RESOLVING THE CONFLICT BETWEEN INNOVATION AND SUSTAINABILITY OF ARTIFICIAL INTELLIGENCE IN EDUCATIONAL ASSESSMENT AND EVALUATION IN HIGHER EDUCATION INSTITUTIONS IN NIGERIA

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Abstract
Advanced Artificial Intelligence (AI) technologies are being used, particularly in educational assessments and evaluation venturing into an exciting new era in education. This transformation, is not just about swapping out old pen-and-paper methods of assessment with shiny new technology. In fact, it is about a total makeover of our approach to assessing and evaluating from the ground up. In this article, the researchers explore the many ways AI is creating change, from how assessments are created, managed and evaluated to how answers are scored, providing comprehensive feedback. The notes that the influence of AI does not stop with assessments and evaluation, as its impact extends to various aspects of education, including personalised learning, curriculum design, administrative efficiency, and even teacher-student interactions. It can also decode heaps of assessment and evaluation data, providing a tailor-made assessment and evaluation experience for every teacher and student. AI-powered tools can help tailor learning experiences to individual student needs, automate administrative tasks, provide real-time feedback, and facilitate more engaging and interactive lessons. Moreover, AI has the potential to assist in identifying learning gaps, predicting student performance, and offering targeted interventions, ultimately transforming both teaching and learning processes. While AI offers numerous benefits, it is essential to balance them with crucial concerns such as privacy and fairness. So, the article delves into the ethical side of using AI in assessment and evaluation. The article discussed ways to navigate these issues responsibly. Lastly, it ponders on the potential developments AI could bring to the assessment and evaluation landscape. It concludes that for higher education institutions in Nigeria to leverage AI in a responsibly way, they need an ethical core that is robust and meaningful. It recommends ways of balancing innovation in educational assessment and evaluation with responsibility.

Keywords: Technology, innovation, education, privacy, fairness

Introduction

Artificial Intelligence (AI) is increasingly transforming educational assessment and evaluation by introducing new methods and tools that enhance the accuracy, efficiency, and personalisation of these processes. AI technologies, which

include machine learning, natural language processing, and data analytics, offer a range of applications that can significantly improve how student performance is measured and how educational outcomes are evaluated. Artificial intelligence offers transformative potential for educational assessment and evaluation by enhancing accuracy, efficiency, and personalisation. Educators can gain deeper insights into student learning, provide more tailored support, and ultimately improve educational outcomes by leveraging AI technologies.

The integration of Artificial Intelligence (AI) in educational assessment and evaluation has the potential to revolutionise Higher Education Institutions (HEIs). However, addressing challenges related to data privacy, security, and bias is essential to ensure responsible and equitable use of AI in educational assessment and evaluation. The conflict between innovation and sustainability in AI applications for educational assessment calls for a strategic approach that incorporates ethical considerations, sustainable practices, and robust governance frameworks. By adopting such an approach, higher education institutions can harness the benefits of AI while mitigating potential risks and ensuring that advancements in AI-driven technologies contribute positively to long-term educational goals.

AI-driven technologies can offer personalised learning experiences, efficient grading systems, and predictive analytics to enhance student outcomes. AI-driven tools promise enhanced accuracy, efficiency, and personalisation in assessments, revolutionising educational practices (Luckin et al., 2016). However, the rapid adoption of AI also raises significant concerns regarding sustainability, including ethical considerations, data privacy, equity, and the environmental impact of AI technologies (Borenstein & Howard, 2021). Balancing innovation and sustainability in AI-driven educational assessment and evaluation is crucial for the long-term success and ethical integrity of HEIs.

Innovation in AI-Driven Educational Assessment

Innovation in AI for educational assessment involves developing sophisticated algorithms that can analyse vast amounts of data to provide insights into student performance and learning outcomes. These innovations can help identify learning gaps, personalise learning experiences, and enhance the overall quality of education (Holmes, 2019). AI innovations in educational assessment involve automated grading systems, adaptive learning platforms, and predictive analytics. Automated grading systems, such as those using natural language processing (NLP), can provide quick and consistent feedback on student assignments (Balfour, 2013).

Adaptive learning platforms tailor educational content to individual student needs, enhancing engagement and learning efficiency (Pane et al., 2014). Predictive analytics utilise student data to identify at-risk students and recommend interventions, potentially improving retention rates and academic success (Johnson et al., 2014). Nonetheless, ensuring the sustainability of these technologies

necessitates addressing issues such as the carbon footprint of AI operations, equitable access to AI tools, and maintaining data security and privacy (Van der Velden, 2018).

Artificial Intelligence in Educational Assessment and Evaluation

Artificial intelligence (AI) is increasingly transforming educational assessment and evaluation by introducing new methods and tools that enhance the accuracy, efficiency, and personalisation of these processes. AI technologies, which include machine learning, natural language processing, and data analytics, offer a range of applications that can significantly improve how student performance is measured and how educational outcomes are evaluated. The following are areas that AI technologies may be very useful in transforming educational assessment and evaluation:

Enhanced Accuracy and Efficiency

AI-driven assessment tools can process large volumes of data more quickly and accurately than traditional methods. For example, automated essay scoring systems use natural language processing to evaluate written responses based on various linguistic and semantic criteria, providing consistent and objective scoring (Shermis & Hamner, 2012). These systems reduce the workload on educators and allow for the timely provision of feedback to students. Machine learning algorithms can analyze patterns in student data to predict performance outcomes and identify areas where students may need additional support (Nguyen, Gardner, & Sheridan, 2020). This predictive capability enables educators to intervene early and tailor their teaching strategies to individual student needs, thus enhancing the overall effectiveness of instruction.

Personalised Learning and Adaptive Assessments

One of the most significant advantages of AI in educational assessment is its ability to personalise learning experiences. Adaptive assessment systems use AI to dynamically adjust the difficulty and type of questions based on a student's performance in real-time. This ensures that each student is challenged at an appropriate level and can progress at their own pace (Klinkenberg, Straatemeier, & van der Maas, 2011). These personalised assessments help educators understand the specific learning needs and strengths of each student, allowing for more targeted and effective teaching interventions. Additionally, AI can provide students with personalized feedback and recommendations for further study, helping them to take ownership of their learning journey.

Comprehensive Data Analysis and Insights

AI technologies enable the comprehensive analysis of educational data, providing valuable insights into student learning and institutional performance.

Learning analytics platforms utilise AI to analyse data from various sources, including learning management systems, online assessments, and student interactions, to identify trends and patterns (Siemens & Baker, 2012). These insights can inform decision-making at multiple levels, from classroom instruction to institutional policy. For instance, educators can use data analytics to identify which teaching methods are most effective, while administrators can leverage insights to improve curriculum design and resource allocation.

Challenges of Artificial Intelligence in Educational Assessment and Evaluation

Despite the many benefits, the implementation of AI in educational assessment and evaluation also presents several challenges. The following are the potential challenges AI posed in educational assessment and evaluation.

Data Privacy and Security

One significant concern is data privacy and security. AI systems require access to large amounts of student data, raising concerns about how this data is collected, stored, and used (Slade & Prinsloo, 2013). Ensuring robust data protection measures is essential to maintain trust and comply with legal and ethical standards.

Potential for Bias in AI Algorithms

Another challenge is the potential for bias in AI algorithms. If the data used to train AI systems is biased, the resulting assessments may also be biased, leading to unfair outcomes for certain groups of students (Holstein et al., 2019). It is crucial to design and validate AI systems carefully to mitigate bias and ensure equity in educational assessment.

Sustainability Concerns

Despite the benefits, the deployment of AI in education brings about sustainability concerns. One major issue is data privacy. AI systems require vast amounts of data to function effectively, raising questions about how student data is collected, stored, and used (Williamson & Eynon, 2020). Ensuring data privacy and security is crucial to protect students' personal information and maintain trust in educational institutions.

Equity Concern

Equity is another critical concern. There is a risk that AI technologies could exacerbate existing inequalities if they are not accessible to all students or if they inadvertently introduce biases into the assessment process (Holmes et al., 2019). Ensuring that AI tools are inclusive and fair is essential to avoid reinforcing educational disparities.

Ethical Considerations

Ethical considerations also play a significant role in the sustainability of AI in education. The development and implementation of AI technologies must adhere to ethical guidelines that prioritise student well-being and academic integrity (Borenstein & Howard, 2021). This includes transparency in AI algorithms and decision-making processes, as well as accountability for the outcomes produced by these systems.

Environmental Impact

The environmental impact of AI cannot be overlooked. AI technologies require significant computational resources, which can contribute to carbon emissions and environmental degradation (Strubell et al., 2019). Sustainable practices in the development and deployment of AI, such as energy-efficient algorithms and green data centers, are necessary to mitigate these environmental impacts.

Resolving the Conflict between Innovation and Sustainability of Artificial Intelligence

Resolving the conflict between innovation and sustainability in AI-driven educational assessment requires a multifaceted approach. HEIs must adopt comprehensive data governance frameworks that ensure data privacy and security while promoting transparency and accountability in AI systems (Williamson & Eynon, 2020). Additionally, promoting digital literacy among students and educators can help them understand and critically evaluate AI tools, fostering a culture of informed and ethical AI use (Holmes et al., 2019). Ensuring equity in AI implementation involves designing inclusive technologies that cater to diverse student populations. This includes addressing potential biases in AI algorithms and ensuring equal access to AI resources and support (Holmes et al., 2019). Collaborative efforts between educators, technologists, and policymakers are essential to create AI systems that are both innovative and equitable.

To address environmental concerns, HEIs can invest in sustainable AI practices, such as developing energy-efficient algorithms and utilising renewable energy sources for data centers (Strubell et al., 2019). Research into the environmental impact of AI in education can further inform policies and practices that minimise ecological footprints. Resolving the conflict between innovation and sustainability in the use of Artificial Intelligence (AI) for educational assessment and evaluation in higher education institutions in Nigeria involves addressing several key challenges and opportunities. Here are some strategies to consider:

Balancing Innovation with Ethical Considerations

i. ***Fairness and Bias:*** Ensure that AI systems used for assessment are free from biases that could disadvantage certain groups of students. This involves regularly auditing AI algorithms for fairness and inclusivity.

ii. ***Transparency:*** Maintain transparency in how AI systems operate and make decisions. Clear communication about the AI's role and functionality helps build trust among stakeholders.

Sustainable Implementation

i. ***Infrastructure Investment:*** Invest in robust and sustainable infrastructure that supports the long-term use of AI. This includes reliable internet access, adequate hardware, and continuous maintenance.

ii. ***Capacity Building***: Train educators and administrators on the use and management of AI tools. This ensures that the technology is used effectively and sustainably.

Policy and Regulatory Framework

i. ***Regulation Compliance:*** Develop and adhere to policies that regulate the use of AI in educational assessments. These policies should align with national and international standards for data privacy and security.

ii. ***Ethical Guidelines:*** Establish ethical guidelines for the development and use of AI in education, ensuring that they prioritize student well-being and privacy.

Cost-Effectiveness

i. ***Cost-Benefit Analysis:*** Conduct thorough cost-benefit analyses to ensure that the implementation of AI technologies is financially sustainable. This involves evaluating the initial investment against the long-term benefits.

ii. ***Funding and Partnerships:*** Seek funding opportunities and partnerships with tech companies and international organizations to support the sustainable deployment of AI in education.

Adaptability and Scalability

i. **Customisable Solutions**: Implement AI systems that are flexible and can be customized to meet the specific needs of Nigerian higher education institutions.

ii. ***Scalability:*** Ensure that AI solutions can scale effectively as the number of users increases, without compromising on performance or accessibility.

Stakeholder Engagement

i. ***Inclusive Decision-Making:*** Engage all relevant stakeholders, including students, educators, administrators, and policymakers, in the planning and implementation processes. This ensures that the AI systems meet the actual needs of the education community.

ii. ***Feedback Mechanisms:*** Establish continuous feedback mechanisms to gather input from users and make necessary adjustments to the AI systems.

Research and Development

i. ***Continuous Innovation:*** Encourage ongoing research into new AI technologies and their potential applications in educational assessment. This helps institutions stay at the forefront of technological advancements while maintaining sustainability.

ii. ***Pilot Programs:*** Implement pilot programs to test new AI technologies in a controlled environment before full-scale deployment. This allows for the identification and resolution of potential issues early on.

Policy Development and Implementation

The following are policy development implementation strategies to consider:

National and Institutional Policies:

i. Develop national policies that encourage the adoption of AI in education while ensuring sustainable practices. These policies should provide a framework for ethical AI use, data privacy, and inclusion.

ii. Institutions should create internal policies aligned with national guidelines to ensure that AI applications are used responsibly and sustainably.

Capacity Building

i. Training and Education:

a. Invest in training educators and administrators on AI tools and their sustainable use. This includes understanding the ethical implications and technical aspects of AI in assessment.

b. Encourage interdisciplinary research and collaboration to foster innovative and sustainable AI practices in education.

Infrastructure and Resources

i. ***Technological Infrastructure:***

a. Improve the technological infrastructure in higher education institutions to support AI tools. This includes reliable internet access, adequate hardware, and software resources.

b. Ensure that these infrastructures are energy-efficient and environmentally friendly to support sustainability goals.

Ethical and Inclusive AI

i. Ethical AI Practices:

a. Establish ethical guidelines for AI usage in educational assessment, focusing on transparency, fairness, and accountability.

b. Promote AI systems that are designed to minimize biases and are inclusive of diverse student populations.

Data Management

i. ***Sustainable Data Practices:***

a. Develop robust data management systems that ensure data privacy and security. This includes secure data storage solutions that are both effective and environmentally sustainable.

b. Utilise AI algorithms that are efficient and minimize energy consumption during data processing.

Research and Development

i. Sustainable Innovation:

a. Encourage research in AI that focuses on sustainable innovation, such as developing algorithms that require less computational power.

b. Support pilot projects and case studies that demonstrate successful integration of AI in a sustainable manner.

Funding and Investment

i. ***Sustainable Funding Models:***

a. Secure funding from government and private sectors that is specifically allocated to sustainable AI initiatives in education.

b. Encourage partnerships with tech companies and non-profits that focus on sustainability in AI.

Community Engagement and Awareness

i. ***Stakeholder Involvement:***

a. Engage all stakeholders, including students, educators, policymakers, and the community, in discussions about the benefits and challenges of AI in education.

b. Raise awareness about the importance of sustainability in AI through workshops, seminars, and public campaigns.

Monitoring and Evaluation

i. ***Continuous Improvement:***

a. Implement monitoring and evaluation systems to regularly assess the impact of AI on educational assessment and its sustainability.

b. Use feedback from these evaluations to make necessary adjustments and improvements to policies, practices, and technologies.

Practical Steps for Implementation

The following are practical steps HEIs in Nigeria can take to resolving the conflict between innovation and sustainability in AI-driven educational assessment.

i. Assessment of Needs: Conduct a thorough assessment of the specific needs and challenges faced by higher education institutions in Nigeria.

ii. Selection of Appropriate AI Tools: Choose AI tools that are suitable for the identified needs, ensuring they are reliable, ethical, and sustainable.

iii. Training and Support: Provide comprehensive training for educators and administrators on the effective use of AI tools.

iv. Monitoring and Evaluation: Establish robust monitoring and evaluation frameworks to track the performance and impact of AI systems, making adjustments as necessary.

v. Collaborative Networks: Build networks with other institutions and organisations to share best practices and resources.

vi. Form a Task Force: Create a task force comprising educators, IT specialists, policymakers, and sustainability experts to oversee the integration of AI in a sustainable manner.

vii. Pilot Projects: Start with pilot projects in select institutions to test the feasibility and impact of AI tools in assessment. These projects can provide valuable insights and serve as models for broader implementation.

viii. Feedback Mechanisms: Develop mechanisms for continuous feedback from all stakeholders to ensure the AI systems meet educational goals and sustainability standards.

ix. Partnerships: Establish partnerships with international organizations and

universities that have successfully integrated AI in education sustainably to learn and adapt best practices.

x. Policy and Governance Frameworks: Establishing robust policy and governance frameworks is essential to ensure that the integration of AI in educational assessment aligns with sustainability goals. These policies should emphasize ethical considerations, data privacy, and equity in access to technology.

xi. Ethical and Responsible AI Use: Implementing AI in education should be guided by ethical principles to avoid biases and ensure fair evaluation processes. This includes developing algorithms that are transparent and explainable.

xii. Capacity Building and Training: Investing in capacity building for educators and administrators is crucial. Training programs on the effective and sustainable use of AI tools can help integrate these technologies seamlessly into the educational assessment processes.

xiii. Infrastructure Development: Ensuring that higher education institutions have the necessary infrastructure to support AI applications is vital. This includes reliable internet access, modern hardware, and software, and technical support.

xiv. Research and Innovation Funding: Promoting research and development in AI applications for education through dedicated funding can foster innovation while ensuring sustainability. This includes supporting local research initiatives that address the specific needs and contexts of Nigerian higher education.

Conclusion

Balancing innovation with sustainability in the use of AI for educational assessment in Nigerian Higher Education Institutions requires a comprehensive approach. This includes developing robust policies, ensuring ethical use, investing in capacity building, improving infrastructure, funding research, fostering partnerships, and continuous monitoring. AI-driven educational assessment is crucial for the long-term success and ethical integrity of HEIs. By addressing data privacy, equity, ethical considerations, and environmental impacts, institutions can harness the benefits of AI while ensuring responsible and sustainable use. Ongoing collaboration, research, and policy development are key to achieving this balance and fostering a future where AI enhances educational outcomes without compromising ethical and sustainable standards.

Suggestions

i. Higher Education Institutions in Nigeria can effectively balance innovation with sustainability by ensuring that the integration of AI in educational assessment and evaluation is both progressive and responsible.

ii. Nigerian Higher Education Institutions can effectively leverage AI for educational assessment and evaluation while ensuring that such innovations are sustainable and equitable.

iii. Higher Education Institutions in Nigeria should address various challenges and leveraging opportunities.

iv. Building partnerships with technology companies, international organizations, and other educational institutions can provide additional resources and expertise. These collaborations can facilitate the adoption of sustainable AI practices in educational assessments.

v. Establishing mechanisms for continuous monitoring and evaluation of AI applications in educational assessments ensures that they remain aligned with sustainability goals. This involves regularly reviewing the impact of AI tools on educational outcomes and making necessary adjustments.

References

Balfour, S. P. (2013). Assessing writing in MOOCs: Automated essay scoring and calibrated peer review™. *Research & Practice in Assessment, 8*(1), 40-48.

Borenstein, J., & Howard, A. (2021). Emerging challenges in AI and the need for AI ethics education. *AI and Ethics, 1*(1), 61-65. doi:10.1007/s43681-020-00002-7

Gulson, K. N., & Witzenberger, K. (2020). The Future of Data in Education: Assessing the Ethical and Political Dimensions of AI. *Educational Philosophy and Theory, 52*(10), 1083-1092. doi:10.1080/00131857.2020.1773799

Holmes, W. (2019). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. *British Journal of Educational Technology, 50*(6), 2325-2342. doi:10.1111/bjet.12839

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.

Holstein, K., Wortman Vaughan, J., Daumé, H., Dudik, M., & Wallach, H. (2019). Improving fairness in machine learning systems: What do industry practitioners need? Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, 1-16. doi:10.1145/3290605.3300830

Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence, 1*(9), 389-399. https://www.nature.com/articles/s42256-019-0088-2

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *NMC Horizon Report: 2014 Higher Education Edition*. The New Media Consortium.

Klinkenberg, S., Straatemeier, M., & van der Maas, H. L. J. (2011). Computer adaptive practice of maths ability using a new item response model for on-the-fly ability and difficulty estimation. *Computers & Education, 57*(2), 1813-1824. doi:10.1016/j.compedu.2011.02.003

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence Unleashed: An Argument for AI in Education.* Pearson. Retrieved from https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/open-ideas/Intelligence-Unleashed-Publication.pdf

Nguyen, T., Gardner, L., & Sheridan, D. (2020). A multi-layered approach for improving predictive performance of student success using machine learning. Proceedings of the 2020 ACM Conference on Innovation and Technology in Computer Science Education, 322-328. doi:10.1145/3341525.3387398

Pane, J. F., Griffin, B. A., McCaffrey, D. F., & Karam, R. (2014). Effectiveness of Cognitive Tutor Algebra I at Scale. *Educational Evaluation and Policy Analysis, 36*(2), 127-144. doi:10.3102/0162373713507480

Shermis, M. D., & Hamner, B. (2012). Contrasting state-of-the-art automated scoring of essays: Analysis. In B. McGaw, P. Griffin, & E. Care (Eds.), *Assessment and Teaching of 21st Century Skills* (pp. 313-331). Springer. doi:10.1007/978-94-007-2324-5_10

Siemens, G., & Baker, R. S. (2012). Learning analytics and educational data mining: Towards communication and collaboration. Proceedings of the 2nd International Conference on Learning Analytics and Knowledge, 252-254. doi:10.1145/2330601.2330661

Slade, S., & Prinsloo, P. (2013). Learning analytics: Ethical issues and dilemmas. *American Behavioral Scientist, 57*(10), 1510-1529. doi:10.1177/0002764213479366

Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and Policy Considerations for Deep Learning in NLP. In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics (pp. 3645-3650). doi:10.18653/v1/P19-1355

UNESCO. (2021). AI in Education: Policy and Governance. https://unesdoc.unesco.org/ark:/48223/pf0000377259

Van der Velden, M. (2018). Ethics of Artificial Intelligence in Education: AI's Impacts on Fairness, Privacy, and Transparency. In C. Gere, R. Iphofen, & A. N. G. K. (Eds.), *Ethics and Artificial Intelligence* (pp. 145-161). Springer. doi:10.1007/978-3-319-96274-2_10

Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. *Learning, Media and Technology, 45*(3), 223-235. doi:10.1080/17439884.2020.1798995

World Bank. (2019). Digital Skills: Frameworks and Programs. https://www.worldbank.org/en/topic/edutech/publication/digital-skills-frameworks-and-programs