

The Relevance of Artificial Intelligence in Educational Measurement and Evaluation

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DOI: <https://doi.org/10.5281/zenodo.21593934>

Abstract

This paper generally examines the relevance of Artificial Intelligence (AI) in educational measurement and evaluation. It highlights AI-powered tools that are used in educational evaluation which includes automatic essay scoring, predictive analytic tools, Chatbots, intelligent tutoring systems, adaptive testing systems, plagiarism detection systems, computer vision, digital assessment tools, voice and speech recognition tools and learning management systems. Having analysed the above tools, the paper establishes that AI is relevant in educational measurement and evaluation for the purpose of efficiency and speed, personalised and adaptive assessment, fairness and equity, scalability and large scale assessment, data-driven decision making, programme evaluation and policy, continuous and formative assessment, automated grading; and simulation and performance based-assessment. In order to promote and sustain the relevance of AI in educational measurement and evaluation, the paper delves into a comprehensive role of educators in AI enhanced assessment which includes; designing assessment, interpreting results, provision of feedback, monitoring AI systems, development of AI literacy among students, curriculum development and using AI tools to support teaching activities. Additionally, the paper elucidates the challenges and limitations of AI in educational evaluation and offers comprehensive recommendations which if educators, policy makers and AI developers can implement will assist in enhancing and sustaining relevance of AI in educational measurement and evaluation, thus resulting in a better way of students' learning and assessment in schools.

Keywords: Artificial Intelligence, Educational measurement, Educational evaluation, Equity, Relevance, Bias.

Introduction

Technology has rapidly been transforming education industry. One of such technological advancements is Artificial Intelligence (AI). Artificial Intelligence is basically reshaping educational industry especially in the fields of measurement and evaluation. Over the years, the demand for personalised, efficient and data-driven

education has increasingly reached a point where AI tools have become indispensable. Traditionally, educational measurement depended heavily on analogue procedures that were not only time consuming, but also subject to human errors (Geng,2011). Additionally, evaluation practices have severally lacked timeless and depth. Having AI technologies integrated in education

industry, educational institutions will now be in a strong footing to automate scoring, personalize learning experiences, provide real-time feed-back and use predictive analytics to enhance learning outcomes (Luckin *et al*, 2016; UNESCO, 2021).

Conceptual clarification of terms

Artificial Intelligence (AI): According to Loder and Nicholas (2018), AI refers to computers that execute cognitive tasks that are usually associated with human minds, especially in learning and problem-solving. AI refers to the ability of machines to perform cognitive functions associated with human intelligence which involve, but not limited to learning, reasoning, problem solving and language understanding (UNESCO, 2021). In education, Popenici and Kerr (2017) see AI as comprising computing systems that are capable of engaging in human-like processes such as learning, adapting, synthesising, self-correction and use of data for complex processing tasks. Elaborating further, Chatterjee and Bhattacharjee (2020) defined AI as computing systems that have the capacity to engage in human-like process such as adapting, learning, synthesising, editing and utilization of various data that are required for processing complex tasks. Additionally, in educational contexts, AI systems employ algorithms to process large datasets, adapt content delivery, and engage in automated decisions that promote effective learning and assessment (Luckin *et al*, 2016; UNESCO, 2021).

Educational Measurement: Educational measurement is a systematic process of quantifying learners' behaviour. It is the

assignment of numerical value to students' assessment activities which include their responses to test items, responses to homework and projects. (Onwuegbu & Okobia, 2009). To Thorndike & Thorndike-Christ (2010), educational measurement is a process of quantifying students' academic performance, skills, attitudes or learning outcomes using standardised tests, classroom assessments or performance-based evaluations.

Educational Evaluation: Educational evaluation is a systematic process that involves a quantitative and qualitative description of students attributes or educational programmes in order to provide a summary data that will inform decision. Thus measurement provides data while evaluation determines the worth or value of that data. Educational evaluation calls for appropriateness, effectiveness and soundness of educational activities (Okpala *et al*, 1993). Hence, evaluation goes beyond collections, analyses and interpretation of data in order to ascertain the effectiveness of educational interventions, programmes or systems. It encompasses formative and summative assessments and centres on both process and product (Grondlund & Linn, 2000).

Objectives of the study

The general objective of this position paper is to examine the relevance of AI in educational measurement and evaluation. Specifically, the objectives of this paper are;

1. To highlight the AI-empowered tools and their uses in educational measurement and evaluation.

2. To explain the relevance of AI in educational measurement and evaluation.
3. To elucidate the role of teachers in AI enhanced educational measurement and evaluation.
4. To discuss the challenges and limitations of AI in educational measurement and evaluation.
5. To offer actionable recommendations for effectiveness in implementation.

Overview of AI tools in educational measurement and evaluation

AI has brought about tremendous transformation in education. AI tools have been known to increase students learning, accelerate the work of the classroom teacher, reducing the teacher's time in facilitating learning and promoting effectiveness in task delivery (Lin *et al*, 2021; Huang *et al*, 2023). AI tools help to reduce anxiety and also predict future learning outcomes (Hawes & Arya, 2023; Luo, *et al*, 2022). AI tools that can be employed in educational measurement and evaluation include the following.

1. Automated Essay Scoring (AES) tools: These are AI tools that can be effectively used for scoring students' responses in tests and assignments at such a speed that helps to save teacher's time and increases students engagement and learning efficiency. Such tools include ETS e-grater and Turnitin which use Natural Language Processing (NLP) to objectively grade essay quickly (Shermis & Bursreen, 2013). These tools can also help to detect plagiarism, thus leading to accuracy in scoring and maintaining academic integrity.

2. Learning Analytics Dashboards: AI platforms like Moodle and Canvas use analytics to offer instructions with actionable insights (Siemens & Long, 2011). Educators can use these tools to monitor students' progress, identifying students at risk and then make necessary decisions that will help improve learning outcomes.

3. Predictive Analytics tools: AI predictive analytics tools have the capacity to use historical data to forecast or predict student progress. This information can help to identify those students that are at risk and who may need additional support (Baker & Inventador, 2014; Hew *et al*, 2020)

4. Chat bots: These are AI tools used for answering queries from students, providing reminders and administering quizzes (Holmes *et al*, 2019). Some chat bots adjust questions based on student abilities.

5. Intelligent Tutoring Systems (ITS): Examples of Intelligent Tutoring Systems include Knewton, Carnegie learning and ALEKS. ITS can provide personalized support and feedback to learners. Based on student interaction, these systems adapt learning materials and instructional approaches to meet student needs (Vanlehn, 2011). For instance, Carnegie learning's AI powered mathematics tutoring systems offer immediate feedback and customized learning paths depending on students' strengths and limitations.

6. Adaptive Testing Systems (ATS): Adaptive testing systems like GRE and GMAT can adjust the difficulty level of test items in real time based on the performance of students and also provide perfect assessment of the abilities of students.

(Williamson *et al*, 2006). ATS can create customized learning pathways for learners, patterning the content and pace towards meeting their needs individually. The ATS have the capacity of providing educators with useful insights into the performance of students, providing constructive information as well as assisting to pinpointing areas where improvement is needed. It is of vital importance that the ATS tools can help in reducing assessment bias by adapting to each student's ability instead of dwelling on predetermined notions.(Luckin & Cukurova, 2019; Williamson& Eynon, 2020).

7. Plagiarism Detection systems (PDS): Plagiarism detection systems are computer software tools that have been designed to help identify areas of similarities or where authors of a written work attempt to claim the ownership of another authors' works or idea by not acknowledging the source or sources (Weber-Wulff, 2016; Kahn, 2018). Plagiarism detection systems like Turnitin and grammarly can be used to detect a copied portion in a write up by applying AI algorithms. By detecting areas of similarity in a written work, the plagiarism detection system can assist students to learn how to summarise appropriately and paraphrase information in a write up, thus helping to improve their writing skills (Weigle , 2013).

8. Computer Vision: This is an aspect of AI that empowers computers to interpret and comprehend visual information around the world. These include Deep learning and Machine learning. Computer vision can be used for automated grading. It can be used for scoring examinations, projects and assignments that are concerned with visual

components like drawings, graphs or diagrams. Computers vision can also be used for automated feedback. It can provide immediate feedback to students on visual assignments. Additionally, computer vision as applied in measurement and evaluation can be used for automated scoring of visual assessments such as grading visual assessments diagram-based tasks and practical skills as in visual labs (Eubanks, 2018).

9. Digital assessment tools: The digital assessment tools can empower educators with the capacity to assess students' understanding by using different varieties of question formats such as essay items, multiple-choice, short answer and supply item type.(Dyjur & Hargis, 2018 ; Wang & Tahir, 2020).The digital assessment tools include the following;

a. Formative Assessment Tools: These are applied in real-time formative assessment, interactive lessons and assignments that provide immediate feedback. These include the following;

- **Socrative:** This is used for real-time assessment for the purpose of interactive quizzes and exit tickets that help to offer instant feedback and analytics.

- **Kahoot:** This is used for creating and administering assignments and quizzes that make learning more engaging and interesting (Wang & Tahir, 2020).

- **Mentimeter:** This is AI interactive presentation tool that is used for creative evaluations with real-time analytics and capabilities.

b. Summative Assessment Tools: Summative assessment tools include the following;

- **Google Forms:** This is AI interactive tool that is used for creating and presenting assessments online with real-time analytics and feedback mechanism.

- **Quizlets:** This is a platform that can be applied in measurement and evaluation. This platform presents assessment and evaluation gadgets for creating engaging meaningful assessments.

c. Interactive Assessment Tools; Interactive Assessment Tools include the following;

- **Thinglink:** This is a tool that can be used for creating interactive images and videos that are required in assessments and evaluations

- **Padlet:** Padlet is AI tool that is used for creating digital bulletin boards, which can be utilized for assessments and discussions.

d. Automated Grading and Feedback Tools: These are tools that can be used for grading students' responses that help to save time for educators and making measurement and evaluation more dynamic. These include the following;

- **Quick key;** This AI tool enhances precision in grading, immediate scoring and instant feedback.

- **Essay Grader:** This is AI tool that is utilized for grading essay and it offers immediate feedbacks to both students and educators. It thus allows educators have time to concentrate on other essential aspects of teaching and learning activities.

10. Learning Management System (LMS):

The LMS are platforms that enable educators to create, present and manage learning materials, projects, assignments, assessment and evaluation of students' learning outcomes, thus making learning enjoyable and dynamic. (Coates & Mahat, 2018) The LMS include;

- **Classkick:** This is used for interactive assignments and peer review which promotes assessment procedure.

- **Moodle:** This is an open source platform that provides a framework for developing and presenting online courses including assessment and evaluation gadgets. (Rice, 2015)

11. Voice and Speech Recognition AI tools: These are AI tools that empower computers to comprehend, interpret human speech and converting it to message or commands. Examples of these tools include; Whisper, Kaldi, Deep speech and Duolingo which implore speech-to-text for assessment of pronunciation and oral fluency.

Relevance of artificial intelligence (AI) in educational measurement

AI has brought tremendous transformation in educational measurement. Its application in educational measurement will help to reduce teachers work load while promoting effectiveness in assessment of learning outcomes. The relevance of AI in educational measurement can be elucidated under the following headings.

1. Efficiency and speed: Test items like multiple-choice items can be graded easily. For instance, automated scoring systems can grade thousands of scripts within a velocity

beyond human imagination. This helps to save time for educators and at the same time provides instant feedback to learners (Zawacki – Richter *et al*, 2019)

2. Personalization and Adaptive Assessment: AI has significantly contributed greatly in the field of educational measurement through its capacity to personalize testing experiences. With AI, assessment can be tailored to student's ability. For instance, Adaptive testing systems like ALEKS and Knewton can adjust item difficulty in real time based on student's response, thus promoting accuracy and reduces anxiety in assessment process (Fletcher, 2018; Doignon & Falmagne 1999).

3. Promoting Fairness and Equity: Bias in testing has been a serious issue in educational measurement. AI promotes fairness and equity by obliterating human bias. This it does through identification of test items that seem to create unfairness to certain group of individuals. AI through the application of its grading rubrics offers scores that are comparable or correlate effectively with human graders (Sherms & Burstein, 2013; Williamson & Eynon, 2020).

4. Scalability and large scale assessment: Traditional or conventional methods of assessment are often laborious and time consuming. AI can simultaneously deliver high – quality assessment to a large number of people. The automated scoring systems and adaptive delivery systems help to ensure manageable and reliable assessments even when it involves large groups of individuals. Additionally, Language and Cultural adaptability of AI makes it possible for

assessment to cover marginalized groups (Flecher, 2018; UNESCO, 2021).

5. Continuous and Formative Assessment: AI presents holistic comprehension of student learning process by integrating measurement into daily learning processes. A case in point is the stealth assessments encapsulated in digital games that permit educators to evaluate persistence, creativity and problem solving without interfering with learning (Shute & Ventura, 2013).

6. Simulation and Performance-Based Assessment: Simulations that are AI-powered offer real contexts that enable learners to be assessed on practical and complex-order skills. For instance, Virtual laboratories, interactive environments and role-play scenarios enable students to exhibit their abilities in problem solving decision and collaboration (Nkwo & Orji, 2022).

Relevance of AI in Educational Evaluation

AI has brought a lot of transformation in the field of educational evaluation. The relevance of AI in educational evaluation includes the following;

1. Adaptive Assessment: AI powered adaptive assessments adjust to students' abilities creating a valid measure of their knowledge.

2. Data-Driven Decision making: AI tools collect and analyse a large amounts of data in order to provide needed information for decision making in education. For instance, Dashboards identify trends instructional gaps and at-risk student, promoting timely interactions (Baker & Inventado, 2014; Omar *et al*, 2021; AIGhandi, 2022).

3. Efficient Evaluation Processes. AI can simplify evaluation procedures, enabling educators to have more time to focus on teaching and mentoring of students.

4. Programme evaluation and policy. AI-powered tools evaluate the impact of educational programmes and provide information for policy decision. For instance, Governments do use AI to evaluate curriculum effectiveness and allocation of resources (UNESCO, 2021).

5. Automatic Grading .AI can be used for scoring student assignments, quizzes and examinations, Thus providing immediate data for decision making This automatic grading helps to reduce workloads of teachers and also enhances accuracy. (Hurt *et al*, 2020)

6 Continuous feedback: AI promotes formative evaluation by offering continuous feedbacks. For instance, Learning analytics track, and adjust pacing, resulting in a more dynamic and engaging evaluation process (Shibani *et al*, 2021)

Roles of Educators in AI- Enhanced Educational Measurement and Evaluation

The incorporation of Artificial intelligence (AI) in educational measurement and evaluation has transformed the ways teachers assess students' learning. As AI technology is being utilized in the field of education, it is proper to clearly define the role of teachers in AI enhanced educational measurement and evaluation in order to enhance the relevance of the technology The roles of teachers in AI enhanced educational measurement and evaluation are succinctly presented as follows.

a). Designing Assessment: Teachers are to design assessments that integrate AI technological tools such as automated grading and feedback system (Pellegrino & Quellmalz, 2010). Teachers are to ensure that AI enhanced assessments are reliable, valid and appropriately measuring student learning so as to provide necessary data that inform decision (American Educational Research Association, 2014).

b). Interpreting Results: Teachers have the responsibility of interpreting and analysing data that are generated by AI tools. Besides, teachers are to utilize the data for planning instruction and making necessary adjustments as regards teaching strategies for a better learning outcome (Means *et al*, 2014). Teachers are to identify areas that require remedial actions for the students, using AI-generated skills or knowledge gap (Knight, 2019).

c). Provision of feedback: Students need to know how they are fairing in teaching - learning activities. It is the duty of teachers to provide human feedback and guidance to students, thus complementing AI generated feedback and support (Hattie & Timperley, 2007). Teachers are to assist students gain adequate comprehension and contextualization of AI-generated feedback, making sure that they can adopt it to enhance their learning (Shute, 2008).

d). Development of AI literacy: Students need to understand how AI works. It is the responsibility of teachers to help the students gain knowledge on how AI tools work, their limitations and potentials biases (Long & Magerko, 2020). Teachers are to encourage students to think critically about data

generated through AI tools, evaluate the veracity and relevance of the data (Ng& Shan, 2020).

e). Monitoring AI Systems: Teachers are to monitor AI systems to ensure that the systems are functioning perfectly. They are to ensure that the systems are providing accurate results concerning the students' progress (Williamson, 2017). This information is necessary to inform decision that will better the students' learning.

f). Using AI tools to support teaching and learning: Teachers need AI tools to support teaching and learning, thus freeing up time that enables teachers concentrate on high-value tasks (Zawacki-Richter *et al*, 2019) These high-value tasks include; interpreting complex data generated by AI tools, providing human feedbacks and guidance, fostering critical thinking and creativity, building relationship and empathy and adjusting instruction in order to meet the different needs of the students. These high value tasks are of paramount importance in helping to ensure all round development of the students. .

g). Curriculum development: Teachers have the responsibility of developing curriculum that integrates AI enhanced educational tools and technologies. AI- integrated curriculum is capable of increasing students' engagement and motivation in learning.

Challenges and limitations of AI in educational measurement and evaluation

The use of AI tools in education has many benefits in educational measurement and evaluation which include offering efficient and scalable solutions for measurement and feedback. However, several challenges and

limitations are associated with AI tools utilization in educational measurement and evaluation. These challenges and limitations are discussed as follows:

1).Bias in the process of assessment: AI - powered tools can cause biases and inequalities in data produced by the systems This is true for the fact that if the system is trained biased on bias dataset, it will produce results that are biased, thus introducing inaccurate and unfair assessment in educational evaluation (kizilcec & Goldstone, 2017) Any decision that is based on unfair assessment data will lead to inappropriate and unreliable decision.

2). Lack of teacher acceptance. Teachers may not be willing to integrate AI measurement and evaluation tools into classroom assessment process due to fear of job displacement or lack of understanding on how AI assessment tools work (Zawacki-Richter *et al*, 2018). This therefore calls for training of teachers in order to ensure full and effective implementation.

3). Data quality and integrity: The goodness of AI is based on the data it is trained on. Hence poor quality of data and integrity may lead to assessment outcomes that are unreliable and inaccurate (Baker & Siemens, 2014).

4). Ethical concerns: Data privacy, consent and inappropriate utilization stand as major issues in AI enhanced educational measurement and evaluation (Eubank, 2018).In educational assessment, AI tools can generate large volume of data from students. For instance in Nigeria where data protection bill is evolving, AI tools might not have defined guidelines as to how data are

protected. Added to this, is the question of whether parents of the students are aware of how the AI generated data are being utilized in schools. Hence, in the absence of strong data protection law, the collection and utilization of students' data could be risky.

5). Inadequate training: Many educators may lack appropriate and sufficient training concerning how AI works. This inadequate training on the part of educators may result in limitation of its application in educational assessment in schools

6). Infrastructure Gaps: The problem of infrastructure gaps occurs as a result of inadequate information and communication (ICT) resources in developing regions or remote areas where internet and ICT facilities are lacking. This again will lead to limitation of AI powered tools application in educational assessment in those remote schools.

7) Financial challenge: The integration of AI powered assessment tools into school assessment programme is not cost effective. The cost of development and implementation of AI powered evaluation tools maybe financially challenging to the extent that teachers, administrators and institutions may find it extremely difficult to foot the cost. This may cost unequal access to AI facilities among schools or institutions (Baker & Smith, 2019; UNESCO 2021).

8). Data security and privacy. There is serious concern about students' data security and privacy. There must be adequate security measures and appropriate data handling procedures for effective complementation of AI enhanced educational measurement and evaluation (Stewart & Estes, 2017).

9). No contextual understanding: The AI powered tools may find difficulty in comprehending the nuances of human languages and context. This lack of contextual understanding is capable of resulting in inappropriate interpretation of responses from students (National Research Council, 2013).

10). Limitation in scope: AI tools are limited in scope as they are designed to access specific areas such as measuring lower order cognitive skills which are normally assessed by objective test items.(Bennett, 2015; Luckin & Cukurova 2019). The AI tools may not appropriately measure such higher-level cognitive abilities like application, synthesis, analysis, and evaluation. Hence AI capacity to measure critical thinking is limited. Additionally, AI tools lack human ability to measure psychodynamic area of learning which includes students' interest, value, feeling, motivation and attitudes. Effective teaching and learning covers the three domains of learning which are cognitive, affective and psychomotor domain. AI powered tools as a result of their inanimate nature are not likely to accurately measure the psychomotor domain of learning which include such areas as cycling, gardening, driving, swimming, boxing, dancing, footballing and other areas that require manipulative skills.(Gulikers & Bastiaens, 2006; Luckin & Cukurova 2019). In view of the above, educators role becomes vital in these areas for effective assessment of learning outcomes.

11. Data Management and storage: AI assessment tools are known to generate a large amount of data concerning students

learning and progress. AI powered assessment tools on their own cannot effectively manage, store and ensure that these data are reliable, accurate and appropriate in meeting different needs of students. The role of teachers is of paramount importance to ensure that such data are appropriately managed, stored and released when the need arises.

12. Lack of Personal Interaction: The use of AI powered tools in educational measurement and evaluation can lead to lack of human interaction which may result in inability to clarify doubts. Students may struggle to clarify some doubts or questions, potentially causing inability to understand importance issues. Additionally, using AI tools in educational assessment leads to reduced human connection. AI systems lack empathy and emotional intelligence, thus leading to insensitive or unhelpful responses. Again, students may even feel disconnected from the process, potentially negatively impacting motivation and real engagement.

Conclusion

From the issues highlighted in this paper, it can be concluded that AI is relevant in educational measurement and evaluation as it enhances efficiency and speed, personalized and adaptive assessment, fairness and equity, scalability and large scale assessment, data-driven decision making, programme evaluation and policy, continuous and formative assessment, automated grading; and simulation and performance based-assessment. Additionally, for the purpose of enhancement and sustainability of the relevance of AI in educational measurement and evaluation, educators are to play vital

role of designing assessment, interpreting results, provision of feedback, monitoring AI systems, development of AI literacy among students, curriculum development and using AI tools to support teaching activities.

There are many challenges and limitations in using AI in educational measurement and evaluation and these challenges and limitations can be effectively handled by educators and AI developers through implementation of appropriate policies such as addressing bias and fairness in educational assessment, promoting human AI collaboration, aligning AI tools with learning objectives and ensuring that data generated by AI tools are of high quality and secured

Recommendations

Based on the challenges and limitations in the use of AI empowered tools in educational measurement and evaluation, it is therefore necessary to make the following recommendations in order to enhance the relevance of the use of AI tools in educational measurement and evaluation.

1. Institutions and AI developers need to detect and prevent bias in order to ensure fairness and equity in assessment of learning outcomes. This can be done by regularly auditing AI systems and taking corrective measures so as to ensure that data generated by AI tools are devoid of bias.
2. There is need for AI developers to design AI tools that foster human-AI collaboration and decision making. Educators need to be provided with opportunities for professional training and development that enable them to understand the working of AI tools so that

they can effectively integrate AI tools into their teaching activities. Additionally, for effectiveness of AI tools in meeting the needs of the students, there is need for interacting with the students, gathering their experiences on the use of AI powered tools. The feedbacks from the students can then be incorporated into the design and development of AT tools for optimal effectiveness.

3. Educators are to ensure that learning objectives are clearly defined. AI powered tools are to be aligned with specific learning objectives and outcomes. This can be done by integrating AI tools into school curriculum to promote effective learning, teaching and assessment of students learning.
4. AI developers should ensure that AI tools are trained on high-quality diverse and pertinent data. Besides, there should be appropriate security measures to protect student data and maintain proper confidentiality. Such robust data security measures include encryption of data, using industry-standard protocols (e.g. TLS, AES) and implementing role-based access control to ensure that only authorised persons have access to students' data. Additionally, implement data anonymization by pseudonymizing students' data to enhance protection of identities. There is also the need to store data on secure compliant servers such as General Data Protection Regulation (GDPR), Children Online Privacy Protection Act (COPPA) and Family Educational Rights and Privacy Act (FERPA).

5. Educators and AI developers need to ensure that all students have access to AI tools. Those with disabilities should be properly accommodated by designing tools that align with assistive technology and offering equivalent format for materials. Such tools must meet the established standards for accessibility in order to ensure effectiveness in their utilization. Besides, educators should collaborate with AI developers to design AI assessment tools that are cost-effective and state and federal governments should make ICT and internet facilities available in remote areas so that schools in those areas can have access to AI tools necessary for assessment and evaluation of students' learning.

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