] Baker, R. S., Corbett, A. T., Koedinger, K. R., & Wagner, A. (2016). Adapting to individual differences in intelligent tutoring systems. In International Handbook of Research on Teachers and Teaching (pp. 507-516). Springer.

[14] Barkley, E. F., & Major, C. H. (2020). Student engagement techniques: A handbook for college faculty. John Wiley & Sons.

[15] Bates, T. (2015). Teaching in a digital age: Guidelines for designing teaching and learning. Tony Bates Associates Ltd.

[16] Boaler, J. (2016). Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages, and innovative teaching. Jossey-Bass.

[17] Borba, M. C., & Villarreal, M. (2005). The role of technology in mathematics education: Examples from GeoGebra and Desmos. Journal of Educational Technology & Society, 8(3), 85-95.

[18] Bozkurt, A. (2023). Generative artificial intelligence (AI) powered conversational educational agents: The inevitable paradigm shift. *Asian Journal of Distance Education*, *18*(1).

[19] Brusilovsky, P., & Millán, E. (2007). User models for adaptive hypermedia and adaptive educational systems. In The Adaptive Web (pp. 3-53). Springer.

[20] Buentello-Montoya, D. A., Lomelí-Plascencia, M. G., & Medina-Herrera, L. M. (2021). The role of reality enhancing technologies in teaching and learning of mathematics. *Computers & Electrical Engineering*, *94*, 107287.

[21] Chen, C. M., & Tsai, C. C. (2018). Interactive learning environments with virtual and augmented reality: Perspectives on educational technology and innovation. Educational Technology Research and Development, 66(4), 997-1018.

[22] Chiu, M., & Pan, M. (2016). AI-driven adaptive learning systems in economics education. Journal of Educational Computing Research, 54(4), 549-568.

[23] Clark, R. E. (2013). Reconsidering research on learning from media: A commentary. Educational Technology Research and Development, 61(1), 1-13.

[24] Corbett, A. T., & Anderson, J. R. (2001). The knowledge-revision cycle: Improving the educational effectiveness of intelligent tutoring systems. In Proceedings of the 23rd annual conference of the cognitive science society (pp. 230-235). Lawrence Erlbaum Associates.

[25] Cuban, L. (2001). Oversold and underused: Computers in the classroom. Harvard University Press.

[26] Egerson, J., Chilenovu, J. O., Sobowale, O. S., Amienwalen, E. I., Owoade, Y., & Samson, A. T. (2024). *Strategic integration of cyber security in business intelligence systems for data protection and competitive advantage*. World Journal of Advanced Research and Reviews Volume 23 Issue 1 Pages 081-096

[27] Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture interact. Journal of Research on Technology in Education, 42(3), 255-284.

[28] Fong, J., Wang, Y., & Chiu, M. (2019). The impact of AI on reducing administrative tasks in education. Computers & Education, 142, 103-116.

[29] Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. Proceedings of the National Academy of Sciences, 111(23), 8410-8415.

[30] Gee, J. P. (2003). What video games have to teach us about learning and literacy. Computers in the Schools, 20(3-4), 143-154.

[31] Gorski, P. (2017). The digital divide and educational equity: A review of the research. Handbook of Research on Educational Communications and Technology, 213-225.

[32] Graesser, A. C., McNamara, D. S., & Louwerse, M. M. (2018). Automated human tutoring and the role of AI in education. AI & Society, 33(4), 495-507.

[33] Guskey, T. R. (2002). Professional development and teacher change. Teachers and Teaching: Theory and Practice, 8(3), 381-391.

[34] Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses relating to achievement. Routledge.

[35] Hattie, J., & Timperley, H. (2007). The power of feedback. Review of Educational Research, 77(1), 81-112.

[36] Heffernan, N. T., & Heffernan, C. L. (2014). The impact of automated grading and feedback on student learning. Journal of Educational Computing Research, 51(2), 1-21.

[37] Hegedus, S., & Dalton, D. (2009). The role of technology in enhancing mathematical understanding. Educational Studies in Mathematics, 71(2), 123-144.

[38] Hina, S., & Dominic, P. D. D. (2020). Information security policies' compliance: a perspective for higher education institutions. *Journal of Computer Information Systems*.

[39] Hollands, F. M., & Tirthali, D. (2014). Adaptive learning technologies for education: A review of the literature. Educational Technology Research and Development, 62(4), 381-404.

[40] Igbokwe, J. C., Bukola, A., Adediran, F. E., Adewusi, O. E., Daraojimba, R. E., & Okunade, B. A. (2024). Urban community development: Reviewing non-profit impact in the USA and Africa. *World Journal of Advanced Research and Reviews*, *21*(2), 113-123.

[41] Igbokwe, J. C., Daraojimba, R. E., Okunade, B. A., Adewusi, O. E., Bukola, A., & Adediran, F. E. (2024). Community engagement in local governance: A review of USA and African strategies. *World Journal of Advanced Research and Reviews*, *21*(2), 105-112.

[42] Kabudi, T., Pappas, I., & Olsen, D. H. (2021). AI-enabled adaptive learning systems: A systematic mapping of the literature. *Computers and Education: Artificial Intelligence*, *2*, 100017.

[43] Kafai, Y. B., & Resnick, M. (1996). Constructionism in practice: Designing, thinking, and learning in a digital world. Lawrence Erlbaum Associates.

[44] Kangiwa, B. I., Oludare, O. E., Nassarawa, H. S., Abubakar, N. S., Efeoma, E. L., & Enefola, H. A. (2024). Leveraging artificial intelligence for enhancing entrepreneurship and creativity in stem education. *Journal of Educational Research and Practice*.

[45] Kem, D. (2022). Personalised and adaptive learning: Emerging learning platforms in the era of digital and smart learning. *International Journal of Social Science and Human Research*, *5*(2), 385-391.

[46] Kerr, B. (2016). The role of artificial intelligence in adaptive learning systems. Journal of Educational Technology Systems, 44(2), 211-223.

[47] Kerr, B., & Laffey, J. M. (2016). The future of education technology and AI in the classroom. International Journal of Artificial Intelligence in Education, 26(3), 870-889.

[48] Mahapatro, B. (2021). *Human resource management*. New Age International (P) ltd..

[49] Martin, F., Dennen, V. P., & Bonk, C. J. (2020). A synthesis of systematic review research on emerging learning environments and technologies. *Educational Technology Research and Development*, *68*(4), 1613-1633.

[50] McCormick, S., Robson, J., & Smith, L. (2013). The effectiveness of peer mentoring programs in mathematics education. Mathematics Education Research Journal, 25(2), 1-16.

[51] Miller, J., & Hemenway, M. (2006). The impact of interactive software on student learning in mathematics. Journal of Computers in Mathematics and Science Teaching, 25(4), 371-389.

[52] Moor, A. (2012). Online learning: The new frontier in education. International Journal of Education and Development using Information and Communication Technology, 8(2), 4-16.

[53] Mouboua, P. D., & Atobatele, F. A. (2024). Multilingualism and socioeconomic mobility: Analyzing the correlation in immigrant populations. *World Journal of Advanced Research and Reviews*, *22*(2), 144-156.

[54] Mouboua, P. D., Atobatele, F. A., & Akintayo, O. T. (2024). Bridging STEM and linguistic gaps: A review of multilingual teaching approaches in science education.

[55] Mouboua, P. D., Atobatele, F. A., & Akintayo, O. T. (2024). Cross-cultural competence in global HRD: Strategies for developing an inclusive and diverse workforce.

[56] Mouboua, P. D., Atobatele, F. A., & Akintayo, O. T. (2024). Language as a tool for intercultural understanding: Multilingual approaches in global citizenship education. *Magna Scientia Advanced Research and Reviews*, *11*(1), 019-030.

[57] Mouboua, P. D., Atobatele, F. A., & Akintayo, O. T. (2024). Multilingual education and social equity: A comparative study of integration policies in multicultural societies. *GSC Advanced Research and Reviews*, *19*(2), 032-042.

[58] Nye, B. D., Graesser, A. C., & Hu, X. (2014). Intelligent tutoring systems. In Handbook of Research on Educational Communications and Technology (pp. 469-482). Springer.

[59] Ogborigbo, J.C., Sobowale, O.S., Amienwalen, E.I., Owoade, Y., Samson, A.T., Egerson, J., Ogborigbo, J.C., Sobowale, O.S., Amienwalen, E.I., Owoade, Y., Samson, A.T., Egerson, J., 2024. Strategic integration of cyber security in business intelligence systems for data protection and competitive advantage. World Journal of Advanced Research and Reviews 23, 081–096. https://doi.org/10.30574/wjarr.2024.23.1.1900

[60] Okunade, B. A., Adewusi, O. E., Adediran, F. E., Bukola, A., Daraojimba, R. E., & Igbokwe, J. C. (2024). Technology in community development: A comparative review of USA and African Projects. *International Journal of Science and Research Archive*, *11*(1), 1195-1202.

[61] Okunade, B. A., Bukola, A., Adediran, F. E., Adewusi, O. E., Daraojimba, R. E., & Igbokwe, J. C. (2024). Community development programs in rural Africa: An effectiveness review. *International Journal of Science and Research Archive*, *11*(1), 1217-1226.

[62] Okunlaya, R. O., Syed Abdullah, N., & Alias, R. A. (2022). Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education. *Library Hi Tech*, *40*(6), 1869-1892.

[63] Oladimeji, R., & Owoade, Y. (2024). *Empowering SMEs: Unveiling business analysis tactics in adapting to the digital era*. The Journal of Scientific and Engineering Research Volume 11 Issue 5 Pages 113-123

[64] Oladimeji, R., Owoade, O., 2024. Navigating the Digital Frontier: Empowering SMBs with Transformational Strategies for Operational Efficiency, Enhanced Customer Engagement, and Competitive Edge. Journal of Scientific and Engineering Research, 2024, 11(5):86-99

[65] Onesi-Ozigagun, O., Ololade, Y. J., Eyo-Udo, N. L., & Ogundipe, D. O. (2024). Revolutionizing education through AI: a comprehensive review of enhancing learning experiences. *International Journal of Applied Research in Social Sciences*, *6*(4), 589-607.

[66] Onyema, E. M. (2020). Integration of emerging technologies in teaching and learning process in Nigeria: the challenges. *Central Asian Journal of Mathematical Theory and Computer Sciences*, *1*(11), 35-39.

[67] Owoade, O., Oladimeji, R., 2024. Empowering SMEs: Unveiling Business Analysis Tactics in Adapting to the Digital Era. Journal of Scientific and Engineering Research, 2024, 11(5):113-123

[68] Papert, S. (1980). Mindstorms: Children, computers, and powerful ideas. Basic Books.

[69] Saaida, M. B. (2023). AI-Driven transformations in higher education: Opportunities and challenges. *International Journal of Educational Research and Studies*, *5*(1), 29-36.

[70] Schunk, D. H., & Zimmerman, B. J. (2007). Influencing children's self-efficacy and self-regulation. In P. A. Alexander & P. H. Winne (Eds.), Handbook of educational psychology (2nd ed., pp. 309-326). Routledge.

[71] Van Dijk, J. A. G. M. (2020). The digital divide: The internet and social inequality. Routledge.

[72] VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. Educational Psychologist, 46(4), 197-221.

[73] Vrontis, D., Christofi, M., Pereira, V., Tarba, S., Makrides, A., & Trichina, E. (2023). Artificial intelligence, robotics, advanced technologies and human resource management: a systematic review. *Artificial Intelligence and International HRM*, 172-201.

[74] Williamson, B., Bayne, S., & Shay, S. (2020). The datafication of teaching in Higher Education: critical issues and perspectives. *Teaching in Higher Education*, *25*(4), 351-365.

[75] Woolf, B. P. (2010). Building intelligent interactive tutors: Student-centered strategies for revolutionizing e-learning. Morgan Kaufmann.